The World that Changed the Machine: Globalization and Jobs in the Automotive Industry

Final Report to the Alfred P. Sloan Foundation

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TABLE OF CONTENTS:

LIST OF TABLES:

LIST OF FIGURES:

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1. Summary of Key Findings

As we enter the new millennium, globalization has emerged as one of the most salient and powerful forces shaping domestic and world economies. Accordingly, a debate has emerged in recent years over the causes and consequences of globalization. On the one side of the debate are the advocates of globalization—the so-called globalization optimists such as Robert Riech, Paul Krugman, and George Gilder. One the other side of the debate are the globalization pessimists, such as Dick Gephardt, Jeremy Rifkin, Bill Greider, Pat Buchanan, and Ross Perot, who counter that globalization is leading to greater economic instability, eroding the power of nation states to shape their destinies, and eroding wages and working conditions for workers in both advanced and emerging economies. Thus far, the debate has proceeded with little in the way of solid empirical research on the actors that are directly shaping globalization at the industry-level nor on effects of globalization on employment. In the past several years, there have been several studies which outline the broad phenomenon of globalization and make some assessments at the macro-level, but there remains a lack of empirical studies at the industry-level.

This study was designed to fill that gap. The study has explored the factors driving globalization in the automotive industry and has begun the task of exploring the effect of globalization on the quality, quantity and location of jobs in that industry. We define globalization as the geographic spread and global-scale integration of production. The central hypothesis of our work is that globalization is causing a shift in the source of competitive pressure, and of competitive advantage, from excellence at the point of production—now more or less assumed—toward excellence in governing spatially dispersed networks of plants, affiliates, and suppliers.

Guided by this hypothesis, the research has focussed on three related questions:

- What are the determinants of the globalization?
- What is the effect of the current wave of globalization in the industry on the location, quantity, and quality of employment?
- How are changes in the organizational structure of the industry affecting the architecture of global production networks in the automobile industry and hence, the location of jobs?

To shed light on these questions the research consisted of four elements:

- Plant-level databases of automaker and supplier facilities.
- Interviews.
- Field research and site visits.
- Archival and historical research.

The study’s key findings are as follows:

Globalization is changing the economic geography of the automotive industry.

- There has been a wave of new assembly and supplier plant construction in places such as China, India, Thailand, Vietnam, Brazil, Mexico, and East Europe. These new investments are being driven by increased competition and market saturation at home, the opening of vast new investment spaces since the end of the Cold War, host country requirements for local production, and an effort by automakers to cut costs within the context of regional trade arrangements such as NAFTA and the European Union.
- Even so, the automotive industry remains overwhelmingly concentrated in the developed economies of Japan, Europe, and the United States.

Globalization is creating new challenges and opportunities for corporate strategy.

- Globalization strategies vary depending on the starting point of individual firms, but there seems to be a large measure of convergence toward 1) building vehicles where they are sold; 2) designing vehicles with common "global" under-body platforms while retaining the ability to adapt bodies, trim levels, and ride characteristics to a wide range of local conditions; and 3) leveraging the move to global platforms by creating assembly capacity that is more "generic" and less model-specific. On the other hand, there is less convergence on the strategies of increased outsourcing and making vehicle assembly more "modular."
- Automakers have employed a series of measures to lower the minimum scale of vehicle assembly plants to reduce the risk of emerging market investments. These measures include starting with small, flexible and expandable "complete knock down" (CKD) assembly plants; sharing large capital expenditures (e.g. paint shops) with other automakers; increasing reliance on suppliers; and moving to modular vehicle designs to simplify the final assembly process and reduce initial investment requirements.
- The newest assembly plants in emerging economies as test-beds to experiment with innovative forms of work and industry organization, especially by American and European automakers. There have been and will continue to be attempts to use the lessons learned in emerging markets to transform existing operations in the traditional centers of the industry, but this process is proving to be extremely difficult.

Globalization is having a significant impact on industry structure.

- Globalization is changing the nature of relationships between automakers and key suppliers. As first-tier suppliers take on a new, larger role in the industry, we are seeing the concomitant emergence of "global suppliers;" firms that have the capability to coordinate and deploy component manufacturing on a global-scale. First-tier suppliers are moving to module design, second tier component sourcing, and the provision of local content in the context of emerging markets. The growing need to provide automakers with modules on a worldwide basis is driving a wave of consolidation and geographic expansion among first-tier suppliers. For suppliers that serve multiple automakers, the geographic scale of operations can surpass that of any single customer. In the long run it may well be suppliers, not automakers, that generate the vast majority of the industry's future foreign direct investment (FDI)—and associated economic and social benefits (e.g. employment).

- The recent spate of investment in emerging markets has all the earmarks of a classic speculative over-extension: too many investments chasing too few buyers. Speculative over-investment in emerging markets, greatly exacerbated by the recent economic crisis in Asia, has combined with sluggish vehicle sales in all large existing markets except for the United States to create a true overcapacity crisis in the industry. Overcapacity, along with the rising cost of global platform development, is driving a wave of mergers at the automaker level.

Globalization is having a variety of effects on the quantity and quality of jobs.

- The quantity of jobs in developed countries has remained more or less constant during the past ten years. In the United States the automotive sector actually added 103,000 workers between 1993 and 1996. At the same time, there has been an erosion of job quality, especially in the United States, as work has shifted from automakers to suppliers, where pay is usually lower. Still, the potential for massive downsizing is real (and especially acute in Japan) as vehicle manufacturing continues to shift to new locations.
- Especially alarming because of the potential impact on jobs in United States and Northwest Europe is the sudden jump in finished vehicle imports from Mexico, Canada, Spain, and increasingly, East Europe. The negative employment impacts of these shifts have been muted—so far—because the assembly plants in these lower-cost locations rely to a significant degree on parts imported from the traditional centers of the industry.
- The consolidation of design activities in core locations has helped to re-energize the traditional centers of the automotive industry (such as the Detroit metropolitan region) with high paying research, design, engineering, and administrative jobs.
- Employment gains in emerging economies have been modest, given the small size of initial investments and low levels of local sourcing, but the jobs that have been created appear to be of extremely high quality by local standards.

2. Introduction

Think back to the 1980s. Many—if not most—commentators portrayed the American economy as reeling under the onslaught of Japanese competition. A crisis of epidemic proportions had hit American manufacturing, threatening in the eyes of many not just American competitiveness but the very essence of the American dream. American companies, especially automotive companies, the argument went, had fallen far behind foreign competitors. Already in the throes of de-industrialization, the death knell was being dealt by the rise of new quality oriented, hyper-efficient manufacturing systems developed abroad. America would not fare well in the era of lean production. In fact, a host of studies documented the challenge—no, the crisis—facing American manufacturers. Using every measure of competitiveness—quality, price, manufacturing efficiency, and consumer acceptance—American companies were being annihilated by foreign competition, and it was the automotive industry that provided the prime example of how backward the once invincible American manufacturing sector had become.

What a difference a decade makes. Today, it is clear that American industry has rebounded. Unemployment rates in the United States are the lowest in 30 years and the economy appears as healthy as it has ever been. At the same time, Europe is undergoing a wrenching restructuring similar to that of the Unites States in the 1980s. Asia, Russia, and perhaps Latin America too are in crisis, teetering on the brink of a deflationary spiral. At the same time, business is booming in the Untied States. American workers continue to be the most productive in the world and American industry the most innovative by far. In some key areas of economic activity, particularly the application of information technology—and especially the Internet—American firms are so far ahead of most foreign competitors that they cannot even be considered to be in the same league.

Even American automakers have stemmed the steady erosion of their market share, at least at home. In Europe, due to high tariffs and resistance to foreign direct investment (FDI), market penetration by Japanese automakers has been much slower than expected. At a time when jobs in the supply-base are increasing at the expense of final assembly, thirty out of fifty of the world's largest automotive suppliers are American, while only five are Japanese. While it would be wrong to say that the American automotive industry has successfully beaten back the competitive threat from Japan, it is clear that the “Big Three” are once again players, as are the major European producers. The field is open and anyone can win, or lose.

What explains this situation? Have American and European automakers caught up with their Japanese competitors, leveling the playing field in terms of manufacturing efficiency and product quality?

While there have been significant improvements, manufacturing performance data still show that by and large, Japanese-owned factories continue to turn out higher quality vehicles at greater efficiency than American- or European-owned factories (Fine and St. Clair, 1996). So, while there is still much room for improvement on the manufacturing front, what is clear is that being lean is no longer enough. Due to the rapid dissemination of best industrial practices—a process speeded by increased head-to-head competition, joint-venture experiments with

Japanese automakers, and excellent academic studies—the world has caught on. In the meantime, the rules of competition in the industry have begun to be recast according to the accelerating processes of globalization, adding new sources of competitive advantage to the old; creating new challenges for automakers to overcome, or be overcome by.

2.1 Is There Anything New About Globalization?

Inherent in the claim that globalization is shifting the terms of competition in the automotive industry is the notion that something is new. A careful review of the historical geography of the automotive industry reveals a startling fact: the industry began to globalize in the earliest days of mass production; by 1928 Ford and GM were assembling vehicles in 24 countries, including Japan, India, Malaysia, and Brazil. Ten years later both companies were operating large-scale integrated "transplant" facilities in Europe. Although there has been a steady increase in the number of automakers willing and able to compete in the arena of international production since the 1980s, American automakers have not had the developing world to themselves since the late 1950s, when European automakers had recovered sufficiently from World War II to begin investing in Latin America, South Africa, and Australia. Of course, the end of the Cold War has signaled the opening of vast new investment spaces in East Europe, India, Vietnam, and China; but again, there have been races to emerging markets before. The 1990s have seen renewed efforts by automakers to streamline operations on a global-scale, particularly in the arena of vehicle and manufacturing design, but such efforts have been underway for decades, and can be traced back—beyond the "world car" strategies of the 1980s—to Ford's failed "1928 Plan," which aimed to supply Model As to the world from three giant River-Rouge style plants in Detroit, Canada, and England.

It is clear that intensified global competition has created new pressure to solve some of the industry's age-old problems, and that corporate response to these pressures are worthy of examination. Still, we need to ask the question quite seriously: what, if anything, is new? Our research has uncovered two aspects of the current round of globalization that are indeed unprecedented: 1) the dramatic increase in finished vehicle exports from low-cost locations such as Mexico, Canada, and Spain in the context of strengthening regional trade arrangements such as NAFTA and the E.U., and 2) vertical disaggregation and the globalization of the supply-chain. Before moving to the substance of the Report, let us briefly highlight these two points, and their impact on jobs, in turn.

Beginning in the 1970s, when a flood of Japanese imports radically intensified competition in the United States and Europe, American and European automakers put aggressive programs in place to reduce operating costs. Of particular importance in terms of economic geography have been regional integration strategies, which have progressively shifted production to lower-cost locations within continental-scale trade arrangements such as Autopact, NAFTA, and the European Union. The functional integration of lower-cost production sites such as Canada, Mexico and Spain have created powerful operating cost gradients that have been diverting investment to these "peripheral" locations since the 1980s. Still, the potential of this infrastructure has remained largely untapped until very recently, when intra-regional exports from these lower-cost locations increased dramatically.

Although jobs have not migrated away from the United States or other advanced industrial nations in massive numbers—yet—the growing reliance on lower-wage countries within North America and Europe could conceivably shift the industry's center of gravity over the long term. The negative impact of these shifts have so far been mitigated to some degree by the reverse flow of parts from "home" to "host" countries, but we cannot turn a blind eye to the distinct possibility that employment displacement at home will become severe as more assembly work is re-located and the supply-bases in these lower-cost locations continue to upgrade their capabilities over time.

The new face of globalization in the 1990s is best revealed by the rise of the global supplier. Companies such as Bosch, Denso, Johnson Controls, Lear Corporation, TRW, Magna, and Valeo have become the preferred suppliers for automakers around the world. Some automakers, particularly American firms, have combined a move to "modular" final assembly with increased outsourcing, giving increased responsibility to first-tier suppliers for module design and second tier sourcing. Many first tier-suppliers have responded by embarking on a wave of vertical integration (through mergers, acquisitions, and joint-ventures) and geographic expansion to gain the ability to provide their customers with modules on a global basis. Thus we are seeing simultaneous trends toward deverticalization (by automakers) and vertical integration (among first tier suppliers) that—in combination with globalization—is helping to create a new global-scale supply-base capable of supporting the activities of final assemblers on a worldwide basis. More than any other characteristic, it is the simultaneous geographic spread of the supply-base—alongside newly established assembly plants—that differentiates the current wave of geographic expansion from those that the automotive industry has seen in the past.

The shift of manufacturing—and of employment—to the supply-base, while not reducing the *quantity* of automotive sector employment, may be having a negative impact on the *quality* of employment, particularly in the United States, where the trend is the strongest. While the supply sector has been a source of dynamic job growth, jobs at non-captive supplier plants in the U.S. are much more likely to be non-union and pay on average about 40 percent less than final assembly jobs. As suppliers become more important—and set up global operations—job quality in the automotive sector could continue to erode. Furthermore, the productivity gains achieved by automakers producing in the United States during the past decade have not yet, by and large, been attained by suppliers, suggesting that many of the costs associated with the adoption of lean production by automakers (e.g. holding parts and material inventories) have been passed along to suppliers. The new pressures on suppliers to meet global price, quality, and delivery standards could lead to productivity-induced job shedding in the parts sector. Still, if depending on large, highly capable global suppliers turns out to be a winning strategy in the new global arena of competition, the head-start that American suppliers have in this regard may force automakers from Europe and Japan to increasingly buy from them, a turn of events that could lead the American automotive industry back to world leadership, even if the two remaining American-owned automakers lag behind.

2.2 The Structure of the Report

The remainder of this report is organized as follows:

The study's research design and methodology are presented in Section 3. Of particular importance is Section 3.3, which outlines the locational typology that has guided much of our research and analysis. Since Section 3.3 provides a description of the locational typology on which much of the report's analysis is based, it will be necessary for readers to comprehend this section prior to reviewing the study's findings in Sections 6, 7, 8, 9, and 10.

Section 4 reviews the academic debates on globalization, calling for a broader interdisciplinary framework that cuts across the various geographic and organizational scales of inquiry. The section goes on to identify the key distinction between the globalization of markets, fostered through increased trade liberalization, and the globalization of production, which continues to be driven in large part by persistent barriers to trade. Section 5 reviews the historical geography of the automotive industry, providing some much needed perspective for the study's findings on the current state of the industry.

The study's key findings are reported in sections 6 though 10. Section 6 outlines the current economic geography of the automotive industry through the use of a variety of maps and descriptive statistics. The continued dominance of the industry's traditional centers is discussed, as is the industry's most recent race to set up manufacturing operations in emerging markets and the overcapacity crisis that has emerged as a result.

Section 7 examines the corporate strategies that relate to globalization, including new market identification and assessment, vehicle development and manufacturing design, and the set of strategies that automakers use to spread risk in emerging markets. The section concludes with a comparison of globalization strategy according to the national origin of automakers. Section 8 relates recent changes in industry structure to the process of globalization, and provides evidence that suppliers are globalizing along-side automakers for the first time in the industry's history. Section 8 also discusses how the recent spate of mergers at the automaker level relate to the process of globalization.

Section 9.1 begins our discussion of the employment effects of globalization by analyzing automotive sector employment and wage trends in the United States. Section 9.2 reveals the growing role of low-cost "peripheral" locations such as Mexico, Canada, and Spain within continental-scale trade arrangements such as NAFTA and the European Union. Section 9.3 discusses the likely employment effects of recent efforts to consolidate design activities in core locations. Section 9.4 examines at the looming employment crisis in Japan. Section 9.5 discusses why market-seeking investments in emerging markets are unlikely to hurt home-country employment. Section 9.6 examines the effect of globalization on host-country employment. Section 9.7 discusses how automakers are trying to use what they learn in emerging markets to transform their operations at home, and

Section 10 provides an analysis of the study's field survey results. Section 11 provides a summary of the report's main points and some concluding remarks.

The appendices provide additional detail on the study's research methodology. Appendix A contains lists of the study's headquarters and plant visits (note: Appendix A is available to study team members only to protect firm confidentiality). Appendix B contains the study's research instruments, and Appendix C contains a list of *Research Notes* that were prepared during the course of the study to disseminate interim results and to provide additional detail for those interested in topics on which particularly in-depth research was conducted. The *Research Notes* are available from the Project Director upon request.

3. Research Design

This section provides a summary of the research tasks and methods used for the study, and presents the locational typology that has guided much of the research and analysis. The research was conducted over a three-year period, with the bulk of the data collected between July, 1996 and April, 1998. Given the large scope of the research questions—as well as the size and heterogeneity of the automotive industry itself—the study was intended to provide a general first-look at the extremely complex and dynamic process of globalization. Moreover, the research process was designed to be self-structuring, with the answers to broad initial questions leading the team to more specific questions over time.

There are three sets of key questions that guided our initial research:

1) What are the determinants of the globalization? Specifically, how do enterprises (in this case automotive sector multi-national enterprises) organize and allocate their production activities over space? We can be sure that production costs play a role, but what weight can we give to other factors such as market access and variations in regulatory environment? What are the characteristics of places (e.g. market size, degree of market penetration, wages, supply infrastructure, labor force characteristics. etc.) that attract and retain enterprise investment?

2) What is the effect of the current wave of globalization in the industry on the location, quantity, and quality of employment? To what extent is high-value added, high-skill work being shifted from the advanced industrial nations to countries with lower production costs? Can established regional industrial clusters offset these globalizing forces by retaining high-value added production and high-skill, high-wage design-related jobs through the adoption of lean production techniques, increasing regional specialization in design and engineering functions for the world industry, and upgrading the local supply base?

3) How are changes in the organizational structure of the industry affecting the architecture of global production networks in the automobile industry and hence, the location of jobs? As final assemblers give more responsibility for sub-system design, component design, and material sourcing to first tier suppliers—and as suppliers globalize their operations—where are the associated high-wage jobs being located?

These questions are relevant to ongoing debates on the employment effects of globalization, both in the economies that are the source of new foreign direct investment (home countries) and those countries that are receiving new investment (host countries). For Americans and Europeans globalization is an especially complex issue because the United States and Europe serve as both a “home” and a “host” location for new investment.

The research was divided into three major strands: 1) the development of plant-level databases for the purpose of spatial analysis and mapping, 2) field research at company headquarters and manufacturing plants, and 3) an examination of industry trends through the review of secondary sources.

The review of industry trends relied on secondary sources for international automotive industry sales, production, trade, employment, and wages. The review of the historical geography of motor vehicle production contained in Section 5 relied heavily on two principal sources: *The*

Multinational Automobile Industry by George Maxcy (1981) and *Global Enterprises and the World Economy* by Carl H.A. Dassbach (1989).

3.1 Plant and Facility Databases

The aim of the database compilation effort was to collect basic plant-level information on all of the world's automotive assembly plants and the bulk of the world's largest 150 suppliers' parts facilities. These databases comprise a unique resource that has allowed us to provide a relatively accurate and complete picture of the global automotive industry.

To date the study has begun the process of collecting—from all available sources—basic information on the universe of automaker-owned **assembly plants** worldwide, including start date, employment, capacity, volume, and exact geographic location (for creating maps using GIS software). Although efforts have been made, we have found it nearly impossible to collect a significant amount of plant-level data on capital investment and wages. Comprehensive wage data are closely held by the firms and, especially for older plants, capital investment data are extremely difficult for firms to compile.

The structure of the motor vehicle industry is relatively concentrated, with the largest twenty firms producing greater than 95% of the world's vehicles (OECD, 1996). Moreover, automotive plants, particularly assembly plants, are often of large scale and even when small, tend to be widely publicized and reported on by the press. These characteristics have made it possible for the study begin to collect basic plant-level data on the bulk of the important facilities world-wide (by contrast, it would be a much larger task to collect these data for less concentrated industries such as electronics and apparel). With the total universe of assembly plant*s* in the world numbering just over 500, creating a reasonably accurate portrait of the global industry has not been too onerous a task.

In addition to the assembly plant database, the project has identified and begun to collect information on more than 2,200 **supplier plants** owned by the largest 150 firms. We have collected basic information such as product(s), start-date, employment, etc. We also have begun to compile a databases on **engine plants** and automaker **design facilities**. As of this writing, the bulk of the study's data collection efforts have gone into the assembly and supplier plant databases; the engine plant and design facility databases are less complete.

The database on automobile **assembly plant locations**, as of October, 1998, contains entries of 529 plants located in 45 countries, representing close to the total universe of worldwide assembly operations for 27 automakers. We have collected information on the exact geographic location of the plants (i.e. latitude and longitude) for 95% of the sample; 1995 production volume data for 91% of the sample, 1996 capacity data for 79% of the sample; inception dates for 38% of the sample; and employment figures for 29% of the sample. The contents of the assembly plant database are summarized in Table 3-1.

The database on automotive **supplier plant locations**, as of October, 1998, contains entries of 2,211 plants of the largest 150 automotive suppliers. The plants are located in 60 countries. We have collected information on the exact geographic location of the plants (i.e. latitude and longitude) for 76% of the sample; type of part, material, or sub-system produced for 81% of the sample; inception dates for 12% of the sample; and hourly or total employment figures for 17% of the sample. The contents of the supplier plant database are summarized in Table 3-2.

The database on **engine plant locations**, as of October, 1998, contains entries of 168 plants located in 24 countries owned by 16 companies. We have collected information on the exact geographic location of the plants (i.e. latitude and longitude) for 89% of the plants in the database, inception dates for 60% of the sample, and employment figures for 49% of the sample. We have just begun to collect unit production data. The contents of the engine plant database are summarized in Table 3-3.

Table 3-1: Assembly Plant Database Contents

Data Category	Number of Plants with Data Collected	Share of Sample with Data Collected
Company	529	100%
Country Location	529	100%
Firm Nationality	524	99%
City Location	513	97%
Exact Location	504	95%
Production 1995	479	91%
Capacity 1996	419	79%
Platform and Model	369	70%
Inception Date	201	38%
Production 1996	183	35%
Employment	149	28%
Invested Capital	7	1%

Source: Globalization and Jobs Project, Assembly Plant Database, October, 1998.

Table 3-2: Supplier Plant Database Contents

Data Category	Number of Plants with Data Collected	Share of Sample with Data Collected
Company	2,211	100%
Country Location	2,181	99%
Firm Nationality	2,135	97%
City Location	1,828	83%
Part Sub-sector	1,788	81%
Exact Location of Plant	1,686	76%
Employment	377	17%
Inception Date	269	12%

Source: Globalization and Jobs Project, Supplier Plant Database, October, 1998.

Table 3-3: Engine Plant Database Contents

Data Category	Number of Plants with Data Collected	Share of Sample with Data Collected
Company	168	100%
Country Location	168	100%
City Location	162	96%
Exact Location	149	89%
Inception Date	100	60%
Employment	83	49%
1996 Engine Production	7	4%

Source: Globalization and Jobs Project, Engine and Transmission Plant Database, October, 1998.

The database on **design facility locations** is the study's most preliminary. As of October, 1998, the database contains entries of 53 facilities located in ten countries owned by ten companies. We have collected information on the exact geographic location of the facilities (i.e. latitude and longitude) for 85% of the plants in the sample, inception dates for 30% of the sample, and employment figures for 11% of the sample. The contents of the design facility database are summarized in Table 3-4.

Table 3-4: Design Facility Database Contents

Data Category	Number of Facilities with Data Collected	Share of Sample with Data Collected
Company	53	100%
Country Location	53	100%
City Location	52	98%
Description of Activities	47	89%
Exact Location	45	85%
Inception Date	16	30%
Employment	6	11%

Source: Globalization and Jobs Project, Design Facility Database, October, 1998.

The plant and facility databases have been laboriously compiled from secondary and primary sources. We believe that they comprise a unique resource. The information they contain have been used to analyze plant characteristics according to the locational typology presented in Section 3.3 and enabled us to create a series of maps using geographic information system (GIS) software to provide visual representations of the spatial characteristics the automotive industry. The maps provide a relatively accurate picture of the geography of the industry.

3.2 Field Research: Interviews

The field research has consisted of several rounds of interviews with automakers and large suppliers, followed by factory visits and the administration of a detailed plant-level questionnaire at a small but diverse set of vehicle assembly plants.

The initial phase of the field research consisted of a series of semi-structured interviews with the leading automakers and largest suppliers based in Europe, Japan, and the United States. The team conducted 23 site visits to the headquarters locations of seven automakers where interviews were conducted with 45 managers. In addition, the headquarters of 11 first-tier suppliers were visited and 26 managers were interviewed. Two on-site interviews were conducted with the research departments of the main automotive trade unions in the United States and Germany, as well as an interview with the General Manager of the main automotive industry trade organization in Japan. The interviews were conducted in the course of three research trips to the Detroit area, one to Switzerland and Germany, and one to Japan. In addition to these on-site interviews, the team conducted approximately twelve supplemental interviews over the telephone. Due to resource constraints, Korean automakers and suppliers were not included in the headquarters interview process. A complete list of headquarters interview questions is provided in Appendix A, Section 1.1 (note: Appendix A is available to study team members only to protect firm confidentiality).

The interviews were guided by the following four sets of questions, which were provided to respondents in advance of face-to-face interviews:

1) **New market identification, new facility design, and capacity planning**: How are new production locations selected? How are new plant attributes determined? How do host country regulations effect the nature of new investments? How are production schedules determined and balanced among plants in various locations?

2) **Automaker-supplier relations both at home and abroad**: How are the facility locations of automakers and suppliers related? What role does the supply-base play in the process of globalization?

3) **Commonalization of vehicle, component, and process design**: How are vehicle and component designs adapted to particular geographic markets? What effects the degree that components and processes can be commonalized across various production locations?

4) **Geographic variations in worker recruitment, training, and work organization**: How is the work-force in different places built, trained, and managed? Does shop floor organization differ?

The interviews, once written-up, have provided the team with more than 100 pages of research notes, containing a rich body of evidence on the globalization strategies of American, European, and Japanese automakers as well as a handful of their most important first-tier suppliers. The material from these interviews proved invaluable to the study's research design, the construction of our field survey instrument, as well as our findings on corporate strategy presented in Section 7. A complete list of headquarters interview questions is presented in Appendix B, Section 2.1.

3.3 A Locational Typology: LEMA, PLEMA, BEM, and HOME

One of the central findings of the interviews was that automotive companies tend to invest in production facilities outside their home countries for very different reasons depending on the type of target location. For example, companies tend to invest in Mexico to provide a proximate low-cost "peripheral" location from which to serve the United States market in the context of NAFTA trade liberalization. Automakers based in Europe (including the European divisions of American firms) tend to invest in Spain for the same reason. The motivation for investments in "big emerging markets" such as China, on the other hand, are entirely related to the penetration and development of new markets. Based on the key distinction between cost-cutting and market-seeking investment locations, the study developed a hypothesis that many plant attributes too could be predicted by type of location, including plant size, degree of integration, level of automation, share of parts sourced from the local supply-base, etc.

According to the above logic the project segmented the types of production locations that are available to automakers into three broad categories: 1) **Large Existing Market Areas**, or **LEMAs**, such as the United States, northern Europe, and Japan; 2) **Peripheries of Large Existing Market Areas**, or **PLEMAs**, such as Mexico, Canada, Spain, Portugal, and East Europe; and 3) **Big Emerging Markets**, or **BEMs**, such as China, India, Vietnam, and Brazil. A fourth type of production location that is sometimes used in the analysis, **HOME**, is treated as a subset of the LEMA category. HOME refers to plants located in the same country where the firm's headquarters are located, such as General Motors in the United States, Volkswagen in Western Europe, Toyota in Japan, Hyundai in South Korea, Bosch in Germany, Denso in Japan, and Lear in the United States.

BEMs provide automakers with opportunities to participate in growing markets. Where market penetration is low and populations are large (e.g. China, India, and Vietnam) the potential for growth in BEMs is tremendous. The intent of establishing new plants in BEM locations is to establish an early market presence in high-potential emerging economies as a way to ensure long-term participation in the automotive market as it develops. The hypothetical characteristics of BEM, LEMA, PLEMA, and HOME type assembly plants are summarized in Table 3-5.

Because of high operating costs, LEMA locations outside of HOME (plants of this type are often referred to as "transplants") are chosen when automakers are sure of their market, perhaps because it was previously established through successful exporting. "Transplant" investments in large existing markets are market-seeking as well, but are more often intended to expand market share initially gained through exports than to develop entirely new markets. Besides the Japanese "transplants" in the United States and Europe, American and European automaker investments in northern Europe fall within the LEMA category.

Table 3-5: The Hypothetical Attributes of BEM, LEMA, and PLEMA and HOME Type Assembly Plants

	BEM	LEMA	PLEMA	HOME
Strategic intent	Market seeking	Market and capability seeking	Cost cutting	Market and capability seeking
Capacity	Low	High	High	High
Wages	Low	High	Low	High
Application of lean principles	High	Low (except Japan)	High	Low (except Japan)
Vehicle development?	No	In some cases	No	Yes
Level of integration	Low	High	Medium	High
Level of local supply	Low	Medium-to-high	Medium	High
Level of exports	Low	Low	High	Low (except Japan)

Source: Globalization and Jobs Project, Interviews

The principal strategic role of PLEMA locations such as Mexico, Canada, Spain, Portugal, and East Europe are to provide a proximate low-cost location from which to supply LEMAs. While PLEMA locations do not provide the same political or consumer payoffs that LEMA locations do, they do provide trade benefits because they share common markets with LEMA economies (e.g. AUTOPACT, NAFTA and the E.U.). We have included plants located in the Eastern European countries of the Czech Republic, Hungary, and Poland in the PLEMA category even though they do not yet share a common market agreement with the E.U., and are currently focused on supplying local markets. In the wake of NATO expansion, there is now a widespread expectation that the E.U. will be broadened to include these Eastern European countries in the near- to medium-term. When such a pact is made, we believe that many of the assembly plants in Eastern Europe will begin to supply Western Europe with finished vehicles as long as motor vehicles are not excepted from trade agreements. Such BEM-to-PLEMA transition strategies were explicitly outlined during some of our interviews with automakers currently active in East Europe.

The typology presented here has limitations. For example, the ability to differentiate the relatively recent Japanese transplant investments in the United States from the much older investments by Ford and GM in Europe is lost. Many smaller emerging markets, such as Namibia, are included in the BEM category. Still, we believe that the locational typology of LEMA, PLEMA, BEM, and HOME has allowed us to see the component parts of the globalization process more clearly. It has been especially important for us to have the ability us to analyze PLEMA locations separately, as they appear to be almost completely different from the majority of BEM plants. Even so, these two locational types are often conflated in discussions of globalization, were all investments in "developing" or "emerging" countries are simply lumped together. As a manager from an American automaker put it, Mexico had "emerged" as a market and is now "part of North American operations."

A map showing the location of vehicle assembly plants of each locational type is presented in Figure 3-1. This map clearly shows the three faces of globalization discussed in this report. First, it shows the intermingling of HOME and LEMA type assembly plants in the American Midwest and in Northern Europe, but not in Japan or Korea. Second, on the outer boundaries of these large existing markets, it shows the build-up of PLEMA type assembly plants in Canada, Mexico, Spain, and East Europe. Lastly, it shows the large number of BEM type plants that have been established throughout the developing world, especially in South America, India, Southeast Asia, and China. Tables 6-1 and 8-1 and Figure 8-1 provide a good summary of the attributes of the global automotive industry according to the locational typology outlined above.

Figure 3-1: Global Map of LEMA, PLEMA, BEM, and HOME Type Automotive Assembly Plants

In the course of the analysis, the locational typology is used in two ways. First, it is used to compare the attributes of *plants* of different locational types. Thus, we sometimes refer to LEMA, PLEMA, BEM, or HOME type *plants*. Plant attributes include production levels, capacity, employment, wages, and the like. Second, we use the typology to analyze the attributes of *markets* of different types. Thus, we sometime refer to LEMA, PLEMA, and BEM type *markets*, or *locations*. Market attributes include vehicle sales, population, market penetration, and the like. Of course, in the context of markets, LEMA and HOME are one in the same, and are used interchangeably. In practice, the analysis of plants and markets can be mixed, because plant attributes (e.g. wage levels, employment, and production output) can be aggregated and/or averaged for an entire market type. The hope is that in subsequent research, the typology can be refined.

3.4 Field Research: Assembly Plant Site Visits

To test the hypothesis developed during the interviews, the project set out to collect detailed information about sourcing, plant design, and employment quality at the assembly plant level. We carefully devised several sets of questions that allowed us to explore plant-level sourcing patterns; degree of vertical integration; production worker demographics, wages and benefit levels; employee involvement programs and job rotation practices; and production worker education and training. Besides input from the research team, the quality of the field questionnaire benefited greatly from review by outside experts, including Frits Pil of the University of Pittsburgh, Davis Jenkins of the Great Cities Institute, Jay Tate of the Berkeley Roundtable on the International Economy, and Isaac Mankita of the University of California at Berkeley. Of course, the final questionnaire is still imperfect and in need of improvement. Its shortcomings are wholly the responsibility of the core research team. The plant-level field survey questionnaire is contained in Appendix B, Section 2.2 of this report.

The field survey questionnaire was used in the course of our visits to matched sets of small-car assembly plants. Since we could only hope to visit and gather data from a tiny fraction of the total universe of plants, we conducted a series of site visits to plants that manufacture the most widely produced models, **small cars**, in various locations. We also designed the plant-level field work for maximum consistency in regard to automaker and car model. For example, a full implementation of the proposed research would include Nissan Sentra factories in Japan (HOME), the United States (LEMA), Mexico (PLEMA), and Thailand (BEM); and Ford Escort factories in the United States (HOME), Mexico (PLEMA), and Brazil (BEM). The design also strives for variety regarding automaker countries of origin, with the small-car plants of two American companies, two Japanese, and two European included to protect firm confidentiality and enable us to analyze variations according to automaker national origin. The proposed matrix of locations for the plant visits are presented in Table 3-6.

Due to resource constraints associated with international travel, as well as some difficulty in obtaining access to the offshore plants of certain automakers, we were not able to gather results from all the plants in the proposed matrix for the current study. However, research on plants of each locational type was completed, allowing us to begin to compile the data needed to begin testing the hypothesis underlying the locational typology presented in Section 3.3. As Table 3-7 shows, data was gathered at two HOME and one LEMA type plants in Japan and the United States, two PLEMA type plants in Mexico, and eight BEM type plants in Vietnam. As of this writing, the field questionnaire was administered at fifteen assembly plants and was returned by thirteen. The two questionnaires returned from plants in the United States (consisting of one HOME and one LEMA type plants) were early, "test" versions of the questionnaire for which follow-up field visits were not conducted. Therefore, the data for these plants are not as complete as the others and the team has less confidence in their accuracy since the results were not substantiated through site visits. In Section 7 we present some of the results of the plant-level field and questionnaire research.

Table 3-6: Proposed Small Car Assembly Plant Visit Matrix (number of plants)

Location Type (# of plants)	American Firms' plant locations	Japanese Firms' plant locations	European Firms' plant locations
HOME	USA (3)	Japan (2)	Europe (3)
Large Existing Market Areas (transplants)	Germany (2), UK (1)	USA (2), UK(1)	none
Peripheries of Large Existing Market Areas	Mexico (3), Spain (1), East Europe (1)	Mexico (1), Spain (1)	Mexico (1), Spain (3), East Europe (1)
Big Emerging Markets	Indonesia (1), Brazil (2), Vietnam (1), China (1)	Thailand (2), Venezuela (1), Vietnam (6)	China (2), India (1), Vietnam (1), Brazil (1)

Table 3-7: Completed Assembly Plant Visit Matrix (number of plants)

Location Type (# of plants)	American Firms' plant locations	Japanese Firms' plant locations	European Firms' plant locations
Home	USA (1)	Japan (1)	
Large Existing Market Areas		USA (1)	
Peripheries of Large Existing Markets	Mexico (2)		
Big Emerging Markets	Vietnam (1)	Vietnam (6)	Vietnam (1)

Although highly preliminary because of the small sample size, the data are suggestive; both supporting and informing the hypotheses summarized by Table 3-5. The findings from the field surveys are presented in Section 10. It is our hope that future research will allow us to flesh out the matrix in Table 3-7 with additional field research. The completed plant visit locations are presented in Appendix A, Section 1.2 (note: Appendix A is available to study team members only to protect firm confidentiality).

4. What is Globalization?

4.1 The Need for a Broader Analytic Framework

Our perspective of globalization is informed by a serious academic debate centered on the degree and nature of integration in the world economy (see Dicken, 1998 for a recent review). Some of the positions in the debate can be roughly mapped along the lines of academic discipline. Economists, who tend to downplay national difference in their search for universal understanding of how capitalist economies work, tend to make the claim that the process of globalization is highly advanced, pointing to the rise of trans-national corporations, the liberalization of trade regimes, and the near elimination of barriers to international currency and equity trading as evidence (Reich, 1990; Ohmae, 1990; Burtless et. al., 1998). Political scientists and sociologists, steeped in a comparative analytic approach, have responded with evidence of the durability of national political and economic structures even as the world economy becomes more interconnected (Koechlin, 1995; Berger and Dore, 1996). Geographers, who tend to look at the spatial aspects of the economy in its finest grain, point to places such as Silicon Valley and the Detroit metropolitan region as evidence that sub-national regions are the optimal scale at which to organize highly efficient and innovative production complexes, a claim that, at first blush, would appear to run counter to the process of globalization (Schoenberger, 1994; Storper, 1994, Cox, 1997).[1] How can it be that scholars come up with such seemingly contradictory views?

The answer lies in the fact that the process of globalization is an ongoing one. In any process of transformation that began long ago and will never completely be finished, characteristics that reflect more or less advanced aspects can be readily identified and highlighted depending on what one is trained to look for. If one wants to locate evidence of a globalized economy, it is easy to find in the rapid integration of world financial and securities markets. If one looks for evidence of the continued importance of the nation-state as an entity, that too is easy to find in persistent tariff and non-tariff barriers to trade at the levels of the nation-state and the trade bloc. If we look for industrial excellence emanating from spatially concentrated clusters of lead firms, specialized suppliers, and industry-specific labor markets, examples abound.

The variety of perspectives is actually quite useful in revealing the myriad aspects of globalization, but problems arise when discipline-specific myopia results in the debate becoming unnecessarily polarized or disjointed. Moreover, since economists tend to wield the greatest influence in both academic and policy circles, the voices of political scientists, sociologists, and geographers tend to be overwhelmed and the important roles of state policy and sub-national agglomeration economies are too often left under-examined. The project we need to undertake is the building of an analytic framework that allows for all the seemingly contradictory evidence. Such a project is necessarily interdisciplinary. It would address some of

[1] Of course there are many exceptions to the rough divisions we make here; all disagreement does not take place between disciplines. For examples of dissenters from economics, sociology, and geography, see Tyson (1991), Gereffi (1994), and Dicken (1992) respectively. Charles Sabel, a political scientist, is well known for his work on the economic organization of sub-national regions (Piore and Sabel, 1984; Sabel, 1989, 1992) and therefore widely cited by geographers.

the knottiest problems that currently exist in modern social science: developing a framework for thinking about economic processes along the entire scale of analysis, from the individual firm to the global industry; and provide a better set of tools to examine the process of economic change in the local, national, regional, and global economies.

4.2 The Globalization of Markets Vs. the Globalization of Production

For economists writing on the subject of economic globalization, a key question has been the degree of uniformity that has developed across national economies. The underlying hypothesis is that the more that national economic systems come to resemble one another, the fewer barriers will exist to the flow of resources to their most efficient use, and the further the world economy will become integrated, or globalized. The usual assumption is that government policies that restrict or subsidize international trade and investment flows, alter exchange and interest rates, or protect local industry from foreign competition interfere with cross-border price signals, impeding the flow of goods, services, and capital to their most efficient uses around the world. This literature pegs the advance of globalization to the continued rise of a global free trade regime (see Rodrik, 1997 and 1999, for a critique).

A key question for political scientists is the degree that national economies are being eclipsed by larger political and economic structures such as multi-country regional trading blocs and the WTO (Luard, 1990; Gill, 1992; Hirst, 1995; Kothari, 1995). Is the role of the state diminishing? The traditional role of the state has been to seek advantage in the world economy by setting trade policy, usually to protect local firms, which are sometimes state-owned. While tariff barriers have been lowered on average, non-tariff barriers to trade such as local content rules and quotas have increased (Dicken, 1998). Even as the reduction of non-tariff barriers to trade move to the center of WTO negotiations, the authority of the state to set trade policy seems alive and well, particularly in high-profile industries such as automobiles, which are often excepted under trade liberalization agreements.

In addition, the aggregation of trade authority into fewer hands under the E.U. and the setting up of regional-scale trade regimes under NAFTA (and perhaps AFTA) have encouraged more companies to pursue *regional global* production strategies (with at least one plant located within each major trade bloc) where it is possible to serve an entire bloc from a single point, ensuring market access *and* adequate economies of scale (Sturgeon, 1997). As trade becomes freer within trade blocs, trade between blocs may become less so (Johnson, 1991; Emmerij, 1992; Hirst, 1992).

So, it is clear that globalization cannot simply be equated with free trade, especially in the automotive industry, were we can point to many instances where trade restrictions—or their threat—have hastened the globalization of production. For example, the establishment of production by Japanese automobile firms in the United States since the late 1970s has been in direct response to trade friction in the sector. Likewise, trade restrictions and local content requirements in many developing countries have long been the central force behind the establishment of local production capacity by foreign firms in a wide range of sectors. Many of the highly publicized investments by automakers in emerging economies during the past several years have been undertaken to gain market access. Still, globalization, in popular usage, most often refers to trade liberalization and the globalization of markets.

To begin to make sense in this gap in the debate, we can say that free trade leads the to globalization of *markets*, while restricted trade leads to the globalization of *production*. When we use this larger framework it becomes clear that globalization can advance along several routes at the same time. On one hand, free trade can lead to globalization in the sense that markets for finished products will be more globalized in a world of increasingly liberal trade rules. On the other hand, in a world with persistent trade restriction in finished goods, firms will increasingly globalize production to serve local markets. The argument then emerges is that globalization appears to advance regardless of how quickly freer trade regimes do or do not develop. State policy, it seems, can only be effective in choosing which aspect of globalization will advance the fastest: markets or production. It is precisely the tenacious and unremitting character of globalization which feeds the popular notion that the advance of world-scale economic integration—whether desirable or not—is inevitable.

4.3 A Working Definition of Globalization

How have we defined globalization for the purposes of the current project? On the broadest level, we interpret the term globalization to refer to the growing *global-scale inter-connection and integration of human activity*. These inter-connections are expressed in many areas of society and economy.

In the arena of *markets*, it is possible to detect the advance of globalization while putting the issue of trade liberalization aside. Some observers discern a world-scale homogenization of consumer preferences for things such as western style dress, consumer goods (including motor vehicles), and entertainment, arguing that globalization is creating a single world culture (Roland, 1992). Perhaps most notable has been the emergence of the "world teenager;" young people who, under the influence of global advertising and mass media (e.g. MTV), seem to wear the same clothing, listen to the same music, eat the same fast food, and aspire to many of the same personal goals regardless of location (Hassan and Kaynak, 1994; King, 1997). Critics of the "one world" thesis point to the persistence of cultural differences; some argue that increased global-scale inter-connection and interaction, by exposing each person to an increasingly diverse array of cultural expressions, creates the experience of a more heterogeneous world, not a more homogeneous one (Smart, 1994; Waters, 1994).

In the arena of *economic integration*, the term globalization also encompasses a wide range of phenomena, including:

1) The cross-border integration of **wholesale and retail financial markets** (Capoglu, 1990; Frankel, 1994; Sobel, 1994).
2) Increased global-scale **market competition** (Audretsch and Claudon, 1989; Stopford and Strange, 1991) and **wholesale and retail trade** (Smeets, 1990, Krugman and Venables, 1995).

3) Increased **foreign direct investment** (Dunning, 1993; Levy, 1993; Nunnenkamp, 1994).

4) Increased cross-border **contracting and global-scale production networks** (Kogut and Kulatilaka, 1994; Gereffi and Korzeniewicz, 1994; Bonacich et. al., 1994; Sturgeon 1997, Borrus and Zysman, 1997).

5) The formation of **international joint ventures and strategic alliances** for R&D (Budd, 1995; George, 1995; Bowonder and Miyake, 1995).

We must view the process of economic globalization in all of its complex manifestations: finished goods trade, intermediate goods trade, FDI, cross-border contracting, etc. For the current project we have focused on the three aspects of international integration with the greatest relevance for the automotive industry: trade, foreign direct investment (FDI), and global-scale inter-firm production networks. In our view, it is especially the growing importance of inter-firm production networks (i.e. the globalization of the automotive supply-base) that differentiates the current round of international investment from past rounds (see Section 8).

Is there any justification in forgoing the well established academic term *internationalization* for the more recent term *globalization*? While both internationalization and globalization refer to the geographic spread of production, we can make a clear distinction between the terms through the example of the automotive industry.

Firms internationalize when they invest in new "offshore" production capacity that is operationally discrete from domestic capacity. GM's investments in Europe are a good example. These operations were begun with acquisition of local firms (Opel and Vauxhall) that continued to develop, manufacture, and sell a set of products that were almost completely distinct from those developed and produced by the parent company's home operations. Until recently there was little or no integration at the level of components, platforms, or models.

Firms globalize when they attempt to integrate key day-to-day functions on a global scale, such as component sourcing, vehicle development, new model introduction (the Big Three's investments in Mexico are a good example). As such, globalization does not necessarily include the establishment of new offshore capacity, since efforts can be made to upgrade and integrate existing offshore operations with domestic operations (GM's current effort to coordinate vehicle development at its Opel, Lansing, and Saturn divisions is a good example, as is the move to current models at older plants in Brazil). In practice however, many companies are simultaneously establishing production in new locations *and* trying to build globally integrated organizations, so the term globalization can be safely assumed to include both dispersion of production and the centralization and coordination of corporate control, vehicle development, and component sourcing.

Dicken (1998, p. 5) makes a similar distinction between internationalization and globalization:

- *Internationalization processes* involve the simple extension of economic activities across national boundaries. It is, essentially, a *quantitative* process which leads to a more extensive geographic pattern of economic activity.

- *Globalization processes* are *qualitatively* different from internationalization processes. They involve not merely the geographical extension of economic activity across national boundaries but also—and more importantly—the *functional integration* of such internationally dispersed activities.

Because we believe that the rise globalization is a *qualitative* change in how the world economy operates, it is inherently difficult to measure in a precise way. Suffice it to say that at some point when transportation and telecommunication costs are low enough, information systems are functional and ubiquitous enough, and the global supply-base is capable enough, globalization can be expected to supplant internationalization as the dominant mode of world-scale economic organization. We believe that if we have not crossed such a threshold yet, we soon will.

5. The Historical Geography of Motor Vehicle Production

It is important to place the current round of geographic expansion in the automotive industry in historical perspective. Accounts that lack this perspective cannot differentiate long term trends from those aspects that are truly new. For example, this section will show that American automakers have had global-scale assembly operations since the 1920s, and that the drive to increase local content has been a prominent feature of the industry since the 1930s. Taking a long historical perspective allows us, in subsequent sections of the report, to identify those aspects of the current round of international expansion that are new, such as the rise of the global supplier and the recent increase of finished vehicle exports from locations with lower operating costs back to automaker's home markets.

The locational determinants of motor vehicle production have changed over time. Prior to the advent of mass production in 1910, the need for customization required proximity to pools of well-heeled customers. When mass production lowered the cost of the automobile to the point where mass markets developed, final assembly moved close to final markets to reduce transport costs. In the 1930s, trade barriers erected by national governments become the main motivation for international production. Automakers were forced to establish local production or forgo participation in the most promising emerging markets of the day. Where trade barriers were extended to automotive parts, automakers moved to integrate offshore production to the extent possible. Both tariff and non-tariff barriers to trade in finished vehicles—or the threat thereof—continue to be a key motivation for the growth of offshore production today. In the 1980s we began to see a new motivation develop alongside barriers to trade, American and European automakers, under increasing competitive pressure from the rather sudden appearance of fierce new competition from Asia, began importing finished vehicles from lower-cost peripheral locations (e.g. Canada, Spain, and Mexico) within the context of regional trade agreements such as the North American Free Trade Agreement (NAFTA) and the European Union. Table 5-1 summarizes the changing motivations for offshore production in the automotive industry. This section traces the geographic spread of the automotive industry over time as the leading firms of the day responded to these changing motivations over time.

Table 5-1: The Changing Motivations for Offshore Production in the Automotive Industry

Motivation	Period
Customer proximity	1890-1919
Lower transport costs	1910-1929
Tariff avoidance/trade friction/local content rules	1930s-present
Lower operating costs	1980s-present

Source: Globalization and Jobs Project

5.1 1890 to 1910: Customer Proximity Determines Production Locations

The internationalization of the automotive production began very early in the industry's history. Production of German Daimler motor cars began under license in France in 1891, Coventry, England in 1896; and in New York City in 1907. Daimler established a wholly-owned engine and parts subsidiary in Vienna in 1902, where vehicles began to be produced under license from Fiat in 1907. In 1903 the French firm Clement formed a joint venture with the British firm Talbot to produce motor cars on both sides of the Channel (Maxcy, 1981). Most early motor vehicles were large and expensive, with bodies, or "coaches" custom made, requiring close proximity between body craftsmen and well-heeled customers. High prices kept markets and production volumes small, and most early foreign license manufacturers eventually closed under the onslaught of new competition from the hoards of domestic manufacturers that arose in each major market.[2] It took the application of mass production techniques to automotive assembly by American firms—especially the rigorously standardized production techniques pioneered by the Ford Motor Company—to allow high-volume motor vehicle assembly to take place at a distance from parent firms.

Table 5-2 lists the earliest examples of automakers producing outside of their home countries, or "offshore." The table reveals an industry that began its international spread almost at its inception. Ford Motor Company established its first production facility outside the United States only one year after its founding, as did General Motors. The table also shows how early the divergent modes of international expansion were set in place by General Motors and Ford. Ford entered the British market with a wholly-owned subsidiary while GM entered through acquisition.

Table 5-2: Foreign Motor Vehicle Plants Established Prior to World War I

[2] In 1904, about 120 vehicle firms and 57 component suppliers in the United States produced about 22,000 units. By 1913 both the market and the supply-base had increased dramatically. About 300 vehicle firms and 1,000 suppliers produced 462,000 cars and 23,000 commercial vehicles (the Ford Model T accounted for nearly 50% of the United States market). In contrast, British motor vehicle production stood at about 34,000 in 1913 and France about 45,000 (Rhys, 1972)

Company	Inception Date	Location	Type of Plant	Mode of Entry
Daimler	1891	France	unknown	License to Local Company
Daimler	1896	Coventry, England	unknown	License to Local Company
Clement-Talbot	1903	England	unknown	Joint Venture
Ford	1904	Walkersville, ON, Canada	CKD Assembly	Joint Venture
Daimler	1907	New York City, USA	unknown	License to Local Company
Fiat	1907	Vienna, Austria	unknown	License to Local Company
GM	1907	Canada	Body mfg./CKD chassis	License to Local Company
GM	1908	England	Integrated Manufacturing	Acquisition (Bedford)
Ford	1911	Trafford Park, England	CKD Assembly	New Subsidiary

Source: Compiled from Rhys, 1972 and Maxcy, 1981.

5.2 1910-1919: Transportation Costs Drive Offshore Production

After several business failures building large, high-priced cars, Henry Ford developed a vision of the automobile as the “replacement for the family horse.” The realization of this vision came in 1909 with the introduction of the Model T, which was an instant success by virtue of its advanced technology[3], low cost, and reliability. Over the next few years a cycle of production improvement, price cutting, increased sales, and capital re-investment in advanced production equipment and methods was put in motion at Ford—productivity grew dramatically as a result. Unit output per worker/year nearly doubled from 6.8 in 1909 to 11.4 in 1912, and again to 19.2 in 1913. Cost savings were passed on to consumers; the successive drops in unit price led to rapid increases in market share and more importantly, to the creation of vast pools of potential new customers for the Model T. The resulting sales boom at Ford was unprecedented in both its size and global reach. The vehicle’s light weight, high ground clearance, reliability, interchangeable parts, and ease of repair made it particularly suited to poor road conditions, not just in the backwoods of rural America, but in Africa, Asia, Europe, and Latin America as well. By 1913 the Ford Motor Company by far the largest automotive firm in the world; sales of the Model T approached 200,000 units, with foreign sales running at about 12-15% (Dassbach, 1989). By the time it was replaced by the Model A in 1927, fifteen million Model T’s had been manufactured and sold worldwide (Rhys, 1972), with sales peaking at more than two million units in 1925 (op. cit.).

Expansion of Ford’s production base outside of Detroit predated the Model T, beginning in 1904—one year after the company’s founding—when a Canadian wagon manufacturer, McGregor, began to assemble Model Ns under license in Walkersville, Ontario. The Canadian tariff on fully assembled vehicles was 35%, and since price competition was Ford’s central

[3] The Model T pioneered the use of stronger, lighter, “vanadium” steel.

lever to expand the market, the mark-up was perceived as being particularly burdensome.[4] However, the Canadian case was somewhat unusual; in this early period tariff avoidance was *not* the major driver of geographic expansion, transport costs were. By 1910 distant sales of the Model T were sufficient to justify building assembly plants close to final markets to reduce freight costs. That year Ford established an assembly plant in Kansas City, MO, to assemble the Model T, becoming the first automobile producer to open a wholly-owned branch assembly plant. Ford could ship eight unassembled Model T "kits" in the same amount of space it took to ship a single finished vehicle. In addition, rail freight charges on a per-pound basis for automotive parts were half those for fully assembled vehicles. This same logic applied to inter-continental shipping, prompting Ford began assembling Model T's at Trafford Park, England in 1911, even without the presence of British tariffs (although operating as a "local" company did provide some tax and perceived market advantages). Because the kits were compiled at Ford's plants in Detroit, the Model T's assembled in England were identical to those built in the United States and Canada, except for adaptation to right-hand drive (Maxcy, 1981; Dassbach, 1989). As we shall see, the assembly of such completely knocked down—or CKD—kits is still quite common in the automotive industry today.

By 1913 Ford production at Trafford Park rose to 7,310 units, making the company the largest producer in Europe (Maxcy, 1981). Ford U.K. became the hub of the company's European production base, exporting vehicle kits to an assembly plant established in Bordeaux, France in 1913, and finished vehicles to other European markets. With the onset of World War I in 1914 both the Trafford Park and Bordeaux plants—over Henry Ford's objections—were nationalized and converted to the manufacture of munitions and ambulances. With the collapse in European civilian sales due to the war, Ford began investing in South America. By 1915 annual Model T sales in Argentina had increased to nearly 1,500 units, prompting the company to establish a CKD assembly plant in Buenos Aires, again to save on transport costs.

Prior to World War I GM, in contrast to Ford, established foreign production bases via acquisition. GM's founder, William Durant, instituted much weaker control structures of his company than did Henry Ford. As a result GM's foreign affiliates retained much more authority over design and manufacturing, affixing locally designed coaches to GM supplied engines and chassis, a strategy reminiscent of the "global platform" approach so many automakers are striving to implement today. In 1907 GM granted a license to the Canadian wagon manufacturer R.S. McLaughlin and in 1908 the company purchased the British firm Bedford Motors. Besides saving on freight costs, GM's early "platform strategy" enabled the company, still competing with high-end producers, to have coaches adapted to local tastes. In 1918 two events came to pass that would dramatically enable GM's inter-war international expansion, the acquisition of Chevrolet, which gave the company its first line of low-priced cars

[4] Ford Canada became an important player in the company's early international expansion. To avoid creating new competitors, foreign investment agreements often included an allocation of markets. Since the Canadian Government was seeking a preferential tariff system with the rest of the British Empire at the time, prospects for exporting finished vehicles from Canada were in many ways better than they were from the United States. Ford Canada was granted exclusive rights to sell in the British empire excluding England and Ireland, were rights had been previously been grated to a local sales agent. Ford Canada was extemely sucessful and financed its local and overseas expansion with retained profits. Over time, local parts content increased drmatically. (Maxcy, 1981) By 1913, production at Ford Canada had increased to about 12,000 units, with exports amounting to nearly half that number. (Dassbach, 1989)

to compete head-to-head with Ford, and the creation of the General Motors Acceptance Corporation (GMAC), a financing arm for the purchase of vehicles that would soon have offices worldwide.

5.3 The Inter-War Years: Barriers to Trade Drive Offshore Production

5.3.1 A Boom in CKD Assembly

Despite a slow start due to the sharp recession of 1920-1921, offshore assembly by American firms increased dramatically during the inter-war period, driven by the need to access growing markets and the fear that future access would be restricted to established companies. Ford and GM had emerged from the war the clear industry leaders; the two companies raced to compete head-to-head in the most promising "emerging" markets of the day. Strikingly, the "herd" dynamics discernible the 1920s were similar—with a much smaller herd—as the current race to establish early production bases in large untapped markets such as China and Vietnam (see Section 6.2). The initial push to establish offshore production during the inter-war period, like the that of the pre-war period, was largely motivated by transport cost savings. Accordingly, the investments came in the form of CKD assembly plants. But as the Depression of the 1930s hit home, economic crisis and rising nationalist sentiments in Europe triggered a sudden jump in tariff barriers that compelled Ford and GM to attempt integrated offshore manufacturing. These attempts would be stymied by the outbreak of World War II, but would be renewed afterward.

In 1919 Ford went ahead with construction of a larger CKD assembly plant in Argentina which had been delayed by the war (by 1926 the Argentinean market would surpass England to become Ford's second largest foreign market after Canada), and opened new assembly plants in Sao Paulo, Brazil; Copenhagen, Denmark; and Cadiz, Spain. Perhaps more importantly, 1919 also saw the opening of Ford's River Rouge plant complex near Detroit, from which the company took in raw materials and turned out finished vehicles—as well as a large quantity of CKD kits destined for foreign and domestic assembly plants (by 1925 the number of Ford domestic CKD assembly plants had increased to 36). In 1922 an assembly plant was established in Trieste, Italy, with exports going to the Balkans, Turkey, Cyprus, Egypt, Syria, and other Middle East markets. The same year, a plant was opened in Antwerp, Belgium, the capacity of the Copenhagen plant was increased to 600 units per day, and a new plant was opened in Sweden. In 1924 assembly plants were opened in Santiago, Chile; and Yokohama, Japan. In 1925 an assembly plant was opened in Berlin, Germany; a new, larger plant was established outside of Paris to replace the Bordeaux plant; and the plant in Cadiz, Spain was replaced with a larger one located in Barcelona. In 1926 an assembly plant was established in Mexico City along with three additional plants in Brazil. Ford Canada, which had exclusive rights to sell Ford's in the British Empire outside of the British Isles, also expanded its offshore CKD production dramatically during the 1920s, setting up assembly plants in South Africa in 1923, Australia in 1925, and India and Malaysia in 1926 (Dassbach, 1989).

In the 1920s GM followed Ford's strategy of establishing offshore plants to assemble American- and Canadian-produced CKD kits. GM opened plants in Copenhagen in 1923; Antwerp and London in 1924; Buenos Aires, Sao Paulo, and Malaga, Spain in 1925; Berlin, South Africa, Uruguay, and New Zealand in 1926; Java (Indonesia) and Osaka, Japan in 1927; and Poland, India, and Sweden in 1928. Beginning in 1925 with offices in Antwerp and Copenhagen, GMAC was operating in 22 countries by 1927, financing about half of the company's overseas sales. Between 1926 and 1928, GM's exports grew from 174,427 units, accounting for 14% of sales to 383,200 units, accounting for 21% of sales. About 70% of exported vehicles were assembled in foreign factories (ibid.).

Table 5-3 lists the offshore automotive assembly plants established between 1913 and 1928, revealing the remarkable geographic spread of the industry, led by Ford Motor Company, in the earliest stages of mass production. Again, this expansion was almost entirely motivated by transport costs savings gained from shipping CKD kits over fully assembled vehicles.

Table 5-3: Foreign Motor Vehicle Assembly Plants Established Between 1913 and 1928

Company	Inception Date	Location	Type of Plant	Mode of Entry
Ford	1913-1925	Bordeaux, France	CKD Assembly	New Subsidiary
Ford	1915	Buenos Aires, Argentina	CKD Assembly	New Subsidiary
Ford	1919	Buenos Aires, Argentina	CKD Assembly	New Subsidiary
Ford	1919-1925	Cadiz, Spain	CKD Assembly	New Subsidiary
Ford	1919	Copenhagen, Denmark	CKD Assembly	New Subsidiary
Ford	1919	Sao Paulo, Brazil	CKD Assembly	New Subsidiary
Rolls Royce	1919-1929	Springfield, Massachusetts	Integrated Manufacture	New Subsidiary
Ford	1922	Antwerp, Belgium	CKD Assembly	New Subsidiary
Ford	1922	Sweden	CKD Assembly	New Subsidiary
Ford	1922	Trieste, Italy	CKD Assembly	New Subsidiary
Ford Canada	1923	South Africa	CKD Assembly	New Subsidiary
GM	1923	Australia	Body mfg./CKD chassis	Acquisition (Holden)
GM	1923	Copenhagen, Denmark	CKD Assembly	New Subsidiary
Austin	1924-1928	Le Mans, France	Integrated Manufacture	Acquisition (Le Bolee)
Ford	1924	Santiago, Chile	CKD Assembly	New Subsidiary
Ford	1924-1938	Yokohama, Japan	CKD Assembly	New Subsidiary
GM	1924	Antwerp, Belgium	CKD Assembly	New Subsidiary
GM	1924	London, England	CKD Assembly	New Subsidiary
Citroen	cf. 1925	Belgium	CKD Assembly	New Subsidiary
Ford	1925	Barcelona, Spain	CKD Assembly	New Subsidiary
Ford	1925	Berlin, Germany	CKD Assembly	New Subsidiary
Ford	1925	Paris, France	CKD Assembly	New Subsidiary
Ford Canada	1925	Geelong, Victoria, Australia	Body mfg./CKD chassis	New Subsidiary
GM	1925	Buenos Aires, Argentina	CKD Assembly	New Subsidiary
GM	1925	Luton, England	Integrated Manufacture	Acquisition (Vauxhall)
GM	1925	Malaga, Spain	CKD Assembly	New Subsidiary
GM	1925	Sao Paulo, Brazil	CKD Assembly	New Subsidiary
Renault	cf. 1925	Belgium	CKD Assembly	New Subsidiary
Ford	1926	Brazil (3 locations)	CKD Assembly	New Subsidiary
Ford	1926	Mexico City, Mexico	CKD Assembly	New Subsidiary
Ford Canada	1926-1954	India	CKD Assembly	New Subsidiary
Ford Canada	1926	Malaysia	CKD Assembly	New Subsidiary
GM	1926	Berlin, Germany	CKD Assembly	New Subsidiary
GM	1926	New Zealand	CKD Assembly	New Subsidiary
GM	1926	South Africa	CKD Assembly	New Subsidiary
GM	1926	Uruguay	CKD Assembly	New Subsidiary
GM	1927	Java (Indonesia)	CKD Assembly	New Subsidiary
GM	1927-1938	Nagoya, Japan	CKD Assembly	New Subsidiary
Chrysler	1927	Berlin, Germany	CKD Assembly	New Subsidiary
GM	1928-1954	India	CKD Assembly	New Subsidiary
GM	1928	Poland	CKD Assembly	New Subsidiary
GM	1928	Sweden	CKD Assembly	New Subsidiary
Chrysler	cf. 1928	Antwerp, Belgium	CKD Assembly	New Subsidiary
Chrysler	1928	London, England	CKD Assembly	Acquisition (Dodge)

Sources: Compiled from Maxcy, 1981 and Dassbach, 1989

The gradual growth of local sourcing at many of these early CKD plants set the stage for later attempts to increase local content in response to the rise in trade barriers during the 1930s and in the post-World War II period. Today, CKD production is usually established with the specific intent of increasing local sourcing as quickly as possible. The overarching motivation of CKD assembly and integrated production alike was expansion beyond the home market and the early capture of market share in emerging economies of the day.

5.3.2 The Strategic Importance of CKD Assembly

Over time, many of Ford and GMs distant assembly plants—under close supervision in the case of Ford—began to source parts and materials locally, both from outside suppliers and through the build-up of internal capabilities. This practice went the farthest and fastest in Europe, where markets were the largest and tariffs the steepest, but local sourcing was growing in other locations as well (e.g. Argentina and Australia). Typical items sourced from local suppliers were tires, glass, upholstery, floorboards, gas tanks, and electrical wiring. In the case of Ford, a strict rule held that local parts and materials had to be of equal quality and be less expensive than those from the United States including shipping costs, insurance, and tariff duties. Tariff duties were often high when existing domestic parts and material producers were present to pressure governments to erect trade barriers. Localization proceeded the fastest and farthest at Trafford Park, which was turning out vehicles with 100% local content by 1926, with the exception of engine blocks sourced from a Ford plant in Cork, Ireland (Maxcy, 1981).

The prevalence of local sourcing by CKD assembly plants in the early days points to an under-recognized fact: that CKD assembly has been a vital part of the automotive industry's geographic expansion from the beginning. Often portrayed as "mere" assembly plants with no backward linkages to host economies, and therefore indistinguishable from finished vehicle exports, increased of local sourcing over time is the norm. Moreover, CKD assembly provides an initial base of activity that provides opportunities for local players that would not otherwise exist. Thus, while CKD assembly plants may be relatively small *financial* assets, they are often crucially important *strategic* assets from the point of view of automakers, and important *developmental* assets from the point of view of host country governments. Today, the stark difference between CKD and integrated assembly is even less relevant than it was in the past. On one hand technological change has increased the complexity and minimum capital requirements of the assembly process. Automobile assembly today requires precision welding tasks and full-body electrostatic baths prior to painting that have elevated the technical and capital requirements of CKD assembly and standard assembly alike. On the other hand the twin forces of deverticalization and modularization have pushed activities once conducted within integrated facilities out of house. So, the CKD plants of today, while small, have come to look more like larger assembly plants, and larger plants have come to look more like CKD plants. To be sure, many of the most recently established CKD plants were designed from the outset with expansion and local sourcing in mind.

5.3.3 The Role of the State Emerges to Drive Offshore Vertical Integration

After World War I many national governments began to impose a variety of regulations that affected automotive trade including local content requirements, tariffs, and import restrictions. These regulations were aimed at generating revenue, creating a local parts industry, and protecting domestic automakers—if any existed. Among the earliest were England's McKenna Duties, which amounted to 33.3% of "if-sold" value for non-Empire imports of vehicles and parts and 22.7% for Empire imports. The McKenna Duties were introduced as a wartime measure in 1915 but were retained after the war and absorbed into Britain's general tariff schedule in 1931, where they remained unchanged until 1956 when gradual reductions began to be implemented (Rhys, 1972; Maxcy, 1981). Other governments (e.g. Belgium), afraid that their markets were too small to demand local parts manufacture, instituted tariffs only on fully-assembled vehicles during the 1920s, leading to an extended life for CKD assembly plants.

As it became clear that the McKenna Duties would not be dropped in peacetime, many other countries began to institute their own tariffs discriminating against foreign automakers, especially American firms.[5] The economic crises that came with the onset of the Depression in 1929 dramatically accelerated the move to higher tariffs. By the early 1930s there was a popular "Drive British" campaign underway in England (Maxcy, 1981). The United States was no exception. The passage of the Smoot-Hawley Bill in 1930 raised tariffs on imports generally from 26-44% to 50-60%, touching off a trade war. Italy, France, and Germany retaliated by raised tariff on imported automobiles and parts to 111%, 86%, 58% respectively (Dassbach, 1989). As foreign market shares plummeted and currency restrictions caused un-remitted profits from assembly operations to pile up offshore at risk of devaluation, Ford and GM both drew up plans to re-invest accumulated profits in integrated production in their most important foreign market: Europe. The approach that each firm took toward this endeavor was greatly influenced by past practices.

As Ford began the transition from the Model T to the Model A in 1927, the company started work on what became known as the "1928 Plan," which called for three giant River Rouge type facilities to supply CKD kits to the world. The plan was to build from the three locations were vertical integration had proceeded the farthest: River Rouge was to supply the United States, Latin America, and the Far East; Walkersville, Canada was to supply Canada, Australia, India, and South Africa; and England was to supply assembly plants in Europe, the Near East, and North Africa. Since large integrated facilities already existed in Canada and the United States, the principal focus of the 1928 plan was the establishment of what Henry Ford dubbed "the Detroit of Europe," a new facility in Dagenham, England with a capacity of 200,000 units.

Several factors were to combine to stymie the 1928 plan and leave Dagenham, the largest plant in Europe at the time, with severe overcapacity: 1) a collapse in sales; 2) market shifts to smaller cars with lower operating costs than the Model A;[6] and 3) growing trade friction and rising tariff barriers within Europe that made untenable the strategy of exporting British-made

[5] Since Ford and GM were by far the largest foreign investors, some of the tariffs were specifically desiged to block the import automobiles with American characteristics (i.e. large piston bore size). (Maxcy, 1091; Dassbach, 1989)

[6] Ironically small "popular" cars that had become a stronghold of British producers such as Morris and Austin were initially developed as a competitive response to the Model T. From the 1930s onward cars the large, powerful, cumbersome vehicles designed for the American market would sell poorly in Europe.

CKD kits to France and Germany (although Ford-UK did export CKD kits to Ford-owned assembly plants located in smaller European markets and opened a new assembly plant of its own in Bucharest, Romania in 1936) (Maxcy, 1981; Dassbach, 1989).

As a response to its effective lock out of Germany and France beginning in 1933-1934, Ford—over the loud objections of English management—announced the official demise of the 1928 Plan and began an aggressive program of local sourcing in France and Germany. The Cologne plant, being built for assembly only, was too small for parts production and Ford worked with local suppliers to achieve 80% local content. By the late 1930s Ford was classified as a "German firm" and began supplying vehicles to Nazi Party members and the German military (Ford-Werke opened a satellite CKD assembly plant in Hungary in 1941). In France, Ford took the unusual step of entering into a joint venture with a local producer, Mathis, located in Strasbourg, to give Ford a French identity. The merger did not go well, especially when Ford tried to discontinue the Mathis-designed model, and by the time Ford took controlling interest in the firm and began construction of a new plant near Paris in 1938, the threat of war shifted production to munitions and military vehicles (Maxcy, 1981; Dassbach, 1989).

GM moved to integrated production in Europe the using same strategy it used to expand in the United States and Canada: acquisition of established local producers. Vauxhall, a small British luxury car producer located in Luton that GM had purchased in 1926 but had left to languish, was upgraded for the manufacture of Bedford Trucks in 1931 and in 1933 a smaller four cylinder Vauxhall model was introduced. The focus of GM's European integration strategy was Germany, where it acquired the country's leading automaker, Adam Opel in 1929. The fiscal crisis that came with the Depression, along with rising nationalists sentiments, led to strict rules blocking the export of currency from Germany beginning in 1934. Sales had began to recover strongly from the Depression beginning in 1933, and between 1935 and 1939 GM embarked on an aggressive investment program at Opel, repeatedly expanding the plant complex at Russelshiem and building a new plant in Berlin. Opel met with a great deal of success and by 1937 the company was the largest automobile producer in Europe. Table 5-4 lists the offshore motor vehicle plants established during the inter-war period, revealing the clear shift toward integrated production relative to pre-war investments.

Table 5-4: Foreign Motor Vehicle Plants Established Between 1929 and World War II

Company	Inception Date	Location	Type of Plant	Mode of Entry
GM	1929	Russelshiem, Germany	Integrated Manufacture	Acquisition (Opel)
Fiat	1930-1973	Heilbron, Germany	CKD Assembly	New Subsidiary
Ford	1930	Russia	CKD Assembly	License to Local Company
GM	1931	Australia	Body mfg./CKD chassis	Acquisition (Holden)
Fiat	1932	France	CKD Assembly	License to Local Company
Fiat	1932-1939	Poland	unknown	License to Local Company
Ford	1932	Cologne, Germany	Integrated Manufacturing	New Subsidiary
Ford	1932	Dagenham, England	Integrated Manufacturing	New Subsidiary
Ford	1934	Paris, France	Integrated Manufacturing	Joint Venture (Mathis)
Citroen	cf. 1935	England	CKD Assembly	New Subsidiary
Renault	cf. 1935	England	CKD Assembly	New Subsidiary
Ford Germany	1936	Bucharest, Romania	CKD Assembly	New Subsidiary

Source: Compiled from Dassbach, 1989

Figure 5-1 shows the shift in GM's vehicle sourcing during the inter-war period—along with the collapse in international sales that came with the Depression. Until 1929 GM was sourcing 99% of its vehicles sold overseas from its United States and Canadian plants, mostly in the form of CKD kits. Beginning with the Depression, offshore sourcing began to increase, rising to 67% by the onset of World War II in 1938 (Dassbach, 1989).

The focus on the activities of Ford and GM in this section is no accident. No other automakers had significant international operations until well into the post-World War II period. Besides a small truck factory in England, an assembly plant in Antwerp, Belgium, its two Canadian plants, and license relationships with several independent assemblers (e.g. GM/Holden in Australia), Chrysler had no production outside the United States until the 1960s. European automakers continued to make small and tentative investments outside of their home countries during the 1920s and 1930s. With the exception of Rolls Royce—which operated a small, undercapitalized subsidiary in Springfield, Massachusetts from 1919 to 1929—all investments were inter-European. The English automaker Morris manufactured a small number of vehicles in Le Mans, France between 1924 and 1928; both Renault and Citroen established assembly plants in Belgium during the 1920s, and in England during the 1930s. The plants in Belgium and England were established to overcome tariffs on fully assembled vehicles, and the McKenna Duties, which effected parts as well, led to a significant level of local sourcing in England. Fiat had a slightly greater level of international involvement. Although the license assembly arrangement in Vienna begun in 1907 ended in the mid-1920s, a Deutsche-Fiat plant in Heilbron, Germany was established in 1930 which produced cars with some local content for the German market until 1973. The French company SIMCA, in which Fiat held a minority interest, assembled Fiat cars under license from 1932 until it the firm was sold to Chrysler in the 1960s. Fiat cars were also assembled under license in Poland from 1932 until 1939 (Maxcy, 1981).

Figure 5-1: Domestic and Local Sourcing of GM's Overseas Sales, Units, 1926-1938

Source: Dassbach, 1989

5.3.4 The Case of Australia and the Timeless Challenges of International Production

The case of Australia during the Inter-war Period provides an excellent illustration of the dynamics that drive FDI in the automotive industry as well as the challenges automakers faced once the investments were made. It is striking that both the drivers and the challenges of offshore investment found in the Australian case are still extremely relevant today. During World War I the Australian Government banned the import of car bodies to conserve on limited shipping capacity. The body-building enterprises that emerged were then protected by high tariffs when the war ended. Until 1925, Ford-Canada used a different body builder/assembler in each of the five Australian States. Prices and product variety were so high that Ford-Canada established a body-building subsidiary in Geelong, Victoria State to manufacture bodies for all Ford products assembled in Australia. Poor internal transportation necessitated dispersed assembly facilities and wholly-owned assembly plants were set up in each state. GM followed a similar strategy for assembly, but relied on a local body supplier, Holden, which it began using in 1923 and eventually acquired in 1931 (Dassbach, 1989).

The case of Australia bears marked similarities to the current wave of automotive industry expansion in small but high-potential markets such as Vietnam and India in four respects. First, the early Australian investments were highly speculative. With a population of only seven million, the appeal of Australia in the 1920s lay in its huge geographic size (Australia is approximately the size of the continental Unites States less Texas), suggesting great application for automobiles and a high potential for population growth. Today, unfortunately, it seems that the large populations—and low rates of motorization—in countries such as China and Indonesia have been used to construct overly optimistic market growth scenarios. Just as the harsh reality Australian Outback would meant that Australia's population would never rival that of the United States, it is just as likely that in most emerging economies low productivity, poverty, urban congestion, and technological backwardness will keep the aggregate level of motorization at low levels for some time to come (see Section 6.4).

Second, early investments in Australia provide another example of the growing role that governments—in a dynamic relationship with local parts and material suppliers—took in the 1920s to force localization by the major players. These forces are still very much in play today. Over time the definition of "chassis" for tariff purposes became narrower as local replacement part suppliers applied political pressure aimed at getting their parts incorporated in newly assembled vehicles. In 1920 tires were excluded, in 1921 batteries, in 1927 shock absorbers, in 1928 spark plugs, in 1929 springs, and finally, in 1930, the Scullin Tariff effectively blocked the import of engine, transmission, and steering parts. Today, while much progress has been made to negotiate lower worldwide tariffs in general, the automobile industry's high profile as an agent of economic development make it perhaps the most excepted sector. Non-tariff barriers, such as voluntary export restrictions, consumption taxes, and local content rules are the norm and automakers have set up—and continue to set up—local production in response to host country regulations.

Third, the special characteristics of the Australian landscape favored modified vehicle designs; in 1935 GM-Holden introduced the highly popular "coupe utility," or "ute," similar to the Chevrolet "El Camino" models sold in the United States during the 1970s, that protected Australian farmers from the dust of the Outback with an enclosed cab, while providing a utility bed with which to carry loads. The principal challenge of globalization in regard to vehicle development today is the balance of commonality (achieved through platform standardization) and adaptability (achieved through module inter-changeability and platform flexibility) (see Section 5.3.1). As we can see in the case of the "ute," these challenges are far from new.

Fourth, the integration of Holden with GM was an extremely difficult process. Before the company was acquired by GM, Holden made bodies for and assembled 10-14 vehicle brands—about 70 different models—produced in lots ranging from 18 to 4,000, resulting in extreme inefficiency. After the sale to GM, Holden continued to act as a "contract manufacturer;" in 1939 about 30% of the company's output consisted of Chrysler vehicles and about 5% other non-GM brands. Bodies were painstakingly fabricated for each model; low volumes, high product diversity, and a lack of standardization drove costs up. Another problem was staff redundancy and lack of coordination between body fabrication (Holden) and assembly operations (GM). GM's home office tried to rectify these problems through standardization of body panels (a shift that was already underway in the USA as a cost-cutting measure in the face of Depression-induced sales collapse) and the creation of a unified "line and staff" organizational structure for all Australian operations, but these efforts were strongly resisted by local management (Dassbach, 1989).

All of these issues, speculative risk, shifting rules regarding trade and local content, the need to adapt vehicle designs to local conditions, and difficulties integrating local partners with the parent company, continue to plague the automotive industry today.

5.4 The Post-War Boom: Barriers to Trade Drive Offshore Integration

Pre-World War Two new vehicle registrations peaked in 1937 at 6.4 million units worldwide, with the United States accounting for 64% of the total. By 1973 new registrations had grown to 39.2 million units, with the United States accounting for only 36% of the total (Western Europe accounted for approximately 30% and the rest of the world for approximately 34%). These figures reflect the automotive sector's rise to become one of the worlds largest and most important industries. Moreover, many countries outside the United States made vast strides toward motorization during this period, creating vast new markets that kept the attention of American automakers and, since high tariffs existed for finished vehicle exports to those markets, continued to drive offshore investments for local production. Prior to the formation of the EEC, European tariffs on imported vehicles ranged from 17% in Germany to 45% in Italy. When the first common market tariffs became effective in 1968, the rates dropped to 22% for fully assembled vehicles and 14% for components. After the Kennedy round of tariff negotiations in 1972 these rates were lowered to 11% and 7% respectively (where they remain today). In addition to high tariffs, higher labor rates and the strong dollar in the post-war period kept prices for American-built vehicles too high for the European market (Maxcy, 1981). Even at 11%, European tariffs are high enough to create a strong incentive for local production today.

5.4.1 Post-war Rebuilding and Continued American Dominance

In the early post-World War Two period most of investment was made in war-torn Europe and in the booming United States. Opel and Ford plants in Germany were reclaimed and rebuilt from bomb rubble (though the assembly plants in Berlin were appropriated by the Russian Military Government). Vauxhall and Ford UK, along with other British automakers such as Austin and Morris, had suffered far less war damage and were in a better position to meet pent-up demand in Europe as well an in export markets. Demand in the United States, given better economic conditions, was far greater than in Europe. All of these conditions led to a reinforcement pre-war structures, with the difference that the British companies (including the American affiliates) gained temporary primacy within Europe, and that a complete break was made from earlier attempts to integrate European operations though transshipment of complementary models or the sharing of common parts. As a result, each European subsidiary of General Motors and Ford, including Ford France (which was eventually sold to SIMCA in 1954), designed and manufactured unique post-war vehicle lines for their respective local and export markets (Dassbach, 1989).

In England General Motors poured a great deal of investment into its previously moribund Vauxhall plant at Luton and opened a new "Bedford" truck plant at Dunstable. Vauxhall's annual output reached nearly 50,000 units by 1950. Ford's huge complex at Daganham, its overcapacity problems finally solved by the huge increase in local and export demand, went through a series of enlargements until the British Government halted any further expansion at the site in 1959. By that time annual production capacity had grown to nearly 600,000 units, Ford controlled 30% of the local market, and the company was the most profitable automaker in England. Daganham had its own deep-water wharf to facilitate shipping, and 60% of the plant's output was exported during 1948 and 1949. In Germany, Ford made a series of large investments in its Cologne facility in the 1950s and by 1960 annual output had grown to 200,000 units per year, with 44% of the total exported. Once Opel sales began to rebound, General Motors—which had been wary of re-investing in Germany in the immediate post-war period—initiated a complete reconstruction of its complex at Russelshiem, bringing total annual capacity to nearly 75,000 units in 1950, with about a third exported. Volkswagen (a firm that Ford had decided not to buy in the 1920s) rebuilt its huge wartime production complex at Wolfsburg, established a new plant in Ingolstadt in 1949, and added another in Hannover in 1956. By 1960, Volkswagen had surpassed Opel to become the biggest seller in Germany, almost entirely on the strength of its inexpensive popular car, the "beetle." In both Germany and England, the American-owned companies left the market for the smallest, least expensive, "popular" cars to local producers such as Volkswagen, Morris, Austin, and Fiat (bid).

5.4.2 European Automakers Emerge as Global Players in the late 1950s.

International investment by American and European automakers grew rapidly beginning in the late 1950s through early 1970s. American firms again led the way; with Chrysler joining GM and Ford with large-scale operations in Europe. During the 1960s Chrysler, which met with a great deal of success in the post-war period but had no production outside of North America, invested $350 million to acquire the French firm SIMCA, the Spanish firm Barrerios, and the English firm Rootes in 1967, giving the company a 7.3% market share in Western Europe by 1973, only slightly behind the shares held by Ford and General Motors (Maxcy, 1981). As a result, American foreign affiliate employment at American firms grew from 430,000 to 730,000 during the period, with most of the gains realized at affiliates in Europe and Latin America (U.S. DOC, 1971 and 1981, from Lynch, 1998).

Despite continued American dominance, the 1960s represent a key turning point in the history of the automotive industry. Beginning in the late 1950s, European automakers, fully back on their feet after World War Two, began to follow a pattern of "offshore" investments similar to that set by American firms, establishing plants in Brazil, Argentina, South Africa, Spain, and Mexico, as well as other countries in northern Europe.[7] Until the mid-1950s, most exports by European automakers were limited to Europe, but beginning in 1955, European companies, especially Volkswagen, began to export aggressively outside of the region, especially to the Unites States and South America (Rhys, 1972). In South America, local production was established in the late 1950s and early 1960s on the strength of this export success. Never again would American firms have only each other to compete with in the arena of international production.

[7] Besides an aborted attempt by Volkswagen (which purchased a Studebaker plant in Brunswick, New Jersey in 1955 and sold it the following year as the higher cost of components and labor in the U.S. became apparent), no European investments were made in the United States since barriers to imports were low, only 8.5%. (Maxcy, 1981)

Most of these investments were made in response to "invitations" by host government for automakers to set up integrated production operations. American and European automakers moved to set up integrated facilities in Brazil, Argentina, Mexico, and South Africa. Table 5-5 shows Ford and GM's international operations in 1971. Even where markets were small, most automakers were unwilling to forego new investments and cede markets to their competitors (an exception is India, from which both Ford and General Motors withdrew in 1954), a dynamic that is common today.

Table 5-5: General Motors and Ford International Operations in 1971

INTEGRATED PRODUCTION		**CKD ASSEMBLY**	
General Motors	**Ford**	**General Motors**	**Ford**
Canada	Canada	Belgium	Belgium
England	England	Denmark	Denmark
Germany	Germany	Ireland	Ireland
Argentina	Argentina	Malaysia	Malaysia
Australia	Australia	South Africa	South Africa
Mexico	Mexico	Venezuela	Venezuela
Brazil	Brazil	Portugal	Portugal
		Philippines	New Zealand
		Morocco	Rhodesia
		Switzerland	The Netherlands
		Uruguay	Chile
		Costa Rica	Egypt

Source: Dassbach, 1989

The 1960s also marked the first instances of severe speculative over-extension in terms of emerging market investments. Certainly the Australian industry had been severely over-built during the 1930s with only Ford and General Motors investing in significant local production, but in the 1960s the participation of European—and to a much lesser degree Japanese—automakers in various emerging markets pushed the competitive risk of emerging market investments to new heights. If it was a risky prospect for one firm to invest in a small but promising market barely big enough for a single assembly plant of optimum size (according to Rhys (1972) optimum assembly plant size in the 1960s was between 150,000-250,000 units per year), the level of risk was compounded when five, eight, or ten automakers all invest in local production at the same time. Such overcapacity problems that result are still evident today (See Section 5.1.5).

Under pressure to meet high local content requirements but unsure of the viability of the relatively small markets in Latin America and Spain, European and American automakers sometimes set up integrated assembly facilities to manufacture obsolete models (or failed to make model updates for long periods). Since production equipment was less flexible and final assembly more detailed at that time, a fairly integrated production operation could be started-up quickly. Since many European plants had been rebuilt after the war, used production equipment for obsolete models came mainly from the United States. Local suppliers for elementary parts could be easily found, and even more complex parts such as engines and transmissions, imported from the home base at first, were eventually produced locally as well. Since old production equipment was fully amortized, production lines in small markets could be profitably operated at medium to low volumes. To provide a rather extreme example, production equipment for the original 1959 Ford Falcon was moved to Argentina in 1962, where the model remained in production with only minor modifications until 1991, by which time 490,000 units had been produced. In the automotive industry today such "product cycle" strategies of international production (Vernon, 1966) have almost entirely disappeared (Vernon, 1979). Besides increased competition and consumer sophistication, many national governments are insisting that models and production methods be near the leading edge. Brazil, for example, has made the import of used manufacturing equipment and conveyors illegal. Some exceptions remain in the case of CKD plants in locations that are perceived as having high risk. But even though these plants sometimes begin production with older models (both Toyota and Daimler-Benz take this approach), these plants usually move to newer designs rather quickly.

With the development of the automatic transmission and the "Kettering" V-8 engine during the 1940s American cars began to grow dramatically in size and power. By the mid-1950s, these features were being offered as standard equipment and the existing differences between the vehicles designed for the North American market and those suitable for the rest of the world began to widen. Lower incomes and higher operating costs meant that demand for smaller, less powerful vehicles continued to be much higher outside the United States and Canada (Australia remained somewhat of an exception to this rule). Table 5-6 clearly shows the dramatic divergence over time between the largest selling American and European passenger vehicles models in terms of in vehicle length and engine size. These differences led to a great deal of success for European models in emerging markets, where low prices and operating costs were appreciated by many buyers.

Still, because of severe income inequality and the lack of a sizable middle-class, demand in the small emerging markets of Latin America and South Africa was much more heterogeneous than either the United States or Europe. Demand for large, expensive vehicles fairly evenly matched with demand for small, lower-priced vehicles. The vast majority of the population of these countries had, and still do not have, the means to purchase new motor vehicles of any kind. Thus, affiliate plants in emerging markets began to manufacture both by low-cost vehicles from Europe and higher-cost vehicles designed for the United States market. For American firms, this arrangement led to a complex division of labor, with parts exports from the United States supporting the local production of American models, and parts exports from European affiliates supporting the production of European models.

Table 5-6: Trends in passenger vehicle size and displacement (based on largest volume model of year)

	Vehicle length (ins.)		Engine displacement (cu. ins.)	
	United States	Europe	United States	Europe
1930	155	144	194	62
1940	192	158	217	64
1950	198	160	217	69
1960	211	160	348	73
1970	216	159	350	91

Source: Dassbach, 1989

As the data in Table 5-7 show, despite relatively high domestic content requirements, American automaker affiliates in Latin America absorbed a significant amount of exports from their parent firms in the United States. In 1977, exports from parents to these affiliates were over $1 billion and, coupled with almost no corresponding imports, resulted in a large positive trade balance with Latin America. European affiliates during this period, though, were largely autonomous from United States operations and trade between U.S. parents and European affiliates was very low, both in absolute and relative terms (imports from U.S. parents accounted for less than 2% of European affiliate sales, but nearly 20% of Latin American affiliate sales). Although the data were not collected during this phase of the study, it is highly likely that European automakers and American affiliates in Europe had similar trade patterns with their Latin American affiliates.

Table 5-7: American Automaker Trade With Foreign Affiliates, 1966-1982 (millions of current dollars)

Exports to Affiliates	**Total**	**Canada**	**Europe**	**Latin America**	**Other**
1966	1,696	1,299	96	198	103
1977	11,650	9,987	442	1,020	201
1982	13,642	11,560	417	1,504	161
Imports from Affiliates	**Total**	**Canada**	**Europe**	**Latin America**	**Other**
1966	1,112	948	145	6	13
1977	8,934	8,207	524	176	27
1982	11,684	10,869	158	529	128

Source: U.S. Department of Commerce (various years). From Lynch, 1998.

5.4.3 Japanese Offshore Investments in the 1960s and 1970s

During the 1960 and 1970s a regional pattern emerged with most new assembly plants established by American and European automakers were located in Latin America and most plants by Japanese firms were located in Asia. There were exceptions to this pattern, namely GM and Ford's investments in Taiwan and a few small Japanese investments in Brazil, Peru, and Ecuador. Investments by Japanese automakers, however, tended to be of a vastly different character than those of American and European firms. Across the board, American and European firms tended to build larger, more integrated plants, where Japanese plants relied heavily on CKD production for long periods. Japanese investments were highly conservative in that assembly plant investments remained scaled to the actual, not potential, size of the local market, something that is still true today (see Table 5-8). Still, in places where Japanese automakers received no competition from more aggressive investors, such as the ASEAN countries of Thailand, Indonesia, Malaysia they were able to capture the lion's share of these markets, especially in countries where local content rules became more stringent over time (see Table 5-9) (Doner, 1991).

Table 5-8: Examples of Japanese Assembly Plants in Emerging Markets

Company	Country	City	Inception	Total Employment	Production 1995	Production 1996	Capacity
Toyota	Brazil	Sao Bernardo	1959	630	4,500	3,203	5,000
Toyota	South Africa	UA	1962	9,423	UA	92,402	UA
Toyota	Thailand	Samut Pakran	1964	4,810	127,833	147,326	UA
Nissan	Peru	UA	1966	UA	UA	UA	UA
Toyota	New Zealand	UA	1966	532	UA	9,982	UA
Toyota	Peru	Lima	1967	124	1,000	900	6,000
Toyota	Malaysia	Shah Alam	1968	1,050	24,544	29,395	70,000
Honda	Malaysia	Johor Bahru	1969	UA	11,207	UA	13,488
Toyota	Indonesia	Jakarta	1970	5,101	75,512	74,761	100,000
Toyota	Thailand	Chachoengsao	1972	885	0	2,090	UA
Toyota	Kenya	UA	1977	433	UA	1,263	UA
Toyota	Ecuador	UA	1979	398	UA	1,286	UA
Toyota	Venezuela	Cumana	1981	1,077	17,900	14,280	21,000
Toyota	Bangladesh	UA	1982	77	UA	146	UA
Suzuki/Maruti	India	Palam	1983	UA	247,898	UA	UA
Toyota	Taiwan	Chung Li	1986	2,825	56,981	79,071	70,000
Toyota	Philippines	Laguna	1989	2,057	36,727	36,867	15,000
Honda	Thailand	Ayutthaya	1992	UA	0	UA	40,000
Mitsubishi	Vietnam	Ho Chi Minh City	1995	151	398	UA	1,000

Source: Globalization and Jobs Project, Assembly Plant Database, October, 1998.

Table 5-9: Japanese Automaker Market Share in ASEAN Countries, 1978-1982*

	1978	1980	1982
Thailand	90.7	90.5	90.1
Indonesia	92.1	88.0	87.7
Philippines	71.7	78.7	87.3
Malaysia	63.9	79.1	80.5

Source: Doner, 1991

The terrain was more contested in South Africa, Australia and New Zealand, where stepped-up investment activity by American firms during the late 1950s was followed by Japanese investments in the 1960s and 1970s. By 1987, Japanese producers had captured 50% of the Australian market (Dicken, 1998) and Toyota, Nissan, and Mitsubishi had plants in operation.

5.5 The Crisis of the 1980s and the Rise of Japanese Automakers

In the 1960s and 1970s Japanese (and to a lesser extent European) automakers began to penetrate the United States market through exports. Although the first "oil shock" of 1973 is often cited as the beginning of a shift toward smaller cars in the United States market, the associated rise in gasoline prices was in fact extremely short-lived. Plans to build a line of small cars by the Big Three were scrapped when oil prices fell in 1974. It was not until 1979, when the second oil shock drove gasoline prices up permanently, that American producers embarked on a serious attempt to enter the small car market. But, by all accounts, Ford's Pinto and GM's Vega were poorly engineered and of notoriously low quality, and failed to stem the loss of market share to European and Japanese imports (Dassbach, 1989). Motor vehicle production in Japan soared from a negligible 300,000 units in 1960 to nearly eleven million units in 1982, growing both on the strength of Japan's largely protected domestic market of about five million units and exports of about six million units. In fact, excluding inter-European trade, Japan came to dominate world finished vehicle exports by a wide margin, with the bulk of exports going to the United States (Dicken, 1998).

Table 5-10 shows the shares of the West European, Japanese, and United States passenger vehicle markets held by automakers from each home country from 1982 to 1995, along with total unit sales for each location. Table 5-10-a shows that in West Europe, market penetration by Japanese firms has been much less than in the United States, where Japanese market share increased to 25% in 1991 (see Table 5-10-c). The success of Japanese automakers in the United States was largely based on superior vehicle quality and durability, as well as the increasing popularity of small, fuel efficient cars with the permanent long term increase in gasoline prices beginning in 1979. The basis of Japanese quality improvements, namely the "lean" production techniques pioneered and perfected by Toyota, have been extensively documented and commented on elsewhere (Womack, et. al., 1990), and will not be presented in detail in this Report. Suffice it to say that lean production includes lower inventories, just-in-time parts deliveries, high performance work organization (teamwork, job rotation, etc.), and continuous improvement programs for quality and productivity.

Table 5-10: Unit Sales and Market Share by Automaker Home Country; West Europe, Japan, and the USA; Passenger Vehicle Units; 1982-1995

a) West Europe Sales and Market Share by Automaker Home Country - Passenger Vehicles

	1982	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**
Total Sales (m units)	11.4	11.7	11.4	11.9	13.1	14.0	14.7	15.3	15.0	15.1	15.2	12.6	13.4	13.5
American Share	21%	23%	23%	22%	22%	22%	21%	22%	22%	23%	23%	24%	24%	24%
European Share	69%	67%	66%	66%	66%	66%	67%	66%	66%	64%	65%	63%	64%	63%
Japanese Share	10%	10%	11%	11%	12%	12%	12%	11%	12%	13%	12%	12%	11%	11%
Korean Share	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	1%	1%

b) Japan Sales and Market Share by Automaker Home Country - Passenger Vehicles

	1982	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**
Total Sales (m units)	5.3	5.4	5.4	5.6	5.7	6.0	6.7	7.3	7.8	7.5	7.0	6.4	6.5	6.9
American Share	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	1%
European Share	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%	2%	3%	3%
Japanese Share	99%	99%	99%	99%	99%	98%	98%	98%	97%	98%	98%	97%	96%	96%
Korean Share	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

c) USA Sales and Market Share by Automaker Home Country - Passenger Vehicles

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Total Sales (m units)	10.4	12.2	14.4	15.7	16.3	15.2	15.9	14.9	14.2	12.7	13.1	14.2	15.4	15.1
American Share	76%	76%	77%	76%	74%	72%	74%	74%	72%	71%	72%	74%	73%	73%
European Share	5%	6%	6%	5%	5%	5%	4%	4%	4%	3%	3%	3%	3%	4%
Japanese Share	18%	18%	18%	19%	20%	21%	20%	21%	24%	25%	24%	23%	23%	22%
Korean Share	0%	0%	0%	0%	1%	2%	2%	1%	1%	1%	1%	1%	1%	1%

Source: author calculations from Ward's Decade of Data.

5.6 The Demise of an Export-led Strategy: The Japanese "Transplants"

The remarkable success of Japanese automaker's export strategy resulted in a gain in market share in the United States that came at the direct expense of the Big Three, sparking a political backlash that resulted in the setting of "voluntary" limits to continued market share expansion via exports. Table 5-10-b shows the stark reality that added fuel to the fire: American automakers have been unable to penetrate the Japan's domestic market whatsoever. In response to these quotas, Japanese automakers embarked on a wave of plant construction in the United States during the 1980s (see Table 5-11). By 1995 Japanese automakers were locally manufacturing two thirds of the passenger vehicles sold in the United States (see Table 5-13-c). A similar dynamic in Europe led to a wave of Japanese "transplants" that began in 1986, with Nissan's plant in the U.K., and picked up steam thereafter (see Table 5-12). By 1995 Japanese automakers were locally manufacturing nearly one third of the passenger vehicles sold in Europe (see Table 5-13-a). In 1986, as "transplant" production ramped up, Japanese exports began a long decline (see Table 5-13-b and Figure 9-4).

Table 5-11: Examples of Currently Operating Automotive Assembly Plants in North America Operated by Non-American Automakers

Firm Name	Country	City	St.	Firm Nationality	Inception Date	1996-97 Emplmnt	1995 Unit Production	1996 Unit Production	1996 Unit Capacity
Volvo	Canada	Halifax	NS	Sweden	1963	UA	7,444	7,327	8,748
Honda	Canada	Alliston	ON	Japan	1987	1,200	106,133	144,547	116,640
Toyota	Canada	Cambridge	ON	Japan	1988	1,418	90,138	97,609	146,955
Suzuki/GM	Canada	Ingersoll	ON	Japan	1989	2,000	182,195	128,071	223,648
BMW	Mexico	Lerma	NA	Germany	UA	1,100	245	586	9,126
Mercedes Benz	Mexico	S. Tianguistenco	NA	Germany	1985	UA	814	1,327	2,342
Nissan	Mexico	Aguascalientes	NA	Japan	1966	UA	53,797	96,148	254,541
Volkswagen	Mexico	Puebla	NA	Germany	1966	12,900	186,918	228,467	456,381
Honda	Mexico	Guadalajara	NA	Japan	1985	UA	90	1,203	29,670
Honda	United States	Marysville	OH	Japan	1982	2,600	393,629	424,462	378,688
Nissan	United States	Smyrna	TN	Japan	1983	3,300	465,788	383,488	457,728
Toyota/GM	United States	Fremont	CA	Japan	1984	4,706	364,599	362,607	418,176
Mazda	United States	Flat Rock	MI	Japan	1987	3,350	149,562	95,726	184,420
Mitsubishi	United States	Bloomington	IL	Japan	1988	3,900	134,975	192,421	245,952
Toyota	United States	Georgetown	KY	Japan	1988	3,000	UA	221,756	245,952
Honda	United States	East Liberty	OH	Japan	1989	1,800	159,366	209,886	226,432
Subaru/Isuzu	United States	Lafayette	IN	Japan	1989	2,200	180,174	194,871	181,784
BMW	United States	Spartanburg	SC	Germany	1994	2,000	11,869	50,051	89,792
Toyota	United States	Princeton	IN	Japan	1996	1,300	NA	NA	100,000
Daimler-Benz	United States	Tuscaloosa	AL	Germany	1997	0	0	65,000*	100,000*

* 1998 figures.
Source: Globalization and Jobs Project, Assembly Plant Database, October, 1998.

This section of the Report has outlined in detail the long history of international expansion in the automotive industry, and the central role that national governments have played in driving that expansion by erecting barriers to trade in finished vehicles. By taking this long view, it is clear that the establishment of Japanese “transplants” in the United States and Europe signaled the demise of “export-led” development strategies in the automotive industry. By adopting a “build-where-you-sell” approach, Japanese automakers have simply begun to operate according to norms that were established in the industry during the 1930s. The massive wave of Japanese imports that came to the United States in the 1970s can, in hindsight, be seen as an anomalous historical event that is unlikely to be repeated.

Table 5-12: Examples of Currently Operating Automotive Assembly Plants in Europe Operated by Japanese Automakers

Company	City	Country	Inception Date	1996-97 Employment	1995 Unit Production	1996 Unit Capacity
Daihatsu	Pontedera	Italy	NA	NA	9,821	35,000
Toyota	Burnaston	UK	1992	2,450	88,449	100,000
Isuzu	Leylend	UK	NA	NA	0	18,000
Honda	Swindon	UK	1992	2,000	91,980	150,000
Nissan	Sunderland	UK	1986	4,600	215,346	300,000
Nissan	Volos	Greece	NA	NA	614	0
Mazda	Ovar	Portugal	NA	NA	120	0
Toyota	Porto	Portugal	1968	1,984	5,937	15,000
Mitsubishi	Tramagal	Portugal	NA	NA	11,124	10,000
Nissan	Avila	Spain	NA	NA	12,618	20,000
Nissan	Barcelona	Spain	1983	4,600	98,024	210,000
Suzuki	Linares	Spain	NA	NA	25,843	50,000
Mitsubishi/Volvo	Born	Netherlands	1995	6,800	98,454	200,000

Source: Globalization and Jobs Project, Assembly Plant Database, October, 1998.

Table 5-13: Local Production Share of Local Sales by Automaker Home Country; W. Europe, Japan, and the USA; Passenger Vehicle Units; 1982-1995

a) W. Europe Production Share of Local Sales - Passenger Vehicles (units)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Japanese	0%	0%	0%	0%	0%	0%	4%	5%	5%	8%	11%	23%	26%	32%
American	108%	108%	101%	107%	106%	102%	106%	104%	106%	101%	103%	98%	105%	107%
European	109%	115%	115%	114%	116%	116%	114%	116%	115%	109%	108%	110%	110%	113%
Korean	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

b) Japan Production Share of Sales - Passenger Vehicles (units)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Japanese	229%	231%	232%	250%	254%	248%	228%	214%	203%	208%	218%	211%	195%	182%
American	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
European	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Korean	NA	NA	NA	NA	NA	NA	NA	NA	0%	0%	0%	0%	0%	NA

c) USA Production Share of Sales - Passenger Vehicles (units)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Japanese	0%	3%	8%	9%	14%	21%	29%	39%	44%	45%	49%	53%	57%	66%
American	89%	96%	98%	96%	92%	96%	87%	88%	81%	82%	84%	83%	88%	85%
European	16%	14%	10%	12%	10%	10%	6%	0%	0%	0%	0%	0%	0%	3%
Korean	NA	NA	NA	NA	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Source: author calculations from Ward's Decade of Data.

6. The Current Economic Geography of the Automotive Industry

6.1 The Continued Dominance of Traditional Industry Centers

It is widely assumed that globalization is changing the face of the automotive industry, especially as automakers rush to set up production in new locations. However, there has been little systematic empirical work done on the subject. To what degree is globalization altering the traditional economic geography of the industry? Is globalization eroding—or alternately strengthening—the position of the traditional industry centers? Where are new investments occurring—and what is the nature and extent of the new investments? The plant-level databases developed by the study have allowed us to begin to answer these questions .

While the establishment of automotive assembly plants in new locations has received much attention in recent years, it is important to underline at the outset that the industry remains overwhelmingly concentrated in the developed economies of Japan, Europe, and the United States. The dominant industry clusters in the American Midwest, Northern Europe, and Japan—as well as what could be a few emerging clusters within Brazil and Thailand—show up well in Figure 6-1, a map drawn from the project databases of assembly and supplier plant locations.

Throughout the subsequent discussions of corporate strategy and employment effects, it should be borne in mind that it is unlikely that the fundamental geographic pattern the industry will change radically. The sunk capital, accumulated labor force skills, and especially the broad and deep supply-bases that exist in the American Midwest, Japan, and Northern Europe make rapid or complete locational shifts highly unlikely, especially as the widespread adoption of JIT delivery and closer design collaboration between automakers and suppliers move forward. Not only are sunk capital, skilled labor forces, and deep supply-bases highly immobile, but they continue to exert a strong attractive force on new investment. As LEMA type "transplants" have been established in the United States and Europe, Japanese automakers have overwhelmingly chosen locations on the outer boundaries of the traditional clusters. Of course, the *kinds* if activities that take place in traditional locations may well change over time (e.g. from labor intensive to capital intensive production, and from assembly to design activities), but as the industry continues to develop in response to competitive and "environmental" shifts (e.g. changes in gasoline prices, gross economic conditions, etc.), we believe that the role of the traditional industry centers will likely become stronger, not weaker over time. We are not suggesting that the industry will cease its spread to new locations, but we do believe that Detroit, to provide one example, will continue to be known as "Motor City" for a long time to come.

Table 6-1 shows worldwide assembly plant characteristics according to the location typology developed in Section 3.3 of this report. The team considers this table, in many respects, to be a "Rosetta Stone" of sorts for the world automotive industry. By collecting more data, we hope to sharpen the picture it provides during future rounds of research.

The developed economy locational categories, HOME and LEMA, contain 257, or 49% percent of the world's assembly plants. Because plants in developed countries are, on average, larger than those in the less developed countries in the locational categories of PLEMA and BEM, LEMA and HOME plants account for 79% of the world's productive capacity (based on a sample of 419 plants). Conversely, assembly plants in PLEMA and BEM type locations account for 51% of the worlds plants but only 23% of the world's capacity. LEMA and HOME assembly plants have, on average, capacity to assemble 188,378 and 229,835 vehicles per year, while PLEMA and BEM assembly plants have, on average, capacity to assemble only 155,810 and 44,195 vehicles per year.

Figure 6-1: Global Map of Automotive Assembly Plant and Supplier Locations

Figure 6-2: Global Map of Automotive Assembly Plant Capacity

The larger size of HOME and LEMA type assembly plants is also belied by higher levels of employment, on average, than those in PLEMA and BEM type plants. Based on a sample of 149 plants, HOME and LEMA type assembly plants employ an average of 5,873 and 5,329 workers, while PLEMA and BEM plants employ, on average, only 3,957 and 2,700 workers. Productivity figures at BEM plants as measured by unit output per worker per year—although highly suspect because they are drawn from different plant samples and very crude because no adjustments were made for degree of integration—appears to be much lower than productivity in HOME, LEMA, and PLEMA type plants, probably because of higher labor intensity at BEM plants. On the other hand, CKD assembly, because it is highly modularized, can show extremely high rates of productivity when activities such as off-site kit consolidation and module assembly are not taken into account. Still, the rather high average employment level of 2,700 at the BEM plants where employment where employment figures were collected is probably due to low capital intensity in the areas of material handling, body welding, and paint. A remarkable finding suggested by these data is that productivity rates at PLEMA type plants, despite lower wages and perhaps slightly lower capital intensity, appears to be the same as HOME type plants. Such a pattern is in keeping with Shaiken's (1990) findings in Mexico . As one would expect, these data suggest that productivity at LEMA type plants is the highest of all the categories.

Although capacity utilization rates for 1995 were close to 70% for LEMA, HOME, and PLEMA type assembly plants, capacity utilization was far higher, 91%, for BEM plants (based on a sample of 419 plants). Because of the current economic crisis in Asia and elsewhere in emerging markets, it is highly likely that capacity utilization rates have fallen since 1995 in most BEM plants as well as in HOME plants in places such as Japan and Korea, except for those serving the booming United States market though exports. On the other hand, PLEMA plants, especially those in Mexico and Canada that serve the United States market, have likely maintained high utilization rates. These assumptions were reinforced during recent visits to assembly plants in Japan, Mexico, the United States, and Vietnam.

The data on inception dates, even though collected for only 201 of 521 assembly plants so far, reveal the geographic spread of the automotive industry over time. Assembly at HOME type plants, on average, began in 1958, a figure that suggests a much older installed base (as well as the concomitant problems associated with older plants discussed in Section 9.7, such as aging capital equipment and ingrained habits among management and production workers) than that of other plants types. The average inception date for assembly at LEMA type plants, 1969, masks the dichotomy in age between the Japanese-owned assembly plants that have been established in the United States and Europe during the 1980s and 1990s, which have an average inception date of 1987, and the American-owned plants that were established in Europe long before. The average PLEMA type plant began production in 1979, a figure that combines plants that were established in Canada and Spain beginning in the 1960s with more recent investments in Mexico. Of course, inception dates do not reveal when major capital investment may have been made. Many PLEMA type plants were established long ago to serve their host country markets but have been recently expanded and upgraded as they have begun to serve LEMA type markets in the Unites States and Northern Europe (see Section 9.2). BEM type plants, on average, began producing vehicles in 1986, a figure that alludes to the recent spate of assembly plant construction in emerging markets. The average is lowered somewhat by the existence of several plants that are quite old by BEM standards, especially in Latin America. Like many PLEMA type plants, many of older BEM plants have been upgraded and expanded quite recently.

Table 6-1: Assembly Plant Characteristics According to Locational Type

	HOME	LEMA	PLEMA	BEM	World
# of Plants (n=521)	199	58	60	212	529
% of Plants	38%	11%	11%	40%	100%
Average Unit Output 1995 (n=479)	149,943	126,635	101,599	31,102	99,236
Average Unit Capacity 1996 (n=419)	229,835	188,378	155,810	44,195	157,109
Total Unit Output 1995 (n=479)	29,388,903	6,964,901	5,892,756	5,287,328	47,533,888
% of World Production	62%	15%	12%	11%	100%
Total Unit Capacity 1996 (n=419)	41,829,942	9,795,635	8,413,747	5,789,497	65,828,821
% of World Capacity	64%	15%	13%	9%	100%
Capacity Utilization 1995	70%	71%	70%	91%	72%
Average Employment (n=149)	5,873	5,329	3,957	2,700	4,466
Average Unit Output/Worker/Year	26	24	26	12	22
Average Inception Date (n=201)	1958	1969	1979	1986	1977

Source: Globalization and Jobs Assembly Plant Database, October, 1988

Table 6-2 presents some important market attributes according to the locational typology outlined in Section 3.3. It reveals some stark differences among them. First, market penetration, calculated by dividing the total country population by the number of passenger vehicles in operation, is much lower, on average, in BEMs than in LEMAs or PLEMAs. Market penetration in PLEMAs, while somewhat lower, on average, than in LEMAs, is too high to justify market-seeking investments. Second, automotive sector wages, on average, are very high in LEMAs and very low in BEMs, with PLEMA locations providing a middle ground that makes them attractive lower-cost locations for exporting vehicles to LEMAs (along with their spatial proximity). Second, as already mentioned, BEMs are growing much faster than other markets, with most of the growth coming from locally manufactured vehicles (the average annual rate of growth in production in BEMs is not far behind average annual sales growth).

Table 6-2: Passenger Vehicle Production Location Types: Market Penetration, Auto Sector Wages, Sales Growth, and Production Growth*

Location	**People/Car 1993**	**Weekly 1991**	**Average Annual Sales AAGR '85-**	**AAGR '90-**	**Avrg. Ann. Production AAGR '85-**	**AAGR '90-**
LEMA	**2.2**	**552.98**	**-0.6%**	**-3.1%**	**0.8%**	**0.0%**
range:	1.7 to 2.6	480 .0 to 712.7	-5.3 to 3.4%	-10.5 to 1.7%	-8.9 to 3.9%	-9.3 to 4.1%
PLEMA	**5.8**	**181.0**	**1.5%**	**-7.7%**	**5.4%**	**3.5%**
range:	2.8 to 11.2	51.9 to 433.6	-7.0 to 7.2%	-19.6 to -0,4%	1.8 to 9.6%	3.2 to 4.0%
BEM	**149.4**	**109.3**	**16.9%**	**16.1%**	**13.8%**	**15.8%**
range:	6.7 to 950.2	20.5 to 384.6	-4.4 to 52.6%	-9.7 to 42.3%	-5.2 to 51.1%	-11.2 to 50.0%

*Un-weighted averages under-represent large markets.
Sources: People/Car: calculated from country statistical yearbooks and Wards PARC; Weekly Wages: OECD (1991) and author fieldwork (1998); Sales and Production Growth: Wards Decade of Data.

The vehicle models produced at 369 of the world's 521 assembly plants where data were collected are summarized in Table 6-3. What is striking is the large number of plants in the sample where commercial vehicles are produced. Field research reveals that most plants in emerging markets, many of which assemble passenger vehicles of some kind, are used to assemble commercial vehicles as well. Commercial vehicles, especially light transport trucks and 15-18 passenger vans, are often the largest initial market in less developed countries, where passenger vehicles are beyond the financial reach of average citizens. Where passenger cars are produced in large quantities, they are often sold into burgeoning taxi fleets.

Table 6-3: Models Produced at 369 Assembly Plants Worldwide

Platform/Model Type	Number of Plants	Share of Sample
SUV/Pick-up/Transport	285	77%
Micro	181	49%
Small (A)	155	42%
Mid-size (B)	154	42%
Full-size (C)	137	37%
Sports/Luxury	81	22%
Large/Luxury	63	17%
Sample Total	369	100%

Source: Globalization and Jobs Assembly Plant Database, October, 1988

6.2 The New Race to Emerging Markets

In a race to grab market share in places where populations are huge and car owners few, automakers have been feverishly building new assembly plants in countries only recently open to foreign investment such as China, India, Vietnam, and East Europe. These BEM investments are being driven by increased competition and market saturation at home and by the opening of vast new investment spaces since the end of the Cold War. For example, the Chinese market is seen as especially attractive. The first foreign investor in China was Chrysler (then AMC), which set up a joint-venture in Beijing to manufacture Jeeps in 1983, and has gradually increased local content to 80%. Automakers without production capability in key emerging markets must rely on finished vehicle exports to build market share, but with high tariffs being the norm, such approaches have a the great disadvantage of driving retail prices up in places where motor vehicles cost more than the vast majority of people can afford.

Table 6-4 shows the wave of new assembly plant investment that began in the 1980s. The wave was initially propagated by Japanese firms investing in North America but is now being driven in large part by American, European, and Korean firms investing in BEM locations such as China, India, the ASEAN nations, Brazil, Argentina, and Russia.

While Table 6-4 is drawn from data on only 38.5% of the world's plants where inception dates have been collected so far, it clearly demonstrates several points, especially about plants established after 1980, for which the data are more comprehensive. First, as just mentioned, there has been a shift in both the origin and destination of new assembly plant investments. In the 1980s, most new assembly plants were established by Japanese firms in the United States. In the 1990s, the bulk of the new investment activity has come from American, European and Korean firms establishing plants in big (and some small) emerging markets (BEMs). Second, the pace of new investment has picked up dramatically during the 1990s. During the study's interviews, a manager at one of the world's largest automakers spoke of the "exponential" increase of assembly plant investments undertaken by his firm. Third, European firms have been very conservative in their offshore investments until very recently. BMW and Daimler Benz have opened their first integrated LEMA type passenger car assembly plants, located in the American South, only in the past few years. Volkswagen is basing a large part of its global production strategy on its earlier investments in China, Brazil, and Mexico. Lastly, the capacity of new plants appears to have diminished rapidly, as far as we are able to judge from data on 1996 capacity, a subject we explore in detail in Section 7.2.2 (obviously, some of this effect could be due to older plants growing over time).

Table 6-4: New Passenger Vehicle Assembly Plants by Type of Investment Location: Home Country of Investing Automaker and Average 1996 Capacity, 1980-1998

New Plant Location Type	pre-1960	1960-1969	1970-1979	1980-1989	1990s
HOME. (e.g. USA, Europe, Japan, Korea)	AAAAAAAAA AAA EEEE J	AA EE JJJ	A JJ	A E	J
Large Existing Market Areas-LEMA. (e.g. USA, Australia, Western Europe, Japan)	AAAAAAAAA AAA	AAAAAAA EE JJ	AA J	AA JJJJJJJJJJJJ	AA E JJJ K
Peripheries of Large Existing Mkt. Areas-PLEMA.. (e.g. Canada, Mexico, Spain, Eastern Europe)	A	A J	AA E	AAA JJ	AAAAA E
Big Emerging Markets-BEM. (e.g. China, India, Brazil, Russia, Thailand, Vietnam). Note: some "small emerging markets," such as Namibia and Botswana, are included in this data.	AA E J	AAAAAAA E JJJJJJ	AAAA E JJJJ	AAAAA E JJJJJJJ	AAAAAAAAA AAAAAAAAA A EEEEEEEEE JJJJJJJJJJJ KKKKKKKKK KKKK
New Plants per Time Period	35	35	19	33	69
Average Unit Capacity in 1996 (earlier plants could have grown)	267,471	197,577	243,043	210,024	55,061

Key: A: American automaker; E: European automaker; J: Japanese automaker; K: South Korean automaker.
Source: Global Assembly Plant Database, Globalization and Jobs Project, October 1998.

6.3 What is Driving Emerging Market Investments?

6.3.1 Market Saturation in Large Existing Markets

The wave of investments in new BEM assembly plants has been driven by slow growth and market saturation in the automotive industry. After growing steadily during the mid-1980s, world-wide annual sales of new passenger cars were stagnant from 1989 to 1995. According to Wards, worldwide annual sales of passenger cars grew at an average annual rate of nearly 3.7% from 1983 to 1989, and then turned negative with an average annual rate of -.4% from 1990 to 1995 (see Table 6-5). Growth is slow in LEMAs because market penetration is very high. As a general rule, we can say that a market with fewer than three people per car is saturated (see Table 6-6).

6.3.2 Increased Competition at Home

Besides slow growth, automaker's home markets have become much more competitive. There has been an increase in the number of firms selling cars in home markets such as the United States, Germany, and Japan. Figure 6-3 presents an analysis of passenger vehicle sales in the United States, Japan, and Germany according the Herfindahl Index of Market Diversity. The index would be zero if market share was evenly distributed among automakers. The index would be one if a single company had 100% of national market share (monopoly industry structure). Thus, the lower the index the more diverse the market. Figure 6-3 shows an across-the-board decrease in market concentration in the United States, Japan, and Germany, revealing the heightened competitive pressure that automakers have been experiencing in their home markets. Germany, as with most European countries, has long had a diverse automotive market due to the inter-penetration of Europe's car markets by European automakers as well as the active presence of American firms. However, strong sales by Japanese automakers have brought the index down further since the late 1980s. In the United States, inroads by Japanese automakers increased the competitive pressure dramatically during the 1980s. In Japan, increased market diversity has come almost entirely from the success of smaller Japanese automakers, and the declining dominance of Toyota and Nissan as they "hollow out" domestic production by substituting exports with local production in Europe, North America, and ASEAN (For market shares in North America, Europe, and Japan by automaker home country origin, see Table 5-13).

6.3.3 The Lure of Big Emerging Markets

Slow growth, market saturation, and increased competition at home have lead automakers to the obvious conclusion that future growth will occur in BEMs, particularly in countries with the largest populations, such as China, Brazil, and India. Table 6-6 presents an international reverse ranking of market penetration for 1995, as measured by people per car in each country. The United States, Australia, and countries in Northwest Europe all had more than one car on the road for every three people (representing a saturated market), while Vietnam, China, Pakistan, the Philippines, and India each had fewer than one car on the road for every 100 people. Vietnam tops the list with 950 people for every car in operation. It is this statistic, more than any other, that explains the recent wave in vehicle assembly plant investments in BEM type locations.

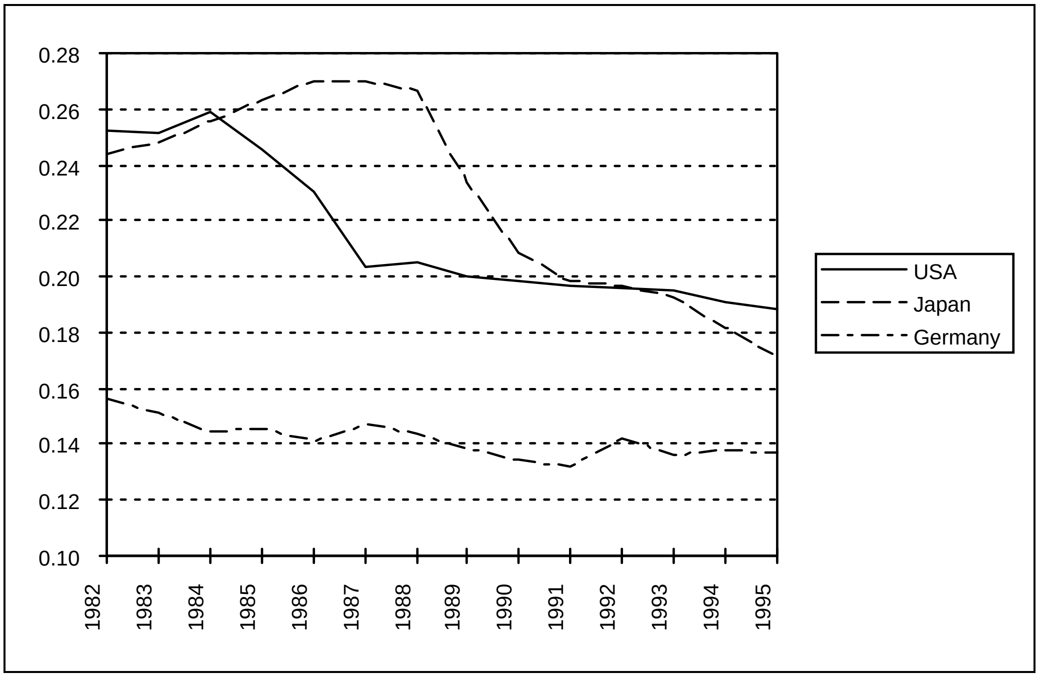
Table 6-5: Worldwide Passenger Car Production by Automaker Origin, 1983-1995 (‘000 units)

	1983	1984	1985	1986	1987	1988	1989
European	10,461	10,062	10,434	11,244	11,880	12,440	12,645
American	10,752	11,905	12,401	12,194	11,222	11,605	11,353
Japanese	7,545	7,595	8,240	8,495	8,784	9,442	10,670
S. Korean	122	159	264	457	793	872	887
Others	172	230	275	362	489	516	558
Total	29,052	29,951	31,614	32,752	33,167	34,876	36,112
% change	9.3%	3.1%	5.6%	3.6%	1.3%	5.2%	3.5%
AAGR ‘83-'89							**3.69%**

	1990	1991	1992	1993	1994	1995
European	12,357	11,968	11,887	10,597	11,590	11,544
American	10,496	9,909	10,009	10,188	10,656	10,641
Japanese	11,777	11,594	11,409	10,820	10,431	10,474
S. Korean	994	1,186	1,322	1,607	1,806	2,006
Others	638	602	665	511	610	837
Total	36,263	35,260	35,291	33,723	35,094	35,503
% change	0.4%	-2.8%	0.1%	-4.4%	4.1%	1.2%
AAGR ‘90-’95						**-0.42%**

Source: Wards Decade of Data

Figure 6-3: Passenger Vehicle Market Concentration in the USA, Japan, and Germany According to the Herfindahl Index (1=monopoly)



Note: the data has not been adjusted for new entrants or industry consolidation.
Source: calculated from Wards Decade of Data.

Table 6-6: Market Penetration by Reverse Ranking: People per Car by Country, 1995

Rank	Country	People/Car	Rank	Country	People/Car
1	Vietnam	950.2	21	Portugal	4.4
2	China	487.9	22	Ireland	3.8
3	India	244.9	23	Czech Republic	3.5
4	Pakistan	154.0	24	Slovak Republic	3.5
5	Philippines	118.2	25	Japan	2.9
6	Indonesia	107.9	26	Spain	2.8
7	Thailand	54.0	27	Netherlands	2.6
8	Columbia	36.5	28	Belgium	2.4
9	Turkey	21.2	29	Puerto Rico	2.4
10	Russia	15.9	30	Sweden	2.4
11	Brazil	13.2	31	France	2.3
12	Venezuela	12.6	32	United Kingdom	2.3
13	Mexico	11.2	33	New Zealand	2.2
14	Chile	10.8	34	Australia	2.1
15	Singapore	8.9	35	Austria	2.1
16	Korea	8.4	36	Canada	2.0
17	Argentina	6.7	37	Germany	2.0
18	Poland	5.5	38	Italy	1.9
19	Taiwan	5.3	39	Luxembourg	1.7
20	Hungary	4.9	40	United States	1.7

Source: Calculated from Country Statistical Yearbooks and Wards PARC.

6.4 The Overcapacity Crisis

Speculative over-investment in emerging markets, greatly exacerbated by the recent economic crises in Asia and elsewhere in emerging economies, have combined with sluggish vehicle sales in all large existing markets except for the United States to create a true overcapacity crisis in the automotive industry.

Globalization means that automakers have returned with renewed vigor to the “built-where-sold” approach to automobile manufacturing established during the 1930s, even in an environment of falling barriers to trade. The assumption of the automakers is that locating production where cars are sold garners the maximum amount of good will from host governments seeking to reduce trade deficits, as well as from consumers, who tend to buy locally-built vehicles for nationalistic reasons. Furthermore, local production provides automakers with a natural hedge against currency fluctuations, as long as parts can be supplied locally. But, what made perfect sense for the first mover made less for the second and so on until excess capacity began to crush these nascent industries under the weight of idle plants, machinery, and workers. Then the Asian economic crisis hit, bringing emerging markets, and the auto plants meant to serve them, to a complete standstill.

Overcapacity in emerging markets—because most of the recent investments have been small and cautious—would be a mere annoyance to the industry if it were not compounded by alarming increases in excess capacity at home. Sluggish car sales in every major market except for the United States, and especially in Japan, where production has been draining away to "transplants" in the United States and Europe since the mid-1980s, has amplified the situation in emerging markets to create a true crisis.

Even before the recent economic turmoil in emerging markets, many automotive industry analysts warned that the aggressive investments were likely to create conditions of severe excess capacity in the near- and medium-term. In a 1997 report by AUTOFACTS, the automotive planning group of Coopers & Lybrand Consulting, it was estimated that excess capacity would reach 21 million units by 1998, more than one and one half times the total 1996 passenger vehicle output of North America. A capacity utilization rate of about 75% was a relatively low point at which to see a boom in new investment. In a “rational” environment one would predict that new investment would be made when capacity utilization is high. With overcapacity further reducing already low profitability for many firms in the sector, some analysts warned that a major “post-globalization shake-out”—one that that could permanently alter the competitive landscape of the industry and have disastrous consequences for the employees of the firms that lose—was immanent. It now appears that these warnings were well founded as we have seen emerging markets, and the auto plants meant to serve them, come to a complete standstill, and the beginnings of what could be a huge wave of industry consolidation at the automaker level.

Overcapacity in emerging markets—because most of the recent investments have been small and cautious—would be a mere annoyance to the industry if it were not compounded by alarming increases in excess capacity at home. Sluggish car sales in every major market except

for the United States, and especially in Japan, where production has been draining away to "transplants" in the United States and Europe since the mid-1980s, has amplified the situation in emerging markets to create a true overcapacity crisis for the industry. In fact, the capacity overhang has now increased to the point where low or negative profitability has created a host of extremely vulnerable acquisition targets, even among large players such as Nissan.

The sheer volume of recent and planned investment, and the willingness that we found in our interviews for automakers to endure negative returns on new BEM investments in the short- to medium-term, give the recent capacity expansion all the earmarks of a classic speculative over-extension, where supply far outpaces demand as large groups of investors try to gain an early-mover advantage at the same time. In some of our interviews we found a corporate imperative to quickly establish "beach heads" in emerging markets at nearly any cost. Several automakers stated that they would not expect profits from BEM plants for 3-5 years after the start of production; and that manufacturing budgets were being based on these time horizons. Such imperatives are only sharpened when competitors make similar moves. What should decrease the attractiveness of a new market, increased competition, is instead spurring automakers to redouble their efforts. Such is the irony of speculative bubbles, when a "herd mentality" rules investment decisions.

An example can be drawn from the study's fieldwork in Vietnam, where eleven automakers have recently begun assembling passenger cars, sport-utility vehicles, utility vehicles, passenger vans, and freight trucks. In 1997 approximately 21,000 vehicles were sold in Vietnam. Of these, about 75% were imported, leaving eleven manufacturers to battle for a share of about 5,000 locally assembled vehicles. In 1998, in the midst of the deepening economic crisis in Asia, the Vietnamese automotive market slowed more than 50%. Table 6-7 shows Vietnam's automotive assembly plant inception date, and 1998 capacity, output, and utilization rate. While market uncertainty made precise data difficult to collect, given our best estimates it was clear that Vietnamese capacity utilization rates were extremely low in 1998. The automakers visited in the field were manufacturing only a few vehicles each day. Most plant and equipment lay idle, many workers had been laid off or had had their working hours reduced. With an average utilization rate of approximately 11%, and a total country utilization rate of only 8%, assembly plants in Vietnam can be assumed to be unprofitable.

Table 6-7: Vietnamese Automotive Assembly Plant Inception Date, and 1998 Capacity, Output, and Utilization

Company	Inception Date	1998 Capacity	1998 Estimated Output	% Utilization
Daewoo	1995	10,500	605	6%
Daihatsu	1996	2,000	556	28%
Daimler Benz	1996	10,000	359	4%
Ford/Mazda	1997	14,000	1,000	7%
Hino Motors	1997	1,760	50	3%
Isuzu	1997	10,000	135	1%
Mekong	1992	5,000	527	11%
Mitsubishi	1995	5,000	688	14%
Nissan	1998	1,000	NA	NA
Toyota	1996	5,000	1,400	28%
VMC	1991	20,000	1,347	7%
TOTAL		83,260	6,667	8%
AVERAGE		7,660	667	11%

Sources: April 1998 author fieldwork and Vietnam Economic Times, October, 1997.

A "rule of thumb" offered to the research team by a strategic planner at one automaker was that GDP per capita must reach about $1,000 per year to create a market large enough to support a profitable automotive industry, and $4,000 per year was required to trigger rapid industry growth. Table 6-8 shows the length of time that it would take to reach these milestones from the starting point of Vietnam's 1997 GDP per capita (about $270) and population growth rates. Assuming Vietnam's GDP continues to grow at its 1997 rate of about 8% (a highly unlikely prospect in the face of the current economic crisis in Asia), it will take 14 years to reach industry profitability and 31 years to reach the point of rapid industry growth.

Table 6-8: Estimated Time to Vietnamese Automotive Industry Profitability and Rapid Growth

GDP/Capita Annual Growth Rate	Year when >$1,000 GDP/capita attained	Years to possible industry profitability	Year when >$4,000 GDP/capita attained	Years to possible rapid industry growth
14%	2005	7	2016	18
11%	2008	10	2020	22
8%	2012	14	2029	31
5%	2020	22	2047	49
2%	2051	53	2109	111

Source: Author calculations from base GDP and population growth rates presented in Mason (1998).

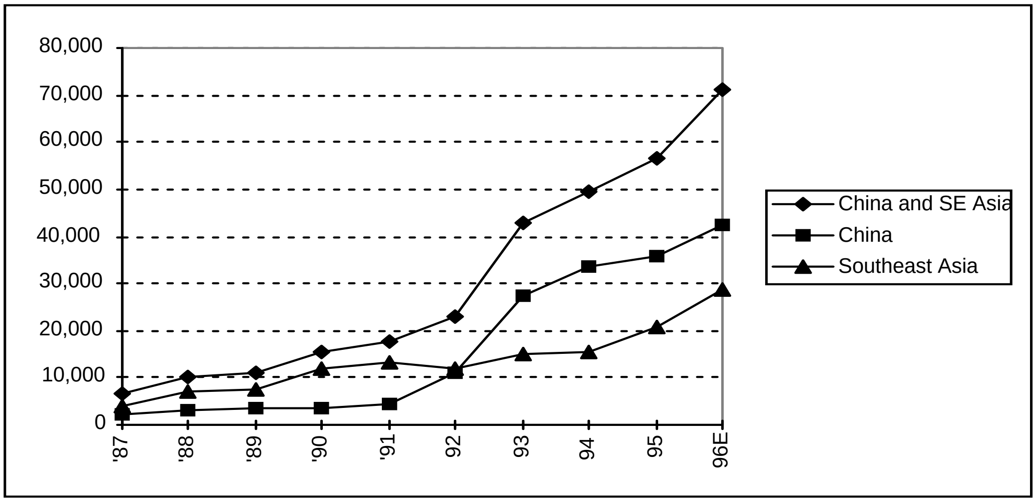
Standard neoclassical economic theory posits that capital automatically migrates toward investments where it can earn the highest return, but in practice, the process does not always work so efficiently, sometimes resulting in boom-bust cycles of under- and over-investment. As investment capital has become increasingly mobile, and can be more easily shifted from one location to another, the problem of over-investment has become more acute (Storper and Walker, 1989). Over-investment comes when a group of investors decide to invest in the same place at the same time. The social dynamics of such herd behavior are strong when a relatively small number of actors base their decisions on the same information and have good knowledge of what the others are doing. The automotive industry provides just such an environment.

The notion that emerging markets, particularly in Asia, were to be the locus of rapid economic growth in the medium term has been widespread, driving a huge wave of new investment into Asia, particularly China and ASEAN (see Figure 6-4). Table 6-9 shows the widely disseminated projections of regional vehicle production. Asia and Eastern Europe were expected to have the highest rates of production growth, with Asia outside of Japan generating 55% of the world's new production. The BEM and PLEMA countries, taken together, were to account for 80% of new production (PLEMA countries such as Mexico, Canada, and Spain were not broken out of the estimates). All automakers hired a similar set of consulting firms and saw the same projections, some even more optimistic than those presented in Table 6-9. Since the projections assumed a decreasing role for finished vehicle exports, it was clear to automakers that the only way to participate in the expected production growth was to manufacture vehicles in emerging markets. Such assumptions played a central role in driving the boom in BEM assembly plant investments.

The investment boom ended abruptly in the summer of 1997, when many of the ASEAN economies, overheated by the rapid influx of foreign capital without sound investment outlets, began to implode. Overvalued currencies plummeted and investors fled to safer havens such as the United States securities and bond markets. It is likely that the Asian FDI figures for 1998 and 1999 will be much lower than what was estimated by United Nations for 1996; they will likely have fallen back to 1991 levels or below, creating a classic boom-bust curve. This kind of boom-bust cycle, lasting about eight years, and dropping suddenly from its peak, has all the earmarks of a gigantic region-wide speculative cycle of over-investment, where distant investors under sway of the herd mentality keep pouring money into a region where opportunities for profitable ventures have long been taken up by those who invested early on. Capital investment, because it is long lasting, is particularly prone to over-investment. Seven-to-ten year cycles have been well documented in fixed capital investments, especially in real estate speculation (Abramowitz, 1961, 1964; Kuznets, 1966). It is also likely that China's crisis has been smaller, even in the face of massive FDI inflows, because its economy is large and dynamic enough utilize the incoming capital more effectively.[8]

[8] Not all over-investment comes in the form of inward FDI. While over-investment does hurt host economies when assets are radically devalued during the bust cycle, financial damage is also dome to outward investors (and sometime their home economies). Imprudent domestic investment too can create a boom-bust cycle. For example, over-investment in Korea (both in the form of domestic investment and outward FDI) has come largely from domestic financial institutions and industrial groups (FDI in Korea has been very small). Still, the financial crisis in Korea has been very severe.

Figure 6-4: Total FDI Inward Flows to China and Southeast Asia, 1987-1996, ($M)



Source: UN Conference on Trade and Development; Division on Trans-national Corporations and Development; World Investment Report, Annex Table 1: FDI inflows, various years, New York and Geneva. Other Asia includes India, Korea, Taiwan.

Table 6-9: Projections of Regional Vehicle Production Made Before the Asian Economic Crisis (units '000)

	1995	**2000**	**2005**	**2010**	**95-'10 AAGR**	**Unit Increase '95-'10**	**% of Unit Increase**
Western Europe	15.3	16.0	16.9	16.9	0.7%	1.6	7%
Eastern Europe	1.8	3.4	4.6	5.7	8.0%	3.9	18%
North America	15.3	16.5	18.5	19.3	1.6%	4.0	19%
South America	2.0	2.4	2.9	3.3	3.4%	1.3	6%
Africa	0.5	0.6	0.7	0.7	2.3%	0.2	1%
Asia	15.7	20.1	23.1	26.1	3.4%	10.4	48%
Japan	10.2	9.3	9.1	8.8	-1.0%	-1.4	-7%
Asia (excluding Japan)	5.5	10.8	14.0	17.3	7.9%	11.8	55%
Oceana	0.4	0.5	0.5	0.5	1.5%	0.1	0%
World	51.0	59.5	67.2	72.5	2.4%	21.5	100%
LEMA	41.2	42.3	45.0	45.5	0.7%	4.3	20%
BEM	9.8	17.2	22.2	27.0	7.0%	17.2	80%

Source: Calculated from Volpato et. al., 1999; Based on LMC and DRI estimates.

If the threat of severe overcapacity is real then, the relevant question becomes: what have automakers done up-front to reduce their exposure to this risk? Since forgoing investments in BEMs has not been seen as a viable option by most automakers, what other measures that are being taken? The following sections provides some answers to this question.

7. Globalization and Corporate Strategy

As the recent investment boom has unfolded, some automakers have been employing a variety of measures that may have the effect of reducing the risk of over-investment. While some of these measures have been explicitly intended to hedge against excess capacity, others have been pursued for different reasons but may have the complementary effect of reducing investment risk as well. In the former category are the practices of developing common "global" platforms, deploying common processes, and testing new markets with small but expandable plant designs. In the latter category are the practices of centralizing control and development functions in core locations, simplifying the final assembly process through modularization, and increasing outsourcing to larger, more global suppliers. Taken together, these measures are have the effect of simplifying the process of developing, manufacturing, and selling automobiles, an outcome that can, to some degree, offset the complexity created by globalization. Automakers are minimizing the size of their new investments, minimizing the number of unique parts in the automobiles they sell, simplifying the final assembly process through modularization, minimizing the variety of the design and production tools they use, minimizing the number of components they make in-house, and minimizing the number of direct suppliers they use. If implemented well and very, very quickly, these strategies, some of which are outlined in this section in detail, could reduce the negative impact of overcapacity.

7.1 New Market Identification and Assessment

One of the questions asked managers during out interviews was how automakers identify and assess markets as potential sales and manufacturing bases. Some automakers have highly structured methods for identifying and assessing potential locations for investment, others entertain and sometimes act on "bottom-up" requests by local sales affiliates to establish local assembly plants, and, of course, some new investments are initiated directly by top management. Vehicle sales and replacement part manufacturing are sometimes the first operations to be established. A range of vehicles can be imported to test market acceptance, estimate market share, and plan capacity needs according to market growth projections. Some companies move to low-volume CKD production when sales of imported finished vehicles in a particular country reach a particular threshold level, say 20,000 units per year.

Beyond the central motivation of potential market size (as measured by people per car), previously discussed in Section 6.3.3, automotive companies analyze the per capita incomes, income growth rates, and the income distribution of their potential BEM customers. Host country state policies such as local and mandatory content rules, export requirements, import restrictions, import tariffs, customs duties, and government incentives are taken into account, as are the stability and character of the current political regime and legal system. Local labor conditions such as prevailing wage rates, the existence and character of trade unions, and the quality of the work-force (including education levels, literacy, and skills) are assessed. The size and quality of the existing component supply-base, systems for vehicle distribution and after-market service, and quality of the general motorization and supply-route infrastructures are investigated. At the corporate level, new production locations are judged for their likely effect on regional-scale trade flows, and how they might fit into the company's overall capacity requirements and complementarity schemes. Finally, new investment are considered in the context of the overall capacity situation in the industry.

All of these considerations add up an extremely complex equation with many dynamic variables that introduce a large measure of uncertainty. As much as some companies may try to make wholly rational decisions via structured processes, uncertainty about the moves of competitors; shifting home and host country rules and regulations; the impact of unforeseen economic, political, and military crises; oil shocks; and the like; make efforts to calculate return on investment from new investments highly imprecise. In addition, there are a host of pitfalls associated with foreign investment, including worse than expected infrastructure, corruption at the state and/or local level, difficulty in complying with tax laws, higher than expected taxes and import duties, over-estimation of market growth and market share, a temptation to increase revisions to existing models and quickly introduce new ones, and promises broken by host governments. Many of these pitfalls are completely outside automaker's control and short of walking away from the investment, something automaker's tend to do only in extreme circumstances, companies appear to have little leverage once initial investments have been committed.

Still, despite these uncertainties, the overriding motivation of market access continues to drive automakers to invest in BEM type locations.

Since the motivation for establishing production in PLEMA type locations—cost cutting—is different than that of BEM investments—market access—automakers sometimes stress different assessment criteria when locating in PLEMA type locations. Of course, all of the considerations associated with BEM investments are relevant in PLEMA type locations, but, because of larger work-forces, labor cost and quality (e.g. skills, education, and turnover) are of greater importance. Labor management relations are of course an important issue. In the mid-1980s the United Auto Workers (UAW), alarmed that some of the fastest growing parts divisions operated by the Big Three (e.g. electronics) were non-union, won an "accretion clause" that stipulated that all workers hired at new plants in the Unites States would be represented by the UAW. From that point forward, many new Big Three parts plants have been opened in places such as Mexico, Spain, and Portugal to avoid the UAW (such motivations have also led the Big Three to increase their use of outside suppliers). Since proximity to LEMAs and the existence of favorable trade arrangements are what differentiate PLEMA type plants from those in other locations, these factors are of paramount importance. Such factors have long made the border region of Mexico an attractive location for labor intensive automotive parts production (e.g. wire harnesses and electronics), but high labor turnover has driven more recent investments to Mexico's interior.

7.2 Global Platforms and Generic Manufacturing Capacity

Corporate strategies in regard to globalization vary depending on the starting point of individual firms, but there seems to be a large measure of convergence toward 1) building vehicles where they are sold, 2) designing vehicles with common "global" under-body platforms while retaining the ability to adapt bodies, trim levels, and ride characteristics to a wide range of local conditions; and 3) leveraging the move to global platforms by creating assembly capacity that more "generic" and less model-specific. On the other hand, there is less convergence on the strategies of increased outsourcing and making vehicle design and assembly more "modular."

7.2.1 Globalization and Product Design: Global Platforms and Local Models

In the realm of vehicle design most automakers are seeking to place a greater number of car models on fewer under-body platforms, allowing for greater commonalization and reusability of parts while retaining the ability to adapt specific vehicle models to local tastes and driving conditions. Such strategies call for global sourcing, tighter coordination of worldwide design efforts, and in cases where platform design activities have become geographically dispersed over time (i.e. American firms), consolidation of project management in core locations and the formation of international design teams. At the same time, the need to respond to unique market requirements has created pressure to localize body design, prompting highly centralized automakers (i.e. Japanese firms) to set up regional design centers to cater to local tastes. Since the benefits of global platforms can only be reaped when they are used and reused across a full product line, there has been a wave of consolidation in the industry as large players acquire small, specialty producers.

Selecting models to manufacture in BEMs is not as straightforward as it might seem. Historical sales data can be inaccurate because it is skewed toward what was available, not necessarily what was desired, and such official data usually ignores the "gray market," which is usually substantial in emerging markets. While it is often assumed that small cars are the most appropriate for poor countries, the bulk of initial sales are often large cars that sell to elites. Poorer customers sometimes pool their resources to by vans and trucks, leaving small cars for the second or third vehicle purchase. In addition, emerging markets are becoming sophisticated very quickly (perhaps because of the influence of satellite television), and outmoded vehicle designs are likely to be rejected. Adding to the difficulties of model selection is the fact that emerging markets are surprisingly diverse and develop differently over time. In Thailand, for instance, small pick-up trucks are extremely popular, while in nearby Vietnam, sedans are preferred to the point where no pick-ups are locally produced. In India, people tend to buy sub-B class sedans as an initial purchase, and upgrade to a new B-class with more options or a stripped-down C-class. In other countries the first car is a communally purchased van, usually bought for commercial purposes, which is replaced with a super-cab pick up that can double as a carrier of people and cargo, and finally a passenger car.

One result of emerging market heterogeneity is that it is sometimes unpredictable which models will take hold. Those that are successful in a wide variety of markets can become *de facto* global platforms, and problems can arise if organizational structures cannot adapt well to unforeseen changes. An example is the Opel Corsa, which emerged unexpectedly as GM's *de facto* global platform. Seventeen plants are now assembling Corsa's, and worldwide output has reached nearly one million units per year. Problems have arisen for GM because the Corsa's success unexpectedly shifted the responsibility for global platform development to Opel's Technical Design Center (TDC) in Russelshiem, Germany. Tensions have arisen because the

TDC did not have (or was not given) the resources to support the multiple design adaptations for various markets. In addition, a great deal of friction has been reported as GM North America has sought to bring the center of gravity back to Detroit for the development of the Corsa's successor.

Despite the highly divergent character of among emerging markets—and between emerging markets and large existing markets—nearly all automakers are striving to commonalize under-body platforms and breaking the car up into front, middle, and rear systems. Platforms of different sizes are often tied to particular engines, such as three, four, six, and eight cylinder designs. Manual transmissions can be reduced to two versions, one for front-wheel drive applications and one for rear-wheel drive.

Global platforms are often designed to with right- and left-hand-drive options from the outset. Local standards can make it necessary to modify vehicles. For example, China has a requirement for high glass transmissibility to prevent vehicle occupants from traveling in anonymity. The condition of roads can effect suspension requirements and the availability of fuel can effect gas tank size requirements. Climatic conditions can effect HVAC requirements and other factors such as cold-starting and engine cooling.

The move toward global platforms is a way to increase scale efficiencies and create a continuous stream of engineering change orders (ECO), in place of the annual flood that come with annual model changes. ECOs are initiated from "main plants," usually located near vehicle development centers, and then these changes migrate to "sister plants." Overall, automakers are striving for commonalization and coordination of engineering releases and bills of materials (BOMs) on a global basis.

For American and European automakers, re-engineering for foreign markets was once much more common, a reactive strategy based on sales. Over time, as local models diverged more and more, costs went up, and component scale economies went down. Today, aggressive programs are in place to restrict such re-engineering. It is clear from our interviews that such coordination continues to be extremely difficult for automakers to implement.

Designs are developed in core locations in North America, Europe, and Japan and then modified for emerging markets. During our interviews, automakers indicated that under-body platform design will continue to emanate from core regions. Automakers have no plans to localize platform design, although one company did say it had a plan to design complete vehicles in China, where such design work was a condition of market entry. In most BEM type locations, local engineering is, and will continue to be, limited to validation of local suppliers. An exception is the Fiat Palio, which was co-designed by design teams in Brazil and Italy for manufacture in Fiat's BEM plants worldwide.

For companies with more than one vehicle development organization (i.e. Ford and GM), globalization means tighter coordination between existing design organizations. As more design organizations are acquired (e.g. Jaguar, Volvo, SAAB, etc.), these firms are moving toward a decentralized vehicle development organization with nodes in many places. The idea is for joint development teams to work with common processes and information systems (e.g.

design tools and communications software). At GM, for example, international engineering staff are using Lotus Notes "groupware" to collaborate across space. Such teams can work on 24 hour design cycles by passing in-progress design files around the world. This process is very difficult to implement and it remains an open question whether co-location is needed or not. Ford and GM are learning with smaller projects at first.

7.2.2 Manufacturing Design for Emerging Markets: Flexible, Expandable, Modular Assembly Plants

In the realm of manufacturing design automakers are seeking to mitigate the risks of globalization-induced overcapacity by building a new breed of highly efficient lower-volume assembly plants that are easily expandable and very flexible in terms of product mix. The reduction of minimum scale economies is being facilitated by a strong move toward *modular assembly*, particularly among American and European automakers. The logic is that assembly plants can be smaller and simpler when vehicles consist largely of pre-assembled modules. When module sub-assembly is taken off-line, it becomes geographically and organizationally separable from the final assembly plant, making initial automotive assembly investments less "lumpy," and the "deverticalization" of the industry more viable.

Many automakers are designing new BEM plants specifically to be flexible and expandable to adjust to market's response the company's product's and market's rate of growth. Such plants can begin production with 2-3 models, and then easily shift output production to the model or models that sell the best. Such "generic models" of plant designs meant are to be modular and reusable. For example, paint shops can be built in such a way that capacity can be added easily. Water filtration systems can be over-built in anticipation of future expansion. Typical model plant sizes are 20, 40, 60, and 100 thousand units for final assembly; 25, 50, 100, 150, and 200 thousand units for power train assembly; and 50, 100, 150, and 200 thousand units for engine and transmission machining. Plant models can be based on a "typical" vehicle models (e.g. small car, pick-up trucks) and power trains (e.g. 4 cylinder). The plant models evolve over time and are adapted to particular places (e.g. warm vs. cold climates). In some cases, generic plant models are developed in collaboration with the construction firms that automakers work with world-wide (e.g. for paint, stamping, and trim).

Shop floor flexibility is maintained by placing production fixtures on wheels, and using overhead lifts to allow workers access to vehicle under-bodies, as opposed to floor pits that tie a particular process to a particular location on the shop floor. The automated "vacuum and fill" equipment used to install fluids in high volume assembly can be done by hand in lower volume settings. Since paint shops are such a large investment, automakers can import painted bodies, although most host government require local welding and painting.

Material planning and logistics are closely related to plant design. On one extreme is the industrial park concept, where suppliers cluster around the assembly plant for JIT integration. On the other, all parts are shipped in as kits for assembly. In practice, plants are transformed over time from the latter extreme toward to former. Because of long supply-lines and difficult logistics, inventories can be initially high in BEM settings.

7.2.3 Manufacturing Design for Global Coordination: Generic Manufacturing Capacity

It is important to note that automakers are seeking to build capacity flexibility into their entire network of assembly plants, not just new BEM plants. Even large assembly plants are not set at a ridged capacity (except for the paint shop), since shifts can be added and subtracted, and most automakers have scenarios in place for situations of over- or under-capacity. Body volumes can be ramped up and down by adding or subtracting shifts, and space in framing shops can be left open to fill late-coming orders. Flexible capacity planning and scheduling methods can be employed to reschedule component shipments as demand shifts from one plant to another. Such approaches are greatly enhanced when assembly plants have the flexibility to produce two or more different models on either of several lines.

Engines and transmissions have large minimum scale economies, and may be shipped to a wide variety of assembly plants. By separating engine and transmission production and, in some instances, body stamping, from final assembly, scale economies can be maintained for highly capital- and skill-intensive process while the minimum scale economies for final assembly can be driven down. As one manager put it during our interviews: “We will never build another monster [400,000 unit per year assembly plant].” In fact, the optimal scale for an assembly plants now seems to be about 150,000 units per year and is dropping rapidly.

Some automakers are attempting to take the further step of standardizing production fixtures across all similar-sized passenger vehicle platforms and models in order to make productive capacity less model-specific. The idea is to design similar-sized vehicle families with common manufacturing locating holes so that different models within a family can be assembled on the same manufacturing line. The more standardized, or “generic,” manufacturing capacity is, the less vulnerable it is to overcapacity problems. With enough standardization, better selling models could be substituted on the production lines of underutilized plants on short notice. Standardization among manufacturing operations would also make the transfer of learning across a widely dispersed organization more likely, since improvements worked out at one plant would be applicable to many others.

A negative aspect of such generic plant designs is that the flexible capacity planning and scheduling methods and disaggregated supply-chains that support them increase the complexity of shipping and logistics systems. Some automakers already have elaborate continental-scale capacity planning methods in place; one of the key challenges ahead for automakers will be to raise these systems to the global scale, creating a truly integrated worldwide production systems flexible and agile enough to meet the dynamic and variegated needs of the global marketplace. The difficulty of creating, managing, and continuously improving integrated global-scale production systems can hardly be overstated, especially in the face of pervasive and persistent local content rules.

7.3 Spreading the Risk: Strategies for Survival in Emerging Markets

7.3.1 Joint Ventures, Capacity Sharing, Contract Manufacturing, and Outsourcing

An obvious way to spread risk in BEMs is through the formation of joint ventures. However, most automakers only form joint ventures when required to do so by the host government's investment rules. If joint ventures are formed with local companies already engaged in assembling vehicles, operational changes cannot necessarily be imposed by the foreign investor. Many automakers insist on operational control if they are forced to undertake joint ventures, whether or not they have equity control. Three-way partnerships and joint ventures with publicly listed companies (because of stock price volatility in emerging markets) are seen as particularly problematic. If forced to enter into a joint-venture, some automakers try to agree in advance on an exit scheme.

Automakers use a variety of methods to hedge against the risk of overcapacity in BEMs. First, "contract manufacturers" or the under-utilized facilities of other automakers can be used to assemble CKD kits, allowing an automakers to forgo direct investment while having vehicles locally assembled. For example, Chrysler uses local contract manufactures to assemble Jeep Cherokees in Austria, Indonesia, Malaysia, and contracts with Volvo, Honda, and Dihatsu in Thailand.

Another method is to sell (or buy) capital intensive assembly processes, such as electrostatic coating and painting, to (or from) nearby assembly plants owned by other automakers. In the Saigon metropolitan region of Vietnam, for instance, Isuzu sells paint capacity to nearby Daimler-Benz. In the Hanoi area, Toyota sells paint capacity to Hino Motors and Dihatsu.

Another popular approach to risk reduction, and one that fits well with the larger trend toward increased outsourcing, is to pass the risk out-of-house to first tier suppliers. In Brazil, one automaker was able to achieve 50% local content in three years, thanks in large part to a key supplier, which supplied rolling chassis to the automaker as 100% local content. Thus the supplier took the responsibility for locating and qualifying local suppliers, and for paying import duties when necessary. The typical strategy by automakers is to transform CKD assembly to integrated production over time by gradually taking parts that can be acquired locally out of kits.

Perhaps the most prevalent way to reduce the risk of offshore investment in through the establishment of CKD assembly plants. Beginning with highly labor intensive, highly flexible CKD assembly facilities geared to current market size is an approach that was pioneered by Japanese companies in the 1960s and 1970s. It is an approach that is being imitated and further refined by American and European automakers today. Of course, all new plant are not small (e.g. GM is planning four new 150,000 unit/year plants for Poland, Brazil, Thailand, and Argentina). In PLEMA type locations, since output is largely being aimed at LEMAs, assembly plants are usually highly capital intensive. In LEMA type locations, automakers use automated production equipment to avoid high wage rates and maintain flexibility in the face of rigid work rules and the difficulty faced in laying off workers once hired.

For some automakers, CKD is now seen as a market development phase of business strategy. What used to be a side business has grown rapidly and has become profitable. With CKD assembly, profits are essentially made by effectively managing the supply chain. CKD plants can drive training, supplier development, and logistics in new locations. As automakers gain more experience, new CKD assembly plants can be set up quickly—sometimes as quickly as five months—in response to market developments or competitor moves. It takes two years to build a new paint shop, but these are not always required. In terms of the sequence of the assembly process, CKD plants are no different than integrated assembly plants. The difference is in consolidation costs (receiving, counting, and packing parts), which are $250-$800 per vehicle. Integrated plants receive parts directly from suppliers, cutting out consolidation costs. For low-volume plants located a great distance from supply centers, CKD makes sense.

CKD assembly allows for greater labor intensity, which leads in turn to greater flexibility in terms of staffing levels and plant layout. Welding robots are rarely used in CKD assembly plants, for example. Some automakers keep company-wide databases of used equipment, and although host governments the use of used equipment and sometime specifically ask automakers to install the latest robotic equipment, some of used equipment does find its way to BEM locations because automakers are reluctant to deploy machinery that is oversized for small markets, even if it has been fully amortized.

CKD assembly, while growing in importance, is also becoming more difficult for a variety of reasons. First, since vehicle kits are drawn from the ongoing assembly lines in other locations, the adoption of JIT parts delivery and color sequencing (where parts come to the factory from suppliers sequenced for assembly in particular vehicles) can wreak havoc on the delicate balances achieved at home. Second, local and mandatory content rules demand, in many cases, an initially high level of local sourcing and a fast transition to local sourcing.

CKD assembly plants are usually far less productive than larger assembly plants. During our interviews, one automaker reported 74 cars per hour (16 man hours for each vehicle) in its integrated facilities and only 2.5 cars per hour (24 man hours for each vehicle) in its CKD facilities. These lower productivity rates, even with extremely high levels of modularity, are due to low volumes and high labor intensity. The result is usually high vehicle costs in developing countries, a fact that severely limits market growth. In Vietnam for example, domestically produced vehicles shown in Table 7-1 sell, on average, for 163% of USA prices. Of course, domestic production is still seen as advantageous because the current mix of import tariffs and consumption taxes raises the prices even of imported vehicles even further. For example, the imported vehicles contained in Table 7-2 sell, on average, for 289% of USA prices. The larger problem that these data point to is the stunting of the local market by the high prices of motor vehicles in Vietnam in general.

Table 7-1: Current New Locally Produced Vehicle Prices, Vietnam and the United States (US$)

Lead firm	Model	Price in Vietnam	Price in USA	Vn Price % of USA
Toyota	Corolla	$24,000	$13,000	185%
Daimler Benz	Mercedes E-series	$74,500	$45,000	166%
Mazda	626	$31,330	$20,500	153%
BMW	3-series	$49,000	$35,000	140%
BMW	5-series	$78,000	$45,000	173%
Average				163%

Sources: Vietnam: Lan, 1997; USA: author estimates based on Boston Globe, July 20, 1998.

Table 7-2: Current New Imported Vehicle Prices, Vietnam and the United States (US$)

Lead firm	Model	Price in Vietnam	Price in USA	Vn Price % of USA
Toyota	Camry	$48,500	$19,000	255%
Mitsubishi	Pajaro	$59,000	$22,500	262%
Chrysler	Jeep Wrangler	$55,000	$20,000	275%
Ford	Taurus	$60,500	$18,000	336%
Toyota	Landcruiser	$67,000	$45,000	149%
Ford	Explorer	$83,000	$25,000	332%
Volvo	960	$115,000	$28,000	411%
Average				289%

Sources: Vietnam: Lan, 1997; USA: author estimates based on Boston Globe, July 20, 1998.

7.3.2 Complementarity Schemes for Regional Economies of Scale

Increasingly, automakers are using the various components (including drive train components) to set up "complementarity" schemes to balance trade flows and achieve regional economies of scale in small markets. For example, engines produced in one country can be trans-shipped with transmissions made in another thereby balancing trade. What is striking about these schemes is the attention automakers seems to pay to maintaining a company-specific balance of trade in each market where they sell. The logic is that even if trade restrictions are taken away, governments will be embarrassed if their trade is out of balance with a major trading partner, a concern that stems from a fear of losing jobs.

Regional integration of the automotive industry is much less developed in Asia than it is in North America or Europe. Japanese automakers supply the domestic market with finished vehicles assembled entirely at home; no use is made of low-cost PLEMA type production locations equivalent to Mexico or Spain. Regional integration in Asia therefore takes two forms: parts exports from Japan to assembly plants located in nearby emerging markets, and intra-ASEAN complementarity schemes. Overcapacity in Japan has thus far acted as a brake on flows of large quantities of finished vehicles from ASEAN. Since final assembly in ASEAN is entirely market-seeking, and each country requires its own final assembly plants, firms have great difficulty in achieving adequate scale economies. Complementarity schemes have been put in place to attempt to solve these problems.

There is a long history of formal "complementarity" schemes in ASEAN, including the ASEAN Industrial Joint Venture (AIJV) begun in 1983, the Brand-to-Brand Complementarity (BBC) scheme begun in 1988, and the ASEAN Industrial Cooperation (AICO) scheme begun in 1996. All of these programs have been based on resource-pooling and market-sharing among ASEAN member states as a way to generate and exploit firm- and industry-level economies of scale. The idea is simple: since each member country by itself has a small market, complementarity schemes are put in place to allow parts manufacturers to supply final assemblers in all member states from a single ASEAN location at favorable terms of trade as long as inter-ASEAN trade among participating companies remains balanced (final assembly has traditionally been excluded from complementarity schemes). Toyota's parts complementation scheme in ASEAN, for example, includes the exchange of transmissions from the Philippines for engines assembled in Thailand and Indonesia. Under this arrangement, Toyota's transmission plant in the Philippines can achieve much higher economies of scale than it would if it were producing for the Philippine market alone. The same is true for the engine plants in Thailand and Indonesia. Parts suppliers also have participated in ASEAN complementarity schemes. Denso (Japan), for example, ships Indonesian-built compressors to Thailand in exchange for starters and alternators. ASEAN complementarity schemes have gained significant participation, largely from Japanese firms, although American firms, such as Ford and Delphi, are now joining in. In 1996, when BBC gave way to AICO, the program had 70 approved projects supplying parts to 10 automakers.

AICO is different than previous arrangements mainly in that is allows complementarity schemes to be set up between separate firms. A minimum of two companies in two different ASEAN countries are required for participation. Parts approved under AICO have tariff rates dropped to 0-5% well ahead of AFTA implementation in 2003. Participating companies must also provide evidence of cooperative activities such as technology transfer, inter-firm training, or consolidated purchasing in order to gain project approval. The goal of AICO is to boost the competitiveness of the ASEAN region by encouraging firms to establish plants with better economies of scale, thereby stimulating intra-ASEAN trade, FDI, technology transfer, and the like.

Though free trade agreements in North America, Europe, and MERCOSUR obviate any need for formal complementarity agreements, automakers still seem to be careful about balancing trade among regional trading partners. During our interviews, a manager at an American automaker spoke of "plans to neutralize tariffs and hedge against currency fluctuations through complementarity schemes that leverage the supplier network." In large markets such as Brazil and China, assembly and parts manufacturing are more likely to be concentrated within a single country.

7.4 Creating the Global Work-force

During our interviews, we found a great deal of convergence in regard to hiring workers for new assembly plants. First, there is heavy reliance on psychological screening and filtering methodologies to locate adaptable individuals who are likely to develop a high identification with the company. Second, training is quite extensive, with new hires often traveling back to the company's home assembly plants for several months of training. Such workers are then used to train subsequent hires. Automakers are sometimes required to inherit an existing workhorse in acquired facilities, but in general they try to hire inexperienced workers who have never worked in an automobile assembly plant to avoid poor, ingrained work habits. Of 1,900 workers hired at one joint venture in East Europe, only 1,200 had worked at the former company, which had 10,000 workers. In spite of their shortcomings, these workers were found to be very technically proficient; they could make spare parts for the machines they used.

Automakers often use country-specific consultants who determine which skills exist and which skills need to be developed through training programs. Reading is important for line workers, but materials are translated so knowledge of English, German, or Japanese is usually not a requirement. Consultants are often used to conduct recruit screening and testing. Among American firms, DDI and AON (formerly HR Strategies) are particularly popular.

Staffing senior personnel for international assignments can be difficult. In the past these jobs were given to the most experienced managers, but as these people have retired with much country-specific information, some automakers have begun to recruit high-potential younger managers with less experience who are willing to take on a "stretch" assignment. Generally, there are two classes of people that accept international assignments. First there are the "rising stars" or "crown jewels" who are being groomed for top management positions. Their careers are carefully managed, and they know they must gain experience in different settings. Second, recruiters go down a list of possible employees and take the first person who says "yes," but people seeking this type of adventure are rare. Since moving overseas often takes people off the local advancement track, good people are reluctant to go. Automakers try to address this problem by treating "expats" very well and hiring local managers as quickly as possible. The role of the initial team is usually to get things up and running and hire their replacement as soon as possible. The incentive for doing this is returning home.

On the whole, as international operations become more important to automakers, effort are underway to create a feeling of identification with the global—not national or brand-specific—organization by rotating key managers through foreign assembly plant for, say, twelve months at a time.

7.5 Comparisons Among Firms of Different National Origin

Thus far, the discussion has been of overall trends in the industry, and especially those being driven by American and European automakers. The Japanese automakers interviewed for the project provide an interesting point of comparison. While American automakers (typified by the Ford 2000 program) are moving toward centralized global decision-making, purchasing, and vehicle line management, Japanese automakers are moving to provide local affiliates with greater autonomy (especially in regard to sourcing) and setting up regional design centers to adapt body designs more closely to local tastes. While at first blush these strategies seem to be divergent, when the vastly different starting points of Japanese and American automakers are taken into account, they appear much less so. Japanese automakers have traditionally kept much tighter control over their offshore operations than American automakers, which are only now aggressively moving to re-combine divergent international operations (e.g. on October 5, 1998, GM announced it was planning merge the management of International with North American Operations). Thus, the establishment of offshore design centers and the granting of more autonomy to offshore affiliates by Japanese automakers can be seen as relatively small steps toward the decentralization of control.

In the arenas of modularization and outsourcing, however, our interviews suggested some real differences in strategy among automakers of different national origin. While Japanese automakers have long relied on their suppliers to produce a large share of their vehicle’s value, part and sub-assembly design work has been kept almost completely in-house. Moreover, although our headquarters interview suggested some new flexibility, especially at Nissan, Japanese automakers still purchase a majority of their components from suppliers that belong to their industrial grouping, especially in Japan. These trends have kept most Japanese suppliers, except for a few large players such as Denso, Bridgestone, Aisin, and Yazaki, small and largely "captive" to their largest customer (this issue is revisited in Section 8.1). Without the size and design capability to become true global players, the bulk of the Japanese supply-base remains largely apart from the newly forming global-scale supply-base, at least for the time being.

It is harder to make general statements about European automakers. However, in terms of the issues just mentioned, they appear to have more in common with Japanese automakers than with American automakers. European automakers, by virtue of being smaller, have traditionally kept greater centralized control over vehicle development than American automakers. Very few European automakers appear to be setting-up regional design centers (Fiat, with its design center in Brazil, may be an exception). This may result from the pursuit of "upscale" market strategies that count on the very "Europeaness" of vehicle designs to appeal to buyers. Like Japanese automakers, European suppliers have tended to be smaller and more "captive," than American suppliers (again, with a few exceptions such as Bosch, Valeo, T&N, and Siemens), but this organizational structure is more the outcome of automakers operating within deeply embedded national supply-bases than the existence of any Japanese-style industrial groupings. For example, Fiat tends to use Italian suppliers, Renault and Peugeot tend to use French suppliers, and Volkswagen and Daimler-Benz tend to use German suppliers. It is an open question if many of these small, nationally-based suppliers will be able to make the leap to global operations. The fact that Ford and GM have full-blown vehicle development centers in Europe has given them an advantage as they move to global sourcing. Volkswagen, which is a leader in the implementation of modular vehicle and assembly plant designs, has largely kept the design and sub-assembly of modules in-house, a fact that may be largely due to the difficulty the company has in reducing the size of its work-force in Germany.

The upshot of this discussion is that American suppliers, by virtue of their large size, design capabilities, and broad geographic reach, now have a wide lead in the race to establish integrated global operations. As the process of globalization moves forward, the core competence for suppliers will increasingly reside in their ability work with a wide range of customers on part, module, and system design in the various world centers of vehicle development, and then deploy component production—in coordination with their customer's logistics and scheduling requirements—to their worldwide network of plants while keeping quality and cost within acceptable limits. Such capabilities are exceedingly difficult to acquire, and very few suppliers can claim that they have true "global competency," but it is clear that American suppliers are leading the way. Figure 7.1 shows the location of the 2,211 supplier plants in the study's Supplier Plant Database. This database contains information on the manufacturing plants of the world's largest 150 suppliers. Although the database is far from comprehensive, and is missing many of the plants owned by the largest Japanese suppliers, it does suggest that American suppliers have a far greater global presence than those of other national origin.

Figure 7-1: Global Map of the Automotive Supply-base According to Firm Nationality

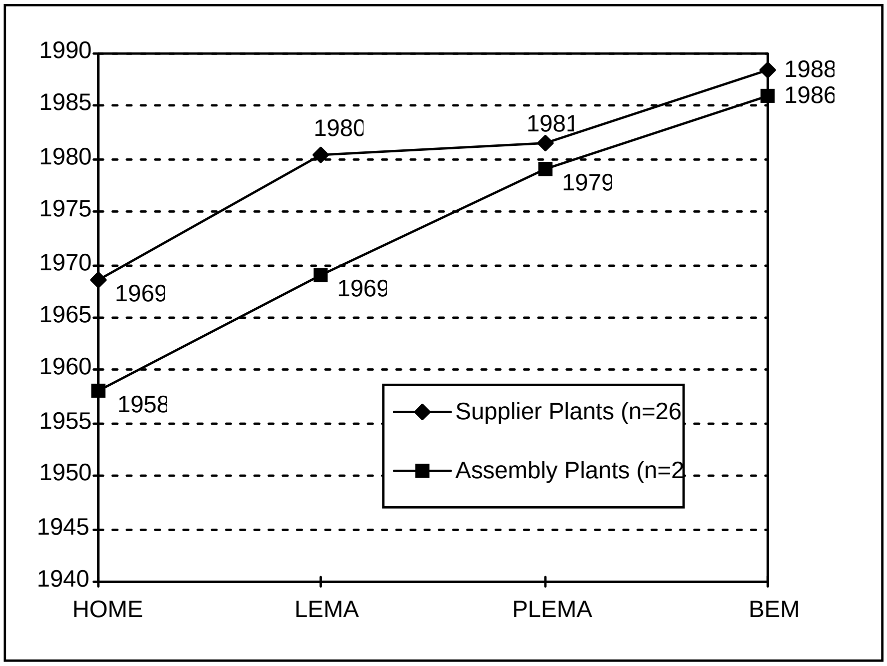
8. Globalization and Industry Structure

8.1 The Rise of the Global Supplier

The new face of globalization in the 1990s is best revealed by the rise of the global supplier. Companies such as Bosch, Denso, Johnson Controls, Lear Corporation, TRW, Magna, and Valeo have become the preferred suppliers for automakers around the world. Some automakers, particularly American firms, have combined a move to "modular" final assembly with increased outsourcing, giving increased responsibility to first-tier suppliers for module design and second tier sourcing. Many first tier-suppliers have responded by embarking on a wave of vertical integration (through mergers, acquisitions, and joint-ventures) and geographic expansion to gain the ability to provide their customers with modules on a global basis. Thus we are seeing simultaneous trends toward deverticalization (by automakers) and vertical integration (among first tier suppliers) that—in combination with globalization—is helping to create a new global-scale supply-base capable of supporting the activities of final assemblers on a worldwide basis.

More than any other characteristic, it is the simultaneous geographic spread of the supply-base—alongside newly established assembly plants—that differentiates the current wave of geographic expansion from those that the automotive industry has seen in the past. This change in character of the globalization process is captured by Figure 8-1, which shows the average assembly and supplier plant inception dates from the study's plant databases according to the locational typology presented in Section 3.3. In places where assembly plants are older on average (HOME and LEMA type locations), the inception dates of supplier plants, on average, lag behind assembly plants by eleven years. In places were assembly plants are newer (PLEMA and BEM type locations), the inception dates of supplier plants, on average, lag behind by only two years.

Figure 8-1: Average Assembly and Supplier Plant Inception Dates by Locational Type



Source: Globalization and Jobs Supplier Plant Database, October, 1998.

8.1.1 The Geography of the Automotive Supply-base

As first-tier suppliers take on a new, larger role in the industry, they are moving to module design, second tier component sourcing, and the provision of local content in the context of emerging markets. For suppliers that serve multiple automakers, the geographic scale of operations can surpass that of any single customer. Indeed, in the long run it may well be suppliers, not automakers, that generate the vast majority of the industry's future foreign direct investment (FDI)—and associated economic and social benefits (e.g. employment).

Table 8-1 shows the average supplier plant characteristics in the study’s Supplier Plant Database according to the locational typology presented in Section 3.3. The data point to the huge global presence that already exists within the automotive supply base; 70% of the plants in the database are located outside of the firm’s home base (in contrast to 62% for assembly plants). On the other hand, HOME type plants do tend have more employees than plants of other locational types, suggesting that the bulk of the jobs in the supply-base are still concentrated at home.

Table 8-1: Average Supplier Plant Characteristics by Locational Type

	HOME	LEMA	PLEMA	BEM	World
# of Plants (n=2,211)	674	652	385	470	2,211
% of Plants	30%	29%	17%	21%	100%
Average Employment (n=377)	1,102	577	468	785	790
Average Inception Date (n=269)	1969	1980	1981	1988	1978

Source: Globalization and Jobs Supplier Plant Database, October, 1998.

The supplier plants show some interesting variations according to product produced (see Table 8-2). Plants manufacturing products that require labor-intensive sub-assembly, such as wiring harnesses, tend to be concentrated in BEM and PLEMA type locations, where labor costs are low. On the other hand, plants using capital-intensive processes, such as coatings (e.g. paint), tend to be concentrated in HOME and LEMA locations. Processes closely associated with final assembly, such as chassis assembly and body panel stamping, follow a locational pattern similar to final assembly, although the prevalence of CKD final assembly drives the share of stamping facilities in BEM locations down. Plants producing electronics products, perhaps surprisingly, are fairly evenly distributed across locational types. This may be a function of the rapid automation of circuit-board assembly during the past ten years, which had reduced the importance of labor costs (Sturgeon, 1998).

Table 8-2: Number and Share of Automotive Plants by Locational Type, Selected Products

	Wiring Harnesses	Coatings	Electronics	Chassis	Stampings	Final assembly
HOME	4	18	56	31	25	199
LEMA	20	12	58	27	12	58
PLEMA	27	11	48	29	13	60
BEM	26	3	64	41	8	212
Total	77	44	226	128	58	529
HOME	5%	41%	25%	24%	43%	38%
LEMA	26%	27%	26%	21%	21%	11%
PLEMA	35%	25%	21%	23%	22%	11%
BEM	34%	7%	28%	32%	14%	40%
Total	100%	100%	100%	100%	100%	100%

Source: Globalization and Jobs Supplier and Assembly Plant Databases, October, 1998.

8.1.2 The Drivers of Increased Outsourcing

The drivers of increased outsourcing include 1) the rising technological complexity of vehicle development, 2) rising logistics complexity as more production locations come on-stream, 3) a desire to "streamline" the final assembly process, 4) a desire to pay for parts only as they are incorporated into vehicles rather than when they are shipped from suppliers, 5) increasing competence in the supply-base, and 6) a desire to lower costs by moving production to non-union suppliers.

Increasingly, suppliers are being selected and involved before components are designed. If no supplier exists for a new technology (e.g. smart airbags), automakers sometimes try to make a best guess on which supplier that will have the technology first. Because suppliers help with prototype development they are better at design-for-manufacturability (DFM) and implementing engineering change orders (ECOs). Thus, situations where a new supplier needs to be brought on-board after volume production has begun are becoming increasingly rare. Redesign for new markets is also easier with highly involved suppliers, strengthening the arguments for global partnerships.

The key to heavy supplier involvement is the promise of future business. Since suppliers are tied to particular vehicle platforms and models, often as a sole source, they share in the risks and rewards of those platforms and models.

Early involvement in design, the high level of integration (e.g. into modules and systems) of the parts supplied, and global integration mean that suppliers act as the sole source for specific models and platforms. Thus, business is won and lost by suppliers in large chunks and for long periods of time. Since automakers want to work with their key suppliers in each market, suppliers often form JVs in BEM locations where local content is required. Early involvement, close collaboration, and sole sourcing reduces development costs because automakers do not have to re-qualify new suppliers for each market. It also spreads the risk of new investments, both in terms of ongoing production and product launch.

Supplier logistics need to be synchronized with those of the assembly plants they serve. Even when great distances are involved, larger, more sophisticated suppliers often are in a better position to do this. To the extent that automaker design, purchasing, capacity planning, and logistics coordination activities are becoming more centralized, the need to work with “global” suppliers will become more acute.

The vertical integration of first-tier suppliers means that many automakers are fewer suppliers than they had in the past. The fact that multiple assembly plants can now depend on single parts plants (either captive or external) has increased the vulnerability of assembly operations to work stoppages— especially when the reduced inventories of JIT deliveries are taken into account. When key supply plants go off-line, the whole system can go down (witness the effect of GM's brake plant strike in 1996 and stamping plant strike in 1998).

In general, American and European automakers do not want their suppliers to be captive because volume spreading among many customers improves supplier scale economies and makes them a more stable partner. Some American automakers are overly not worried about technology or design leakage to competitors through shared suppliers because their chief concern is getting to market first; once the product is on the market, it can be reverse engineered in any case. Also, suppliers often have separate plants or at least production areas for each customer. However, several automakers expressed a real concern with losing competency to the supply-base in general.

In-line sequencing has also accelerated the adoption of “just-in time” parts delivery, where modules are delivered in a sequence according to the sequence of cars moving down the assembly line. The key motivation for in-line-sequencing is color matching. Mirrors, interior panels, seats, dashboards, carpets, door handles, and bumpers all have to match or accent the body color.

Different automakers have different approaches to their supply-base. GM and Ford, long among the most vertically integrated automakers, have been aggressively outsourcing to cut costs and reduce overhead, both by increasing their use of outside suppliers and moving to spin off their internal parts subsidiaries as independent "merchant" firms (Delphi by GM and Visteon by Ford).
According to our interviews at both the automaker and supplier levels, sourcing is still fairly traditional at GM and Ford, which have globally centralized purchasing. Suppliers still have little influence over design. There is some experimentation with pre-selection of suppliers and involvement prior to project approval where suppliers are asked to bid on the parts they would like to make, but the drive toward low-cost sourcing is still extremely strong. As a result, there is a great deal of tension between purchasing, which seeks low cost, and manufacturing, which is trying for modularity, local content, and co-location.

Chrysler, on the other hand, buys as much as 70% of the value of its vehicles from outside suppliers, a stance it in part inherited though its acquisition of AMC and gained through the closure of a host of internal parts plants during the crisis years of the early 1980s. Japanese automakers are well known for their use of multi-tiered supplier networks and high outsourcing levels, but, as already discussed, the nature of Japanese supplier networks differ from those that have been developed by American and European firms in that they are more "captive." In general, Japanese suppliers tend to be more dominated by their largest customer. Even Japan's largest supplier, Denso, which is a Toyota Group company, generated half of its 1997 revenues from Toyota, and virtually none of its revenues from Toyota's arch rival, Nissan.

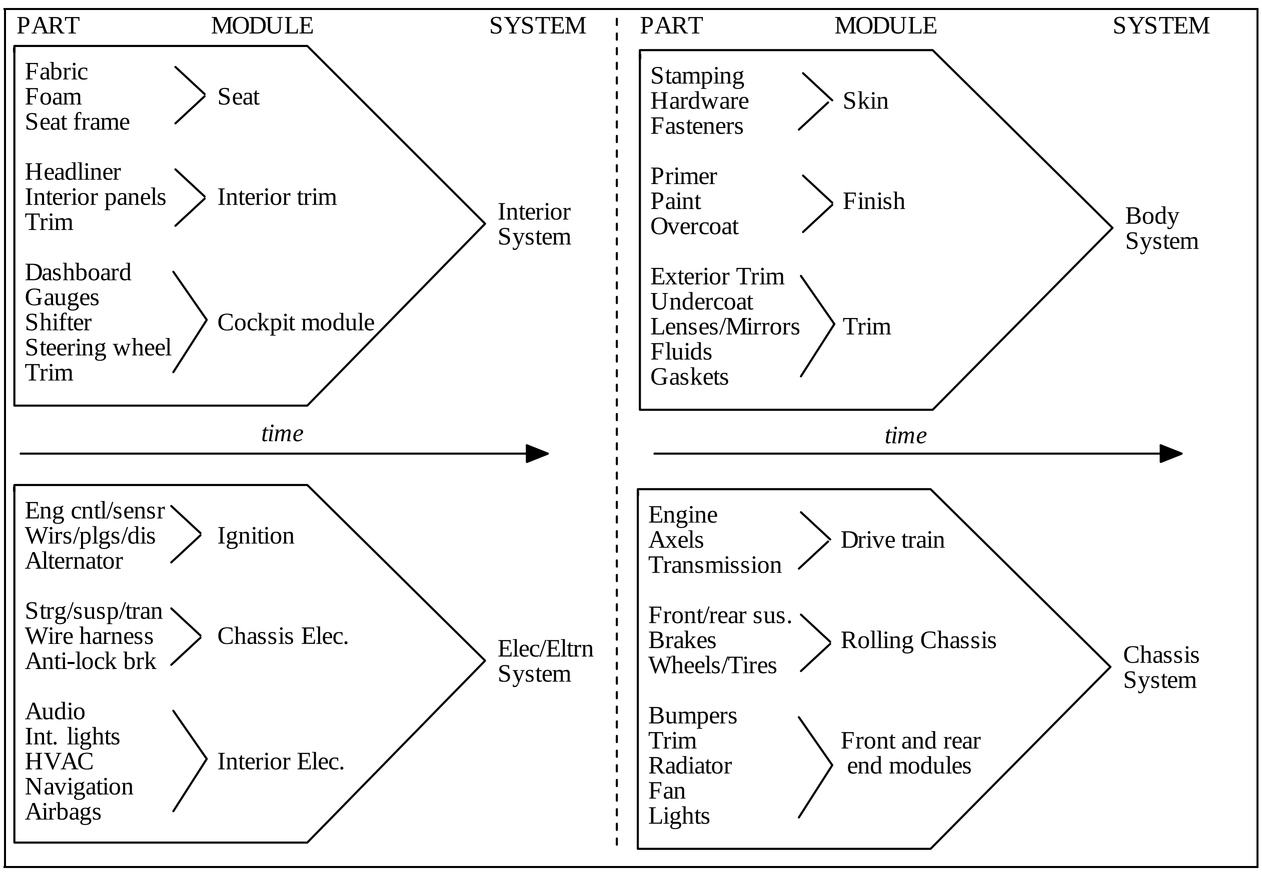
8.1.3 The Move to Component Modules and Systems

In the past automakers practiced low-level parts assembly within final assembly plants, purchased parts based on price, and paid minimal attention to quality. Rising wage rates for assembly workers have driven American and European automakers to ask both outside suppliers and in-house parts facilities to do more design and sub-assembly work. This trend often referred to in the automotive industry as "modularization," has already been discussed in the context of assembly plant design. For example, vehicle doors can be delivered with the glass, fabric, interior panels, handles, and mirrors pre-assembled. Dashboards can be delivered complete with polymers, wood, displays, lights, and switches. The aim of modularization is to take labor out of the final assembly process (design for manufacturability can serve the same purpose).

Fifteen modules represent about 75% of vehicle value. Important modules are suspension (supplied as "corners"); doors, and headliners (which can come with grip handles, lighting, wiring, sunroof, sun visors, and trim pre-assembled); heating, ventilation, and air conditioning (HVAC) units; seats; dashboards; and drive trains (i.e. engines, transmissions, and axles). The logical extension of the trend toward modules would be for suppliers to provide groups of related modules, in what could be called "module systems." For example, seats, interior trim, and cockpit modules could be supplied as a complete "interior system." Figure 8-2 provides a graphic representation of the apparent trend from discrete parts to modules and systems.

It is important to note that some modules comprise continuous sub-assemblies, while others do not. For example, seats and HVAC units comprise continuous sub-assemblies, while vehicle electronics can consist of a variety of discrete components that work together to make up a functional unit. Contiguous sub-assemblies provide the key benefit of assembly-line simplification, while non- contiguous modules do not. Sourcing non-contiguous modules from a single supplier provides opportunity for automakers to pass the responsibility for module-level system integration to suppliers. For example, an electronics supplier such as Bosch can make sure that the engine controls work properly with temperature, pressure, r.p.m., and other sensors that provide information to the control unit. In other instances, sourcing non-contiguous modules is a way for automakers to pass warranty responsibility for an entire aspects of vehicle quality, such as engine and transmission sealing, on to suppliers. Some automakers refer to contiguous sub-assemblies as "modules" and functionally related non-contiguous parts as "systems"

Figure 8-2: From Part to Module to Systems



The drive toward modularity often goes hand-in-hand with increased outsourcing and supply-base consolidation. Since automakers are asking their suppliers to provide modules and systems, there has been consolidation in the supply chain as first tier suppliers buy second tier suppliers to gain systems capability (e.g. TRW's recent acquisitions, for example, have given the company the capability to deliver all aspects of occupant restraint systems).

8.1.4 Building a Global-scale Supply-chain

For automakers that are aggressively adopting modular assembly processes, new plants are going further with co-location with suppliers than existing plants because larger modules are more difficult and expensive to ship long distance and are more likely to be sequenced. Global suppliers are sometimes involved with negotiations with host country government and can benefit from the incentive packages that they provide.

There is a tension between "global sourcing" and "local sourcing." The charter of many automaker's global purchasing organizations is to scan the world for low-cost, high quality parts. This means that the scope of the supply-base is growing beyond national boundaries, and when combined with increased outsourcing, it explains why many automakers have becoming increasingly dependent of both domestic and foreign suppliers. However, there are two forces that inhibit unfettered global sourcing. First, there is the need for module suppliers to become involved early in the design process. This limits module sourcing to those suppliers with design facilities close to the vehicle design centers of the automakers, and explains why many world-class suppliers have set up design operations within the traditional centers of vehicle design. Second, local content rules can effectively block the shipment of parts from a low-cost sources to an automaker's worldwide network of assembly plants. Locally procured parts usually cost more than those obtained through global purchasing organizations, and local content rules obviate the implementation true low-cost global sourcing strategies. In practice, parts that can be sourced globally tend to be highly standardized, easily transportable, and be subject to low tariffs (e.g. electronics, brakes). Parts that tend to be sourced locally tend to be highly specific to a particular vehicle models and color sequences (e.g. interior panels), difficult to ship (e.g. seats), and/or subject to high tariffs (e.g. body panels). Suppliers with truly global operations (i.e. design centers near automaker design centers and manufacturing plants near automaker assembly plants) can create a bridge between global and local sourcing.

First tier suppliers often qualify local suppliers by sending sample parts to their customer's design centers to make sure design specifications and quality standards are met. The supplier's nearby design center can often play an intermediary role in this process.

For automakers that rely heavily on suppliers, the capability to set up integrated assembly operations in new location simply does not exist in-house, so they cannot hope to meet local content requirements without the local participation of their key suppliers.

The is a great tension between the need for supplier co-location with assembly plants, which allows for JIT delivery, and the consolidation of supplier production in large plants that serve multiple customers, which creates economies of scale that drive costs down. There are two factors that come into play: the type of part and the quality and cost of long distance supply-line infrastructure. Of course, if suppliers cannot justify the cost establishing a co-located facility, then automakers must find other means. For example, auto makers sometimes ask suppliers license their designs to indigenous suppliers (this provides an opportunity for indigenous suppliers to upgrade to world-class standards and join global-scale production networks). Since modules are bulky and harder to ship, automakers are pushing their suppliers to co-locate with its assembly plants in offshore locations. In some cases, suppliers are locating in industrial parks close to assembly facilities, where modules are built-up from parts sourced from their the local supply-base and their worldwide network of plants and suppliers. On the other hand, where the quality of supply-lines are good, such as in Europe, tightly coordinated JIT deliveries can come from a great distance. For example, while GM's did not try to resettle suppliers around its new plant in Eisenach, (former East) Germany because of resistance from their suppliers' works-councils, the company found that suppliers do not necessarily need to be clustered around the plant if high quality supply lines are reliable. Eisenach has "no" inventory and regularly receives JIT deliveries of bumpers, facias, and seats—items that need to be delivered in sequence because of color matching—from suppliers located as far as 1,000 kilometers (621 miles) away.

Automakers can not afford to have their suppliers follow them to a new location and then fail, so when establishing an industrial park, they try to create "site equity" by attracting several suppliers to its new plant locations. Some Tier 1 suppliers use the same materials and Tier 2 suppliers, and external scale economies can build up in an industrial park, especially when other automakers are located nearby. As automakers expand globally, pressure is out on suppliers to keep the value of their brand name. When new plants are established too quickly, they sometimes do not perform well at first.

8.2 Why Mega-Mergers Won't Save the Automotive Industry

"Mega-mergers" at the automaker level have become a fact of life in the automotive industry. Most recently, France's Renault has taken a stake in Nissan, Japan's financially stressed number two automaker. Ford already controls Jaguar, Volvo, and Mazda; General Motors controls SAAB and Isuzu; and BMW controls Rover (see Table 8-3 for a summary of mergers and final-product-level alliances among automakers). In the wake of the DaimlerChrysler merger announced in 1998, it is clear that the automotive industry has entered a period of massive consolidation.

Figure 8-3: Automaker Mergers and Final-Product Alliances

Buyer	Seller	Year	Controlling Interest?
Toyota	Hino	1966	yes
Toyota	Dihatsu	1967	yes
GM	Isuzu	1971	yes
Peugeot	Citroen	1974	yes
Ford	Mazda	1979	yes
GM	Suzuki	1981	no
Fiat	Alfa Romeo	1986	yes
Chrysler	AMC	1987	yes
Ford	Kia	1988	no
Ford	Jaguar	1989	yes
GM	SAAB	1989	yes
Volkswagen	Skoda	1991	yes

BMW	Rover	1994	yes
Daimler Benz	Chrysler	1998	yes
Hyundai	Kia	1998	yes
Ford	Volvo	1999	yes
Renault	Nissan	1999	?

Driving the wave of mergers is the belief among automakers that only full-line, global car-makers will survive the transition to the new global economy. Small producers such as Volvo have not been able to remain independent because they were not able to recoup the skyrocketing costs of product development or reuse common under-body platforms across a wide range of models. For large companies, the acquisition of specialty producers are a way to quickly flesh out their product lines. So, Jaguar furnishes Ford with a luxury marquee suitable for Europe, Chrysler provides Daimler with a full line of mid-priced cars without diluting the revered Mercedes brand name, and so on. Since gaining global-scale manufacturing operations is now seen as a key requirement, the DaimlerChrysler marriage means that Chrysler now has access to Daimler's assembly capacity in Europe, Asia, and South America, and Daimler has access to Chrysler's huge production base in North America (see Table 8-3).[9] Likewise, Mazda and Isuzu have provided Ford and GM with a much larger and badly needed presence in Asia.

Besides creating a global-scale network of assembly plants, acquisitions can give automakers access to an enlarged supply-base. Ford's partnership with Mazda, for example, has the company access to Mazda's well developed supply base in Thailand. Given the difficulty of establishing local supply, and the great pressure automakers are under to develop local content, such relationships can be a great asset.

Table 8-3: Daimler-Benz (autos) and Chrysler Assembly Operations, 1996 Unit Capacity

	INTEGRATED	PRODUCTION	CKD	ASSEMBLY
	Daimler-Benz	Chrysler	Daimler-Benz	Chrysler
	Germany (5)	USA (11)	Thailand (2)	Thailand
	USA	Mexico (3)	India	India
		Canada (3)	Argentina	Argentina
			Malaysia	Egypt
			Vietnam	Brazil
			Mexico	Venezuela
			Spain	Austria
Total Capacity				
4,139,932	830,000	3,028,790	131,342	149,800
Share				
	20%	73%	3%	4%

Source: Globalization and Jobs Assembly Plant database, October, 1998.

Still, such combinations do little to mitigate the fundamental problem with overcapacity, which is creating much of the weakness that is allowing the mergers to proceed (see Section 6.4). For consolidation to solve the overcapacity problem, it would have to somehow enable car-makers

[9] Daimler-Benz, although a smaller vehicle company than Chrysler, is the largest industrial firm in Germany by virtue of its diversified businesses in rail transport systems, electronics, aerospace, and military hardware and systems.

to eliminate redundant manufacturing capacity, a process that has proved—quite thankfully from the perspective of the autoworker—to be extremely difficult, slow, painful, and costly in Japan, Germany, and the United States alike.

The complementary car lines gained through mergers may create more full-line players, but they do little to alleviate excess capacity. Opportunities to reduce capacity are created when vehicle lines are redundant, not complementary. Complementary production geographies may create global competitors in one fell swoop, but again, this does little to fix the problem. If the goal is to gain a production foothold in all the world's existing and emerging markets, capacity reductions that decrease geographic reach defeat the purpose of the merger.

The mergers we are seeing in today's automotive industry are between vastly dissimilar companies in terms of product mix and geography, which is why the marriages have been referred to by analysts as a "good fit." But, it is precisely when companies are similar, are a "poor fit," that mergers lead to the elimination of excess capacity and restored profitability.

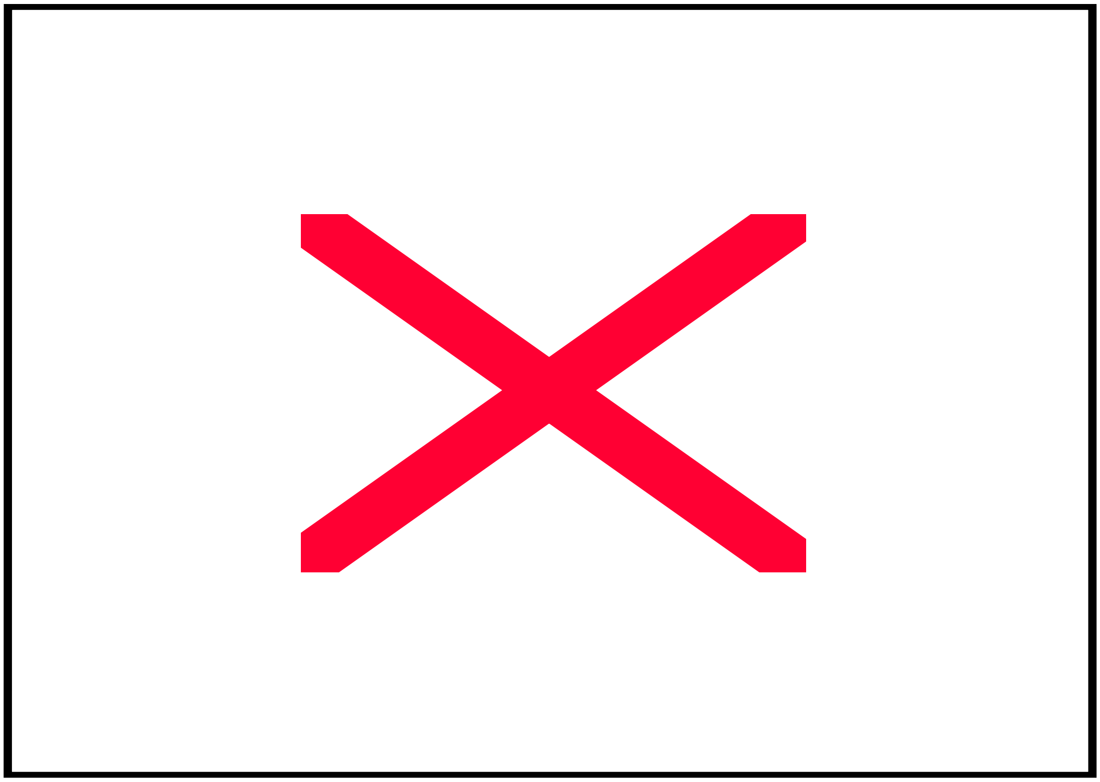
The ominous conclusion is that consolidation only helps to alleviate excess capacity if it results in massive rationalization, in effect eliminating redundant plants—and jobs. But in fact, mega-mergers that involve companies of different national origins make the process of rationalization even more intractable than it already is. Daimler had to explicitly state that its merger with Chrysler would not lead to downsizing or plant closings. In the context of the Renault/Nissan alliance it is likely to be exceedingly difficult—in political terms—for a French company to take the lead on a radical program of rationalization in Japan.

So, while overcapacity invites consolidation, consolidation without rationalization will do little to solve the industry's underlying problem with overcapacity.

What will mega-mergers mean for consumers? Figure 8-4 shows world automotive market concentration according to the Herfindahl Index. The index would be zero if market share was evenly distributed among automakers. The index would be one if a single company had 100% of world market share (global monopoly industry structure). Because market share was increasingly evenly distributed among industry players between 1984 and 1992, market concentration decreased during the period. Strong performance by smaller firms such as Fiat, Honda, and Suzuki—along with the emergence of new entrants such as Hyundai—cut into the dominant positions of market leaders such as GM and Ford, even as these companies acquired small producers such as SAAB and Jaguar.

The late 1990s has seen a dramatic jump in market concentration, as mergers and final-product alliances have formed between larger players, such as Daimler and Chrysler and Renault and Nissan. The result is an alarming level of industry concentration from the perspective of market control and consumer choice. Although a figure of 0.1 on the Herfindahl Index does reveal relatively balanced market share in the industry, the number of independent firms worldwide has dropped from 25 in 1982 to a mere 15 in 1999. It must be kept in mind that these are *global* figures; the index numbers tend to be higher within national markets because large domestic players typically hold high market shares (see Figure 6-3).

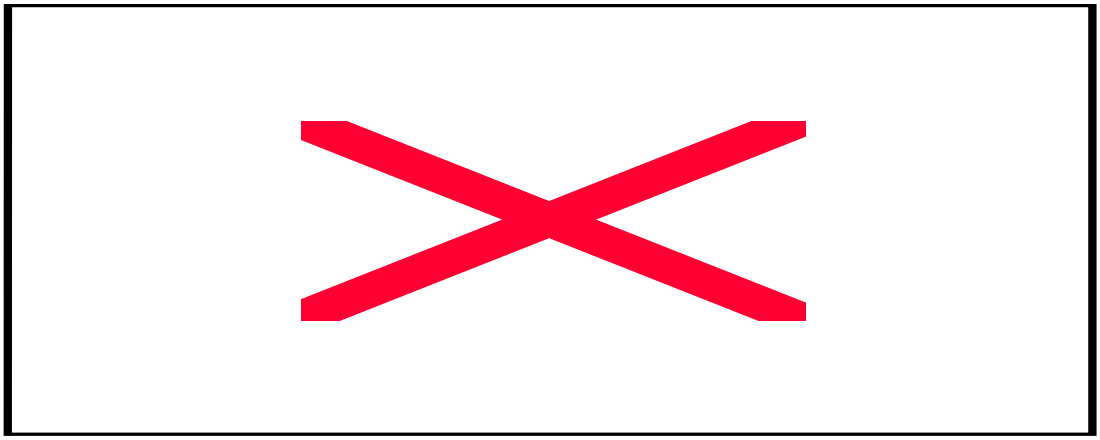
Figure 8-4: Worldwide Passenger Vehicle Market Concentration According the Herfindahl Index (1=monopoly), 1982-2000



* Assumes that sales and market share remain at 1995 values.
** Assumes that Fiat gains controlling interest in Mitsubishi and that sales and market share remain at 1995 values.
Source: calculated from Wards Decade of Data.

Figure 8-4 shows world automotive market concentration according to the Herfindahl Index through 2010 assuming that the recent spate of mergers and alliances continues unabated, resulting in only seven independent automakers and a global Herfindahl Index value of .15. If such an extreme level of industry concentration comes to pass, the negative effects on consumer choice and value could well be severe. Moreover, there is currently no single international standard to measure market dominance or its abuse. Even if such a global standard did exist, there is currently no mechanism to enforce the breakup of trans-border monopolies and oligopolies (Janow, 1996).

Figure 8-5: Worldwide Passenger Vehicle Market Concentration According the Herfindahl Index (1=monopoly), 1982-2010 (estimate)



* Assumes that sales and market share remain at 1995 values.
** Assumes that Fiat gains controlling interest in Mitsubishi and that sales and market share remain at 1995 values.
*** Assumes that Volkswagen controls BMW and Lada; Fiat, Renault, and Puegeot merge; DaimlerChrysler controls Honda; Hundai and Daewoo merge; GM acquires Suzuki, and that sales and market share remain at 1995 values.
Source: calculated from Wards Decade of Data.

9. The Employment Effects of Globalization

For an increasing number of commentators on the left and right—from Dick Gephardt, Jeremy Rifkin (1995), and Bill Greider (1997); to Pat Buchanan (1998) and Ross Perot—technological change and far-flung globalization are combining to eliminate high-paying manufacturing jobs from American soil, with dire consequences for the national prospect. On the other side of the debate come the globalization optimists—again spanning the left-right political spectrum from Robert Riech (1992) to Paul Krugman (1995) to George Gilder (1992)—arguing that a new era of free trade and electronic commerce will liberate Americans from the drudgery of the world's dirty, dangerous, and mind-numbing manufacturing work, while increasing opportunities in high-paying research, design, and management occupations. The key is not to limit foreign investment and trade to save manufacturing jobs, say the optimists, but to invest in technology, education, and re-training to create a new army of "symbolic analysts" with the tools needed to seize the helm of the new global economy. For both sides of this debate, it is assumed that globalization will lead to a continuing decline in manufacturing employment in developed economies. The debate has centered on what this globalization-induced job shift will mean for working America. A similar debate is unfolding in Japan, were the “hollowing out” of the manufacturing base is said to be occurring as production shifts to offshore locations (see Katz, 1998, for a discussion).

While this debate is worthwhile, it is clear that it cannot advance very far without a sober analysis of the key underlying assumptions. Has globalization really contributed to a decline in manufacturing employment in developed economies? If so, to what degree? How has globalization affected the quality of jobs both at home and abroad? Given current trends, what is the future likely to hold? The import of these questions—and a glaring lack of solid research—is what helped to motivate us to undertake this study of globalization and jobs in the automotive industry.

It should be borne in mind throughout the subsequent discussion that the effect of globalization on employment is extremely difficult—if not impossible—to quantify precisely. In particular, the impact of globalization on jobs is difficult to tease apart from the effects of technological change, organizational change, and secular demographic shifts toward younger workers with more education (Lynch, 1998). Accordingly, we have not undertaken a systematic econometric analysis of the question, but have chosen instead to looked closely at the aggregate statistics and trends and undertake detailed analysis of what is happening to the quantity and quality of employment in a small but carefully selected sample of automotive assembly plants throughout the world (the results of this fieldwork are presented in Section 10). On the question of jobs, our study has found that in the automotive industry—perhaps not surprisingly—the process of globalization, when examined broadly, is likely to both create and destroy jobs, both raise and lower job quality. What we have tried to do is trace the probable effects, shedding some light on when, where, and under what conditions each of these various outcomes can be expected.

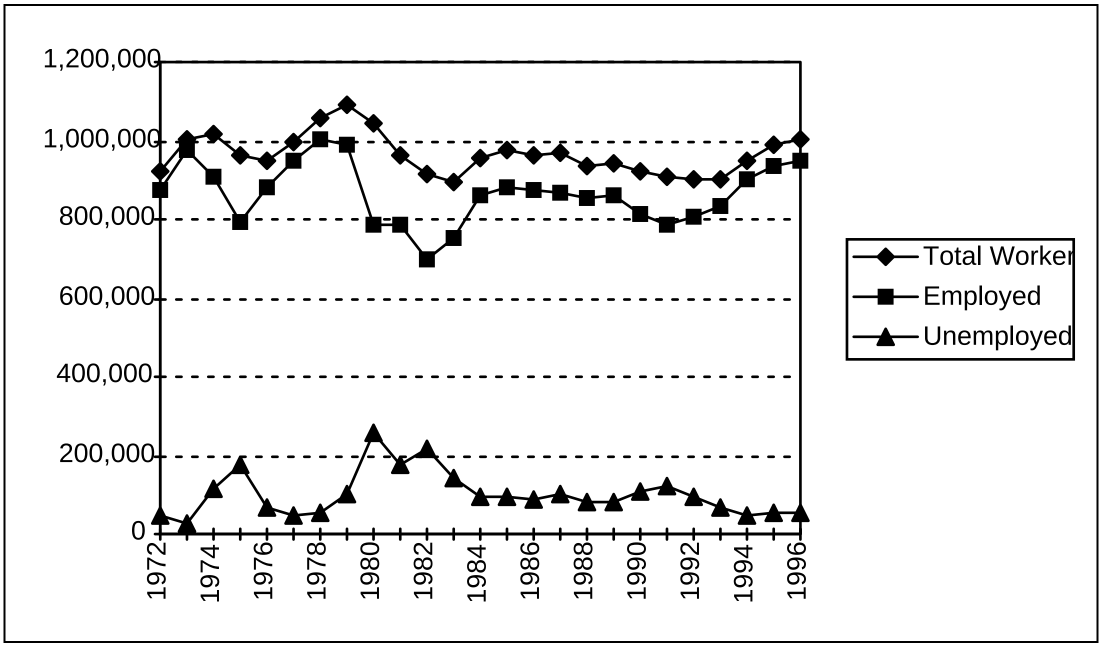
9.1 Trends in United States Automotive Sector Employment and Wages

Our most basic finding is that the aggregate effects of globalization—due to counterbalancing trends—have been rather small, at least so far. In fact, for the United States, automotive sector employment, after dropping from its pre-crisis peak of one million in 1977, actually grew between 1987 and 1996 from 867,000 to 946,000 jobs, an increase of 9 percent. This growth occurred even in the face of a loss (largely through attrition) of 59,000 jobs at Big Three body and final assembly facilities in the United States.[10] Over this period, globalization both contributed to these job losses, as the Big Three increased exports from assembly plants in Mexico and Canada, and mitigated them to some degree, as the Japanese-owned assembly plants added some 30,000 new jobs to the United States automotive sector.

Figure 9-1 presents the overall automotive sector employment and unemployment picture for the United States from 1972 to 1996. The figure shows that overall employment, with the exception the height of the industry crisis from 1980 through 1983, has remained largely within the 800,000-1,000,000 range. Even more striking is the lack of volatility during the post-crisis period. Clearly, automakers in the United States have not been laying off and re-hiring workers in the numbers that they were in the 1970s and early 1980s (unemployed auto workers numbered 257,000 in 1980). Whether this is due to smaller and fewer recessions, no-layoff clauses negotiated by the United Auto Workers, hiring limits that have kept existing workers on overtime schedules during market upturns, employment moving into the supply base where output is spread among a larger number of automotive and non-automotive customers and therefore less prone to demand volatility, the arrival of Japanese transplants with a tendency to keep workers on the payroll during downturns—or a combination of these factors—it is clear that employment stability has increased dramatically in the sector since the early 1980s.

Figure 9-1: Total United States Motor Vehicle Sector Employment, 1972-1996 (‘000 jobs)

[10] Job losses at Ford and GM parts plants in the United States have been much larger; GM alone eliminated 125,000 jobs between 1990 and 1997, almost entirely through attrition (Bradsher, 1998c).



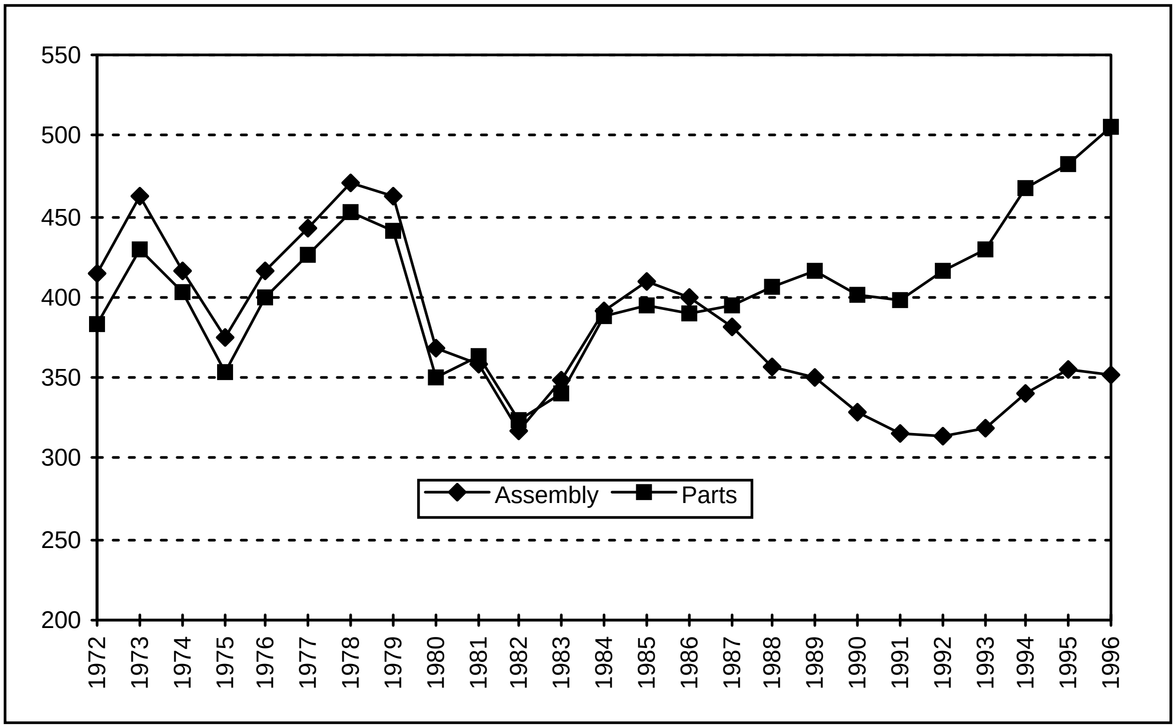
Note: Includes SIC 3711 (Motor Vehicles and Car Bodies) and SIC 3714 (Motor Vehicle Parts and Accessories). Does not include SIC 3713 (Truck and Bus Bodies), 3715 (Truck Trailers), and 3716 (Motor Homes).
Source: American Automobile Manufacturers Association

Another striking feature is the strong employment growth during the mid-1990s, which has driven automotive sector unemployment levels down to their lowest levels since 1977. Despite severe volatility during the 1970s and 1980s, the total employed and unemployed work-force declined by only 26,000 workers between 1972 and 1983—the height of the crisis—and had rebounded by 56,000 by 1985. But after 1985, the industry's labor force began a slow and steady contraction, shrinking by 79,000 workers by 1993. It is this long, slow decline that has fit so well with the overall story of America's seemingly inexorable loss of manufacturing employment. In a striking reversal, however, the automotive industry added 103,000 workers between 1993 and 1996, calling the "inevitably" of such sectoral shifts into question.

Of course, as already discussed, the nature of the manufacturing jobs in the automotive industry have changed substantially, especially since 1986, when the industry's long-time rough employment parity between the assembly and parts sectors began to diverge. Figure 9-2 clearly shows this dramatic divergence and reveals that it is the supply sector that has been the real source of job growth in the United States automotive industry since the late 1980s, even as GM and Ford have eliminated thousands of jobs from in-house parts facilities in the Unites States (in many cases in-house parts facilities were sold or spun-off as independent companies, so jobs were not, in effect, eliminated). Automotive parts suppliers generated 110,000 jobs during the 1987-1996 period, with nearly all of that growth coming since 1992. This is more than three times the number of jobs added by the Japanese transplants during this same period, and nearly double the jobs lost at Big Three assembly plants. Between 1987 and 1996, the supplier share of automotive sector employment increased from 51% to 59%, while the Big Three's share dropped from 48% to 35%. To be sure, the business created by the Japanese transplants is responsible for some expansion in the supply-base and certainly there has been a wave of hundreds of transplant suppliers, but the increasing importance of suppliers in general—especially first tier suppliers—is largely responsible for the sector's recent employment growth.

There may be a sectoral shift going on the United States economy, but the story may be more complicated than a simple transition from a manufacturing to services. As the lead firms in industries such as motor vehicles, electronics, and apparel "deverticalize," we may be seeing a parallel transition of manufacturing employment into the supply-base.

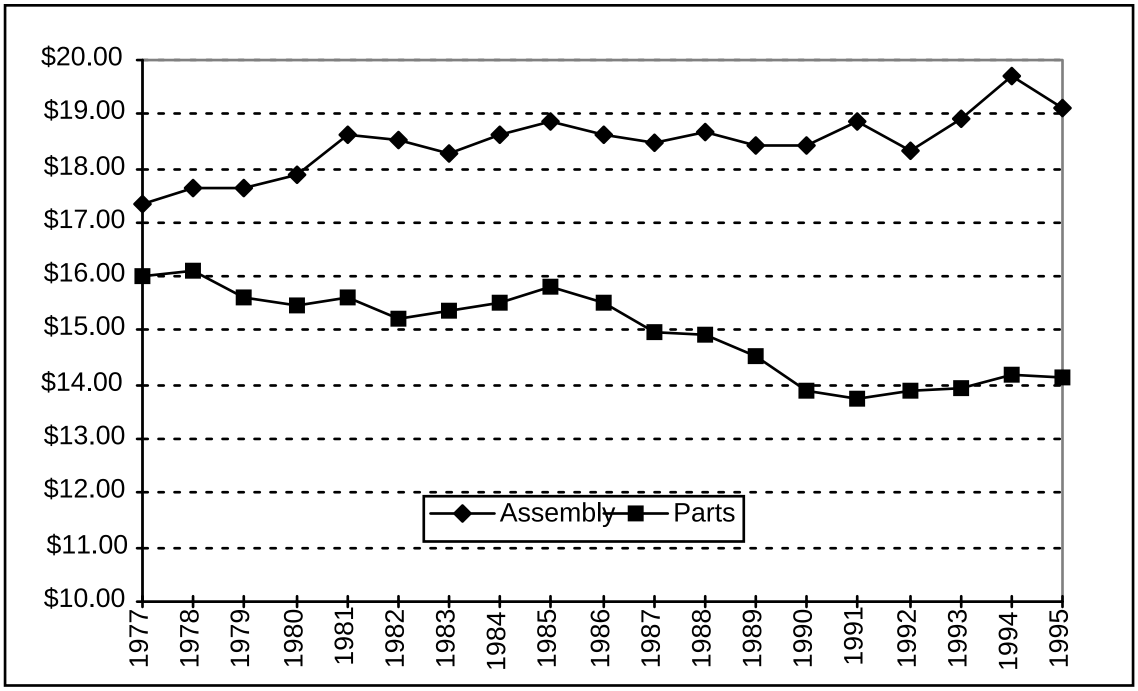
Figure 9-2: U.S. Motor Vehicle Assembly and Parts Manufacturing Employment, 1972-1996 ('000 jobs)



Note: Includes SIC 3711 (Motor Vehicles and Car Bodies) and SIC 3714 (Motor Vehicle Parts and Accessories)
Source: American Automobile Manufacturers Association

The shift of manufacturing—and of employment—to the supply-base is hardly a panacea for autoworkers. Jobs at non-captive supplier plants in the U.S. are more likely to be non-union and pay on average about 40% less than final assembly jobs. Jobs at captive parts facilities pay on average about 30% less. And, as Figure 9-3 clearly shows, the assembly-supply wage gap has been steadily widening since the late 1970s. As suppliers become more important—and set up global operations—job quality in the automotive sector could continue to erode.

Figure 9-3: Average Hourly Earnings of U.S. Production Workers in Automotive Assembly and Parts, 1977-1995 ($1992)



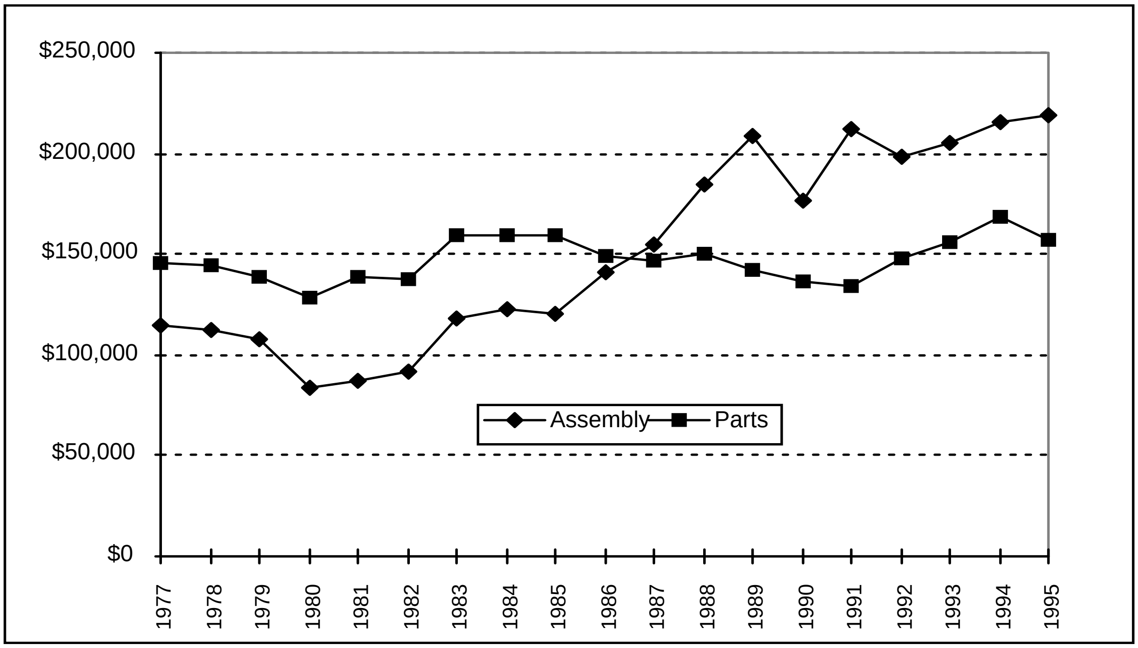
Source: U.S. Department of Commerce, 1992 and 1996, from Lynch, 1998.

Furthermore, as Figure 9-4 shows, the productivity gains achieved by automakers producing in the United States during the past decade have not yet, by and large, been attained by suppliers, suggesting that many of the costs associated with lean production (e.g. holding parts and material inventories) have simply been passed up the supply-chain (Helper, 1991). As outsourcing and modularization proceed apace, automakers are putting new pressures on suppliers to meet global price, quality, and delivery standards. In the future, these pressures could lead to job shedding in the United States among suppliers that improve productivity in domestic plants, an accelerated re-location of production to lower cost locations within the NAFTA trade bloc, or both.

On the other hand, another element of job quality—employment stability—could be positively impacted by the enhanced role that suppliers now play in both the automotive industry. The build-up of internal expertise at supplier firms often progresses hand-in-hand with an expanded customer base. When suppliers take such a "merchant" stance within their industries, their fortunes are less "captive" to those of any single customer. This leads to a smoother demand profile, stable employment requirements, and—critically in highly automated production environments—consistently high utilization rates for capital equipment. In some instances, diversification can be achieved by serving customers active in several different markets (Sturgeon, 1998).

Moreover, if depending on large, highly capable global suppliers turns out to be a winning strategy in the long run, the head-start that American suppliers have in this regard may force automakers from Europe and Japan to increasingly buy from them, a turn of events that could lead the American automotive industry back to world leadership, even if the two remaining American-owned automakers lag behind.

Figure 9-4: Productivity in Assembly and Parts, 1977-1995 (1992 $ value added/employee)



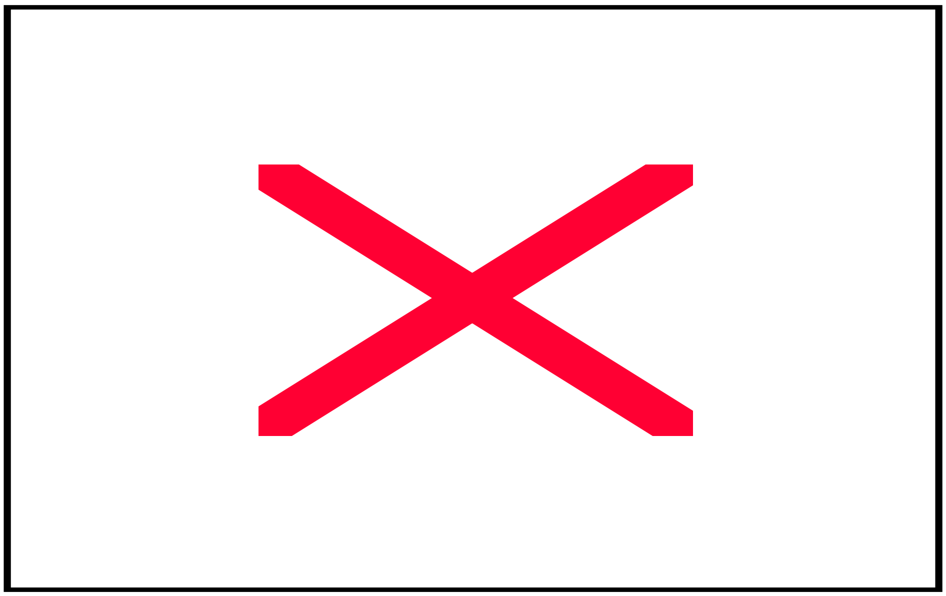
Source: U.S. Department of Commerce, 1992 and 1996, from Lynch, 1998.

9.2 Regional Integration and Low-cost Production Strategies

When the flood of Japanese imports radically intensified competition in the United States and Europe beginning in the late 1970s, American and European automakers began to put programs in place to lower operating costs. Of particular importance in the realm of economic geography are *regional integration strategies*, which have progressively shifted production to lower-cost locations within continental-scale trade arrangements such as Autopact, NAFTA, and the European Union. The integration of lower-cost PLEMA type production sites (see Section 3.3 for a description of the study's locational typology) such as Mexico, Spain, and Canada, with the largest existing markets and supply-bases in North America and Europe has created a powerful operating cost gradient that appears to have been influencing key investment decisions by automakers, particularly during the 1990s.

Volkswagen, for example, closed its sole United States plant in 1988, and upgraded its factory in Puebla, Mexico—which had long been producing "Beetle" model sedans for the local market—for the manufacture of "Golf" model sedans, largely for export to the United States. Production at the plant increased to nearly 230,000 by 1996. In 1997 and 1998, the factory was upgraded again, this time for the production of "New Beetle" model sedans, a vehicle almost exclusively intended for the United States market. The total capacity of the plant complex in 1998 was about 450,000 units. Chrysler, Ford, GM, and Nissan have all followed similar strategies, upgrading and expanding older car and truck plants in Mexico that had been assembling for the local market for export to the United States. As these new high volume production capabilities have come on-stream, exports of finished vehicles from Mexico to the United States have soared. As Figure 9-5 shows, finished vehicle exports from Mexico to the United States increased from a mere $244M in 1989 to $9.7B in 1996, and increase of 3,911%. This increase far outweighs the (albeit substantial) growth of bi-lateral trade in parts between the two countries and the almost negligible rise in finished vehicle exports from the United States to Mexico.

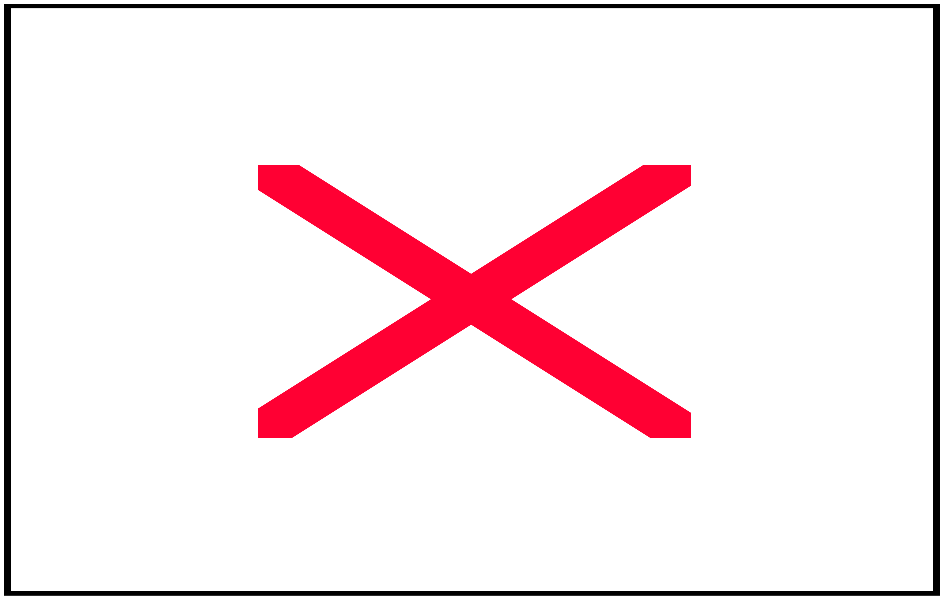
Figure 9-5: Mexico's Finished Vehicle and Parts Trade with the United States, 1989-1996 (value of shipments in thousands of current US dollars)



Source: Tradstat

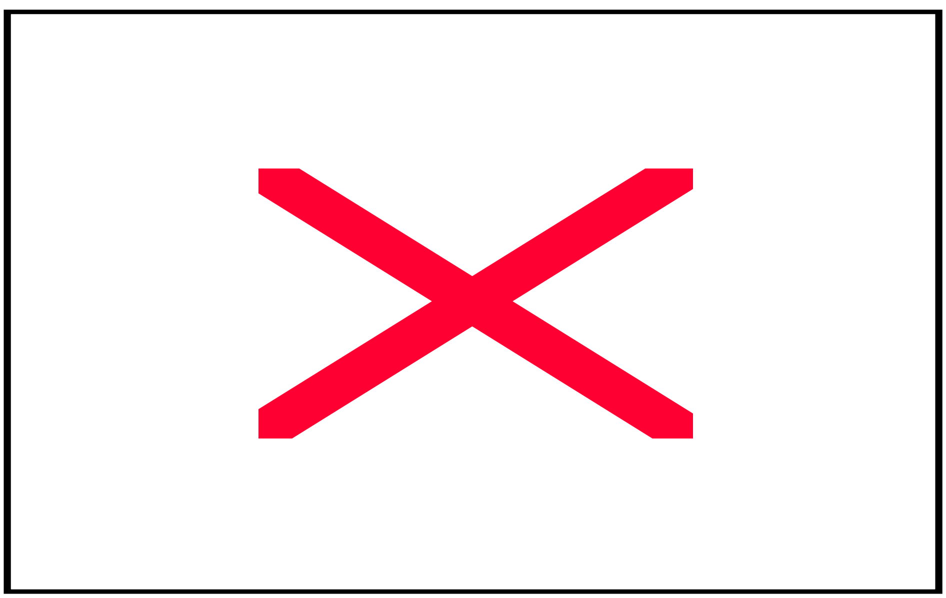
A story similar to that of Mexico can be told for other PLEMA type assembly plants in Canada and Spain (see Figures 9-6, and 9-7). In both instances, trade liberalization in finished motor vehicles began much earlier, but beginning in the early 1990s, exports of finished vehicles to the LEMAs of the United States and Northern Europe began to rise dramatically. Canadian plants have always been high volume, current model producers, but in Spain, some older plants were upgraded for export. The value of finished vehicle exports from Canada to the United States increased 245% between 1989 and 1996, from $8.9B to $31.4B, while the value of vehicle exports from Spain to the ten original non-Iberian E.U. countries increased 137%, from $2.6B to $8.1B.

Figure 9-6: Canada’s Finished Vehicle and Parts Trade with the United States, 1988-1996 (value of shipments in thousands of current US dollars)



Source: Tradstat

Figure 9-7: Spain’s Finished Vehicle and Parts Trade with the Ten Non-Iberian E.U. Countries, 1988-1996 (value of shipments in thousands of current US dollars)



Source: Eurostat.

Table 9-1 shows the share of finished vehicle exports from Mexico and Canada to the United States, and Spain to the ten original non-Iberian E.U. countries. The share of Mexico's total vehicle exports going to the United States increased from a mere 12% in 1992 and 1993 to 75% in 1996. The share of Canada's exports going to the United States also rose, from 71% in 1992 to 95% in 1996. The trend in Spain's exports to the ten original non-Iberian E.U. countries is less clear. Although the E.U. 10 did absorb a rising share of Spain's exports immediately after European unification in 1992 and 1993, the share began to drop thereafter, perhaps because the E.U. had expanded its borders to include Denmark, Finland, and Sweden.

Table 9-1: Total and Intra-regional Exports of Finished Vehicles from Mexico, Canada, and Spain, 1992-1996 (value of shipments in thousands of current US dollars)

MEXICO	Total Vehicle Exports	Vehicle Exports to USA	USA Share
1992	3,955,147	467,490	12%
1993	4,912,030	566,677	12%
1994	5,888,013	865,071	15%
1995	9,371,855	2,576,187	27%
1996	13,099,881	9,792,749	75%
CANADA	Total Vehicle Exports	Vehicle Exports to USA	USA Share
1992	22,770,131	16,179,303	71%
1993	26,831,393	20,012,801	75%
1994	30,488,197	25,718,857	84%
1995	32,952,621	28,985,722	88%
1996	32,878,937	31,351,790	95%
SPAIN	Total Vehicle Exports	Vehicle Exports to EU 10	EU 10 Share
1992	11,738,013	6,069,604	52%
1993	10,606,449	6,551,778	62%
1994	13,446,515	6,840,296	51%
1995	16,462,633	7,234,532	44%
1996	18,069,928	8,142,034	45%

Sources: Total Exports: Comtrade; NAFTA exports: Tradstat; EU 10 exports: Eurostat.

While these numbers are dramatic, it should be pointed out that the increase in motor vehicle exports from lower-cost PLEMA assembly plants has been occurring within a more general context of increasing total exports from PLEMA type locations. Table 9-2 shows the share of top ten exports by product for Mexico, Canada, and Spain for the period 1992-1996, along with the growth in value for each product for the period. Except for Mexico, where motor vehicles displaced oil as the top export, the share of the top ten exports have not changed very much as total exports have grown. What is striking is that value of motor vehicle exports outstrip any of the other top export products by a wide margin in all three countries. This is especially true in Spain, where passenger and commercial vehicles together account for 48% of the value of the countries top ten exports.

Table 9-2: Share of Top Ten Exports by Product; Mexico, Canada, and Spain, 1992-1996

MEXICO							% Change
HTC Code	Product Description	1992	1993	1994	1995	1996	'92-'95
781	**Passenger Cars etc.**	**15%**	**17%**	**17%**	**20%**	**UA**	**123%**
333	Petrol./Bitum. Oil,Crude	33%	26%	23%	20%	UA	0%
773	Electrical Distrib Equipment	9%	11%	10%	9%	UA	65%
778	Electrical Equipment NES	7%	8%	8%	9%	UA	102%
764	Telecomms Equipment NES	6%	7%	8%	8%	UA	108%
761	Television Receivers	6%	7%	9%	8%	UA	123%
713	Internal Combustion Engines	7%	7%	8%	8%	UA	88%
784	**Motor Veh Parts/Access**	**7%**	**8%**	**8%**	**7%**	**UA**	**56%**
772	Electric Circuit Equipment	6%	6%	6%	6%	UA	61%
782	**Goods/Service Vehicles**	**3%**	**3%**	**3%**	**5%**	**UA**	**215%**
	Value of Top 10 Products (US$M)*	22,252	24,812	29,228	36,894	UA	66%
CANADA							% Change
HTC Code	Product Description	1992	1993	1994	1995	1996	'92-'96
781	**Passenger Cars etc.**	**24%**	**27%**	**30%**	**29%**	**29%**	**75%**
641	Paper/Paperboard	12%	10%	10%	12%	11%	33%
248	Wood Simply Worked	9%	11%	11%	9%	10%	67%
931	Special Transactions NES	9%	9%	9%	9%	10%	53%
333	Petrol./Bitum. Oil,Crude	9%	8%	7%	8%	9%	46%
784	**Motor Veh Parts/Access**	**10%**	**10%**	**9%**	**9%**	**9%**	**25%**
782	**Goods/Service Vehicles**	**12%**	**11%**	**9%**	**8%**	**7%**	**-16%**
251	Pulp And Waste Paper	7%	5%	6%	9%	6%	22%
343	Natural Gas	6%	6%	6%	4%	6%	40%
764	Telecomms Equipment NES	3%	3%	3%	3%	4%	118%
	Value of Top 10 Products (US$M)*	62,819	70,246	79,476	89,507	90,685	44%
SPAIN							% Change
HTC Code	Product Description	1992	1993	1994	1995	1996	'92-'96
781	**Passenger Cars**	**44%**	**44%**	**45%**	**45%**	**42%**	**47%**
784	**Motor Veh Parts/Access**	**11%**	**10%**	**11%**	**12%**	**13%**	**69%**
57	Fruit/Nuts, Fresh/Dried	11%	12%	11%	10%	10%	35%
54	Vegetables,Frsh/Chld/Frz	6%	7%	7%	7%	6%	64%
334	Heavy Petrol/Bitum Oils	7%	6%	5%	4%	6%	34%
782	**Goods/Service Vehicles**	**4%**	**3%**	**4%**	**4%**	**6%**	**131%**
851	Footwear	5%	6%	6%	6%	5%	60%
713	Internal Combust Engines	4%	3%	3%	4%	5%	91%
662	Clay/Refractory Material	4%	4%	4%	4%	4%	65%
625	Rubber Tyres/Treads	4%	4%	4%	4%	4%	51%
	Value of Top 10 Products (US$M)*	24,628	22,598	27,517	33,569	38,138	55%

Source: Data in this table are taken from the COMTRADE data base of the United Nations Statistics Division. Notes: UA=unavailable; *current dollars.

As already discussed in Section 3.3, automakers appear to be operating on the assumption that Poland, the Czech Republic, and Hungary will eventually be admitted as members of the European Union, allowing plants in these countries to export freely to the LEMAs of Europe. Just as the Big Three's assembly and parts plants in Mexico have become an integral part of North American operations, the functional integration of East and West Europe could provide a new low-cost periphery and perhaps, an eventual shift away from European LEMA type locations and East Europe's principal PLEMA competitor, Spain.

We should not let the modest aggregate employment effects of globalization to-date mask the fact that globalization is creating new opportunities and vulnerabilities for working people from Detroit to Shanghai. The threat to jobs in the United States and Northwest Europe from the increased flow of finished vehicles from PLEMA type assembly plants is obvious. Although jobs do not appear to have migrated away from the United States or other advanced industrial nations in massive numbers—yet—the growing reliance on Mexico, Canada, Spain, and perhaps Eastern Europe could conceivably shift the industry's center of gravity over the long term. The negative impact of these shifts have so far been mitigated to some degree by the reverse flow of parts from "home" to "host" countries, but we cannot turn a blind eye to the distinct possibility that employment displacement at home will become severe as more assembly work is re-located and the supply-bases in these lower-cost locations continue to upgrade their capabilities over time. This last point is especially pertinent in light of the increased globalization of the supply-bas, which promised to speed the localization process.

While the quantity of jobs in developed countries has remained more or less constant during the past ten years, there has been an erosion of job quality, especially in the United States, as work has shifted from automakers to suppliers, where pay is usually lower. Moreover, the potential for massive downsizing is real (and especially acute in Japan) as vehicle manufacturing continues to shift to new locations. Even though we present our locational typology of BEM, LEMA, PLEMA, and HOME as static, it is important to note that BEM plants, in particular, have the potential to be transformed into PLEMA type plants as the outer boundaries of trade blocs expand outward. Just as the assembly plants in Mexico and Spain have been upgraded to PLEMA status, so too could some of the BEM plants being established today. HOME plants and markets too can change their role in the global industry. The GM plant in Fremont, CA, went through such a transition when the facility was re-opened as NUMMI (GM/Toyota joint venture) in 1984. The entire domestic industry of the U.K. can also be said to have gone through such as transition, as all but a few small British automakers met their demise or have been absorbed by automakers from other countries. In a 1998 paper written for this study, Teresa Lynch makes this point very powerfully:

> The motivations for incorporating Spain into the European system and Mexico into the North American system call into question a clean division between market-seeking and cost-cutting investment. Although automakers justify investments in Mexico by reference to market potential and often cite Spain as an example of how local production generates goodwill and yields dividends in terms of local sales when a market matures, the evidence suggests that if these investments were not tied to cost-cutting or labor-taming strategies in the home country, they would not have been sufficiently profitable and therefore probably not undertaken. ...Both the Spanish and Mexican cases, then, suggest that if sufficient manufacturing capability is present or can be generated and trade arrangements are sufficiently liberal, countries with insufficient demand to sustain an auto sector can be brought on-line as regional export bases. Both cases also suggest that such a strategy will be

pursued when it meets another objective, such as cutting overall costs of regional production by reducing dependence on plants in high-wage countries.

9.3 Consolidation of Design Activities: a Revitalization of the Core?

The consolidation of design activities in core locations has helped re-energize the traditional centers of the automotive industry (such as the Detroit metropolitan region) with high paying research, design, engineering, and administrative jobs. Jobs of these types are attracted to core locations for good reason. Within the United States, the industry is still remarkably concentrated in its traditional location in the Great Lakes Region (see Table 9-3). While there has been a movement to the Southern States, which increased their share of automotive employment from only 5.7% in 1970 to 16.7% in 1992, the continued dominance of the Great Lakes Region is clear. Table 9-3 shows that the Great Lakes Region decreased its share of U.S. automotive sector employment from 69.4% in 1975 to 59.1% in 1992. It is also notable that wages in the Great Lakes Region maintained a 5-10% premium during this period.

Table 9-3: Regional Share of Motor Vehicle Sector Employment and Relative Wages

Share of US Employment	South East	Great Lakes		Wages (US =100)	South East	Great Lakes
1970	5.7	69.4		1970	78.9	104.9
1975	6.8	68.7		1975	72.9	106.8
1980	9.4	64.1		1980	73.1	109.3
1985	12.5	60.9		1985	73.5	111.9
1990	15.6	59.4		1990	75.2	112.8
1992	16.7	59.1		1992	79.1	110.8

Source: Bureau of Economic Analysis

The largest automotive sector job shift in the United States has been from the Mid-Atlantic States and West Coast to the South East States. Given the proximity and excellent transportation linkages between the South East states and the Great Lakes (Rubenstein, 1992), the overall effect has been a re-concentration of the Automobile industry around its traditional, albeit expanded core in the American Mid-West. Hicks (1994) refers to this re-concentration of the American automotive industry within the wider Midwest region as the formation of a "virtual Detroit." In the 1970s and 1980s, Ford and GM closed almost all of their assembly plants on the East and West Coasts, in part because they were too far from the crucial supply-base in the Mid-West. During the course of a project interview, a manager at a Big Three automaker referred to the attractive force of the Midwest's automotive supply-base in driving this re-concentration.

9.4 Why Market-Seeking Investments are Unlikely to Hurt Employment at Home

Automakers do not set up BEM type plants for the purpose of re-exporting finished vehicles to LEMAs or HOME markets (see Section 3.3 for a description of the study's locational typology). During out interviews a manager at one automaker estimated that a 75% cost reduction at BEM plants would be required to offset the added costs of poor infrastructure, low productivity, lack of raw materials, duties, shipping, and the like. Because most of the plants established in BEM locations begin with CKD assembly, employment requirements can actually be *increased* in source plants, where additional working hours are required to processes, consolidate, and package vehicle kits destined for CKD assembly plants in BEM locations. In fact, CKD assembly in emerging market locations can help to alleviate overcapacity problems by absorbing some of the output of under-utilized assembly plants at home, a motivation that may be part of the explanation for the recent spate of CKD investments by Korean firms (note: we must identify this point as pure conjecture since the study conducted no interviews with Korean automakers).

Of course, with the gradual and eventual shift to local content, the positive employment impact of BEM assembly plants for home country employment can be expected to diminish, but this can take a long time. One automaker stated that the shift to integrated production would only come with an annual unit sales reached 50,000 units per year; another at 100,000 units; and yet another suggested it would explore integrated production when sales reached 120,000 units per year for two models. Another automaker stated that a shift from strict kit assembly toward "free-flow" of parts would begin at an annual volume of 20,000 units and become full-blown by 50,000 units. Without rapid market growth, BEM assembly plants may not reach such output levels for many years to come. As parts from home come to comprise a smaller share of the total bill of materials for each vehicle, both local and global sourcing to a BEM assembly plant can increase. Of course, with global sourcing, the possibility of home country sourcing, and its attendant employment benefits, remain a possibility. For items that require a great deal of skill and capital investment, and therefore large scale production, such as engines and transmissions, home country sourcing is possible even when offshore plants make the full transition to "integrated " production. Trigger points for engine and transmission production were said to be extremely high, about 150,000-200,000 units per year. So, even with a gradual shift from CKD to integrated production, there are likely to be modest long-term employment benefits to market seeking investments in BEM and LEMA (i.e., transplant) type locations.

There is one major exception to this argument: home country employment *is* likely to decline when market seeking investments displace home country exports, as has been the case with Japanese investments in the United States and Europe (see Section 9.4). However, as already discussed in Section 5.6, we believe that the establishment of Japanese "transplants" in the United States and Europe has signaled the demise of such "export-led" development strategies in the automotive industry. Korean automakers, for example, had only the late 1980s and early 1990s to implement their export-led strategies, and have abruptly switched to a built-where-sold" approach in the late 1990s.

9.5 Employment Effects in Developing Countries: a Few Good Jobs

What are the effects of new automotive sector investments for employment in developing countries? Are the investments helping or hurting workers? What effect are they having in the quantity and quality of jobs? Debates over the effects of FDI on developing countries are not new. As early as the 1950s, some scholars recognized the positive role of foreign capital in bringing skills and know-how to developing countries (Hirschman, 1958). Other scholars, however, have warned that FDI, particularly through multinational corporations (MNCs), can be detrimental to economic development. The latter school argues that MNCs create a small enclave in the recipient country, helping increase the income of only the richest social group of the country but failing to benefit most of the population, particularly the poor, and thus worsening the overall income distribution. This is said to occur because 1) MNCs tend to use more capital-intensive technology, which has a labor-displacing effect, and thus do not help generate employment; and 2) incomes generated out of their investment are largely taken back to their home countries and not distributed locally. In particular, the entry of MNCs often has a negative impact on small-scale local producers (Caves 1996).

While the earlier literature on FDI mainly focused on the impact of FDI on income distribution, the more recent literature, influenced by a new (endogenous) growth theory, has shed new light on the role of FDI in promoting growth as it generates increasing returns in production through transferring knowledge, skills, and technology (see de Mello 1997 for review). FDI is believed to have a positive effect on human capital accumulation through the provision of training and skills acquisition and diffusion for workers in recipient countries (de Mello 1997: 9, OECD 1998). FDI is also expected to be a potential source of productivity gains via spill-overs to domestic firms (de Mello 1997: 9). However, other scholars argue that what promotes growth is not FDI per se but particular characteristics of recipient countries which attract FDI, including existing factor endowments, such as the existence of well-educated labor (Kokko 1992).

With regard to the effects of FDI on jobs, both the earlier and the more recent literature imply that whether FDI has a positive effect on the quantity and quality of jobs in the recipient countries, in terms of employment creation and improved skills, depends on the extent to which they create linkages, beyond their small enclaves, with local firms to facilitate the externalizes and spill-overs of their activities. The creation of linkages between FDI-related firms and local firms through the supply chain generates jobs for local workers. The externalities and spill-overs of FDI-related firms occur through frequent interactions with the local suppliers, including various forms of guidance, training, and technology transfer. Such spill-overs in turn improve the skill levels of workers in local suppliers, and thus increase their wages and other labor benefits.[11]

The study's field and survey research in Vietnam and India suggests that employment gains in emerging economies have been modest, given the small size of initial investments and low levels of local sourcing. However, the jobs that have been created appear to of extremely high quality by local standards. The field work suggests that the majority of autoworkers in BEM locations are paid a premium over prevailing industrial wages and are being exposed to advanced work organization and quality control practices.

Since many of the new investments in BEM locations are for CKD assembly, automakers can employ labor intensive methods. The logic that capital can be substituted for labor as wage rates rise, some that is more or less expected. Very few assembly processes are machine-specific. As long as the assembly sequence remains the same, labor can almost always be substituted for capital equipment. For example, welding can be conducted by workers in open framing stations or by robots. In labor intensive plants there are more opportunities to institute high performance work practices. Another reason to use labor intensive processes initially is to generate employment, something that host governments appreciate. In fact, given low volumes

[11] These three introductory paragraphs are drawn from Okada, 1998.

and small markets, labor intensity is one of the few means that automakers have to generate substantial employment that might justify the granting of incentives by host governments.

In Vietnam, the small size of the local market and the prevalence of CKD assembly meant that only about 1,500 workers were employed at the country's 10 CKD assembly plants in operation in 1998. On the other hand, the share of workers organized in teams at CKD vehicle assembly plants was generally high, although job rotation was much less common. Vietnamese autoworker wages, while low by ASEAN and world standards, were found to be very high by Vietnamese standards. In 1998 Vietnamese autoworkers were paid, on average, greater than three times the prevailing industrial wage in Vietnam. In terms of purchasing power, Vietnamese autoworker wages on average can be said to be equivalent to $17.03USD per hour (the average would drop to $11.47 without Ford, which has taken the approach of hiring its future managers first and training them on the production line—the assumption is that production workers will be hired when volumes increase, perhaps at lower wages) (Sturgeon, 1998).

The research conducted in India by Okada (1998) reveals an across-the-board wage premium at local suppliers that had received direct investment (FDI) from foreign joint-venture partners over suppliers that did not (see Table 9-5). In addition, suppliers with FDI showed a higher adoption rate for advanced work organization and quality control practices such as quality circles, suggestion schemes, multi-skilling and job rotation, and ISO 9000 certification (see Table 9-6). These data suggest the powerful role that FDI can play in upgrading a country's automotive supply-base and work-force capability.

Table 9-4: Average Annual Earnings at First-tier Suppliers in India, 1996 (in US$)

	Managers	Engineers	Production Workers	Helpers (Unskilled)	Casual Workers
Suppliers with FDI (9 firms)	6,492 (n=256)	2,208 (n=671)	1,440 (n=3183)	648 (n=80)	792 (n=1475)
Suppliers without FDI (31 firms)	5,184 (n=133)	1,488 (n=432)	1,020 (n=2128)	708 (n=618)	576 (n=623)
Total (40 firms)	6,060 (n=389)	1,920 (n=1103)	1,236 (n=5511)	708 (n=698)	720 (n=2173)

Notes: 1) Out of the sample firms, only those which have matching data for employment and wages are included in this computation. 2) n refers to the number of employees in the category. 3) The exchange rate was US $1 = Rs. 35.43 in 1996 (IMF 1997). Source: Okada, 1998.

Table 9-5: Adoption of Advanced Work Organization at First-tier Suppliers in India, 1996

	QC circle	Suggestion Scheme	Multi-skilling/ Rotation	ISO 9000 Certification
Suppliers with FDI (n= 11)	5(45%)	4(36%)	7(63%)	7(63%)
Suppliers without FDI (n=36)	6(17%)	7(19%)	17(47%)	15(42%)
Total (n=47)	11(23%)	12(26%)	24(51%)	22(47%)

Source: Okada, 1998, from author survey.

It is important to note that the benefits to employees mentioned here are, so far, accruing to a very small group of workers, and the overall impact of automotive sector FDI on the

Vietnamese and Indian economies remains extremely small. Still, the opportunity for workers to learn in such leading-edge industrial settings is extremely rare in places where agriculture is still by far the dominant occupation and the vast majority of industrial enterprises employ extremely elementary production techniques. As foreign companies increase their presence in BEMs, having a group of workers and managers experienced in high performance work practices will be essential, not only to provide personnel for foreign-owned factories, but as entrepreneurs with the capability start businesses that conform to world standards of quality and performance.

9.6 Green-field Experiments and the Transformation of the Home Base?

During the course of our interviews, we were struck by the fact that automakers—and this is especially relevant for American and European automakers—are frequently able to develop their most advanced modes of production, not in their home bases in the advanced industrial countries, but in the far flung outposts of emerging economies. They are able to do so because these new locations offer escape from the long legacy of rigid—and to some extent ossified—organizational and institutional structures that have accumulated at home. Because of the power of labor unions; as well as “outmoded thinking,” “cultural blocs,” and “management fiefdoms,” that our interview subjects attributed to “old-line” managers; automakers find it very difficult and costly to close or to introduce new approaches to assembly at plants in their home bases, where assembly often remains at extremely detailed levels. As one manager put it during our interviews, green-field locations provide automakers with “a clean sheet of paper” with which to implement advanced practices.

As a result, American and European automakers are using their newest assembly plants in emerging economies as test-beds to experiment with innovative forms of work and industry organization. There have been and will continue to be attempts to use the lessons learned to transform existing operations in the traditional centers of the industry, but the process is proving to be extremely difficult. In an approach that demonstrates the lengths automakers sometimes must go to transform existing facilities, one automaker built a new engine line directly alongside an older line to demonstrate new techniques and win acceptance.

The new Daimler-Benz plant in Tuscaloosa, Alabama provides a good example of how quickly “green-field” assembly plants can allow automakers to adopt new approaches. Although Daimler-Benz purchases about 40% of the value of its German-built passenger vehicles from outside suppliers, the plant in Alabama had an initial external sourcing ratio of about 70%, and plans are in place to move quickly to 80%. Another, well known example is the Volkswagen truck plant in Resende, Brazil, to which suppliers bring sub-assembled modules directly to the assembly line and then take the unprecedented additional step of attaching it to the vehicle moving down the line. In our interview with IG Metall, the German Metalworkers Union, it was made clear that such practices would be impossible to implement in Germany.

GM will base their new plants in Thailand and Shanghai, China on what they learned at their plant at Eisenach, former East Germany, which was opened in 1995. The approach used at Eisenach was blended from the experience gained at NUMMI (a joint-venture with Toyota in

Fremont, California), CAMI (A joint-venture with Suzuki in Ingersoll, Canada), as well as from input from newly hired personnel formerly employed by Toyota. Eisenach was GM's first integrated "lean" production system that was not applied in piecemeal fashion to an existing facility but fully implemented on the first day of the plant's operation. The focus was on teamwork, open communication, short lead times, and continuous improvement (*kaizen*). Quality circles were instituted, break times were allowed to be flexible and mass relief was given between shifts, and job classifications were limited to two. In addition, the plant at Eisenach was configured to have a string of loading docks adjacent to the assembly line to receive parts shipment on a just-in-time (JIT) basis.

Eisenach was then used as a model for a recently opened GM truck plant in Brazil, which in turn may be used as a model for a new generation of assembly plants to be established in North America, perhaps within 50 miles of existing plants (agreements with the U.A.W. give autoworkers the right to turn down transfers to work sites more than 50 miles away from their existing jobs). GM has publicized its intent to invest $21B in the United States by 2001, but has been less forthcoming about its plans for expansion in Mexico America (Bradsher, 1998a, 1998b, and 1998c). It is interesting to note that the last two presidents of GM's Brazilian operations now run GM North America (Bradsher, 1998a) and that the former president of GM Mexico has been installed to manage GM International Operations.

However, during our interviews it was repeatedly pointed out that green-field settings are not always a panacea. While it is often easier to implement flexible work organization practices in green-field locations, one automaker we interviewed found "worker empowerment" (e.g. flat hierarchies and employee involvement) hard to implement in (current or former) autocracies such as China, Russia, Vietnam, and East Europe. According to Okada (1998), it has been difficult for automakers in India to get line workers to maintain and clean their own workstations (a cornerstone of Toyota-style worker involvement), since sweeping floors has traditionally been a task assigned to the lowest "untouchable" caste of society. New plants that are built from existing facilities can initially be a "step backward" in terms of plant design and work organization. In places where transitions are underway from command to free-market economic systems, personnel sometimes need to be taught the basic concept of profit-making.

10. Field Survey Results

To test some of the hypotheses developed during the interviews, the project set out to collect detailed information about sourcing, plant characteristics, and employment quality at the assembly plant level. This section presents the results of that research, which was supported by the administration of a detailed questionnaire, as well as a physical walk-though of the plant's operations and a follow-up discussion with the plant's management. The field survey questionnaire is contained in Appendix B, Section 2.2 of this report. A list of plant's where visits were conducted and/or questionnaires administered is presented in Appendix A, Section 1.2 (note: Appendix A is available to study team members only to protect firm confidentiality).

Although our field visits were initially designed to include matched sets of small-car assembly plants, once in the field, we made the opportunistic decision to include commercial vehicles, especially in BEM type locations, where utility trucks and multi-passenger vans are often the initial models produced (see Section 7.1 for a discussion). The proposed and completed matrix of locations for the plant visits were presented in Tables 3-6 and 3-7. Due to resource constraints associated with international travel, as well as some difficulty in obtaining access to the offshore plants of certain automakers, the current study was not able to gather results from all the plants in the proposed matrix. However, research on plants of each locational type was completed, allowing us to begin to compile the data needed to test the hypotheses underlying the locational typology summarized by Table 3-5. As Table 10-1 shows, data were gathered at two HOME and one LEMA type plants in Japan and the United States, two PLEMA type plants in Mexico, and eight BEM type plants in Vietnam. As of this writing, the field questionnaire was administered at fifteen assembly plants and was returned by thirteen. The two questionnaires returned from plants in the United States (consisting of one HOME and one LEMA type plants) were early, "test" versions of the questionnaire for which follow-up field visits were not conducted. Therefore, the data for these plants are not as complete as the others and the team has less confidence in their accuracy since the results were not substantiated through site visits.

Although highly preliminary because of the small sample size, and thus not generalizable to the industry as a whole, the data presented in Table 10-1 is suggestive; both supporting and informing the hypotheses summarized by Table 3-5. We are well aware that the small number of visits made to plants in all categories makes these data very specific to the plants included in the study. Nevertheless, we will do our best to interpret the results here, while bearing in mind the acute need for additional research.

In terms of general characteristics, the results from the plant visits correlate roughly with the more comprehensive data drawn from the assembly plant database (see Table 6-1). BEM plants are the most recently established, and the home plants are the oldest. In terms of plant size, BEM plants are far smaller that the other plants (8,611 units capacity on average), with the PLEMA plants occupying the middle ground. The market-seeking characteristics of both the BEM and LEMA type plants are reflected by the fact that none of the vehicles produced were exported. The high level of exports in the three home plants reflects the fact that two of these plants were located in Japan.

The data on sourcing is interesting. The BEM type plants sourced nearly all of their inputs from the home country of the parent automaker, and had, on average, only 13 suppliers. Both of these figures reflect the fact that all of the BEM plants were engaged in the assembly of CKD kits. Both the LEMA and HOME plants drew heavily on the local supply base, but surprisingly, the two PLEMA type plants surveyed, on average, relied on their home country, for 87% of the value of their inputs.

Table 10-1: Assembly Plant Field Survey: Average Results by Locational Type (n)

Plant Characteristics	Inception Date	Cap. Inv. $M	Capacity	Output	% Utilization	% Exported
BEM (9)	1996	$28	8,611	682	11%	0.0%
LEMA (1)	1982	$1,700	458,450	422,913	92%	0.0%
PLEMA (2)	1978	UA	173,522	142,239	82%	91.0%
HOME (3)	1969	UA	456,413	384,983	85%	53.4%
Sourcing	# of Suppliers	% Home	% Host	% Other		
BEM (9)	13	91%	1%	8%		
LEMA (1)	381	0%	90%	10%		
PLEMA (2)	532	87%	7%	6%		
HOME (3)	416	88%	NA	12%		
Integration	% CKD	% of Plants w/o Stamping	% of Plants w/o Painting	% of Plants w/o Trim		
BEM (9)	100%	100%	33%	0%		
LEMA (1)	0%	100%	0%	0%		
PLEMA (2)	0%	0%	0%	0%		
HOME (3)	0%	33%	0%	0%		
Technology	Number of Welding Robots	Number of Welding Guns	Number of Body Asmbly Robots			
BEM (9)	0	38	0			
LEMA (1)	UA	UA	UA			
PLEMA (2)	105	40	7			
HOME (3)	240	0	60			
Employees	Employees	# Job Class.	% Female	% Contingent	Units/Work/Yr.	
BEM (9)	156	6	6%	2%	4	
LEMA (1)	5,800	2	UA	UA	73	
PLEMA (2)	3,039	23	UA	29%	49	
HOME (3)	2,360	10	UA	0%	114	
Teams	% in Teams	Meetings/Month	% Who Rotate	% X-Functional		
BEM (9)	85%	14	25%	5%		
LEMA (1)	UA	UA	92%	UA		
PLEMA (2)	50%	4	21%	UA		
HOME (3)	67%	3	10%	5%		
Wages	Hourly Wage	Amount Between High and Low	% Between High and Low	Plant Wages x Prevailing Wage	Company % Health Benefits	
BEM (9)	$0.93	$0.14	23%	4.8	100%	
LEMA (1)	$18.70	$12.90	69%	UA	100%	

PLEMA (2)	$2.57	$1.37	52%	2.3	100%
HOME (3)	$15.96	$9.82	62%	1.2	95%

Source: Globalization and Jobs Assembly Plant Field Survey, 1998.

In regard to level of integration, none of the BEM plants had an adjacent stamping facility, and three of nine did not have in-house paint shops (these plants used the paint shops of nearby automakers). The LEMA plant did not have an adjacent stamping facility, but both of the PLEMA plants did, as did two of the three HOME type plants.

No robots of any kind were present at the BEM plants we visited; all welding and assembly was done by hand. The welding at the HOME type plants was completely automated, but one of the PLEMA type plants employed a mix of hand and robotic welding. Many more body assembly robots (e.g. glass installation, sealant application, fluid filling) were in use at the HOME type plants than the PLEMA type plants, and the BEM plants did not use them at all.

The average number of employees is in keeping with the average size of the plants, but when a crude productivity measure is taken by dividing the yearly unit output at the plants by the number of employees, the figures suggest that the HOME type plants were most efficient (114 units per employee per year), the LEMA type plants second (73 units per employee per year), the PLEMA type plant third (49 units per employee per year), and the BEM type plants last (4 units per employee per year). The higher productivity rates at HOME and LEMA type plants are likely a function of capital intensity. Very few women were employed as production workers at any of the plants, and contingent workers (defined as temporary or part-time workers) were heavily used at one PLEMA type plant (57% of production workers at this plant were defined as temporary).

Employee teams were heavily used in all of the plants where data was collected. The one PLEMA type plant that was not using teams at the time of our visit was planning to implement them in the very near term. In general, fewer assembly plants employed the techniques of job rotation (within a team) and even fewer used cross-functional rotation (across painting, welding, and trim lines for example).

Finally, wages at BEM and PLEMA types plants were very low, but these plants tended to have a smaller spread between the lowest and highest wages paid than the LEMA and HOME plants, and the wages paid were many times the prevailing rates for manufacturing work in the general areas where the plants were located. In all of the plants, the company paid most, if not all of the health benefits provided (BEM plants provided on-site health clinics that could be used by workers without charge.

11. Summary and Conclusions

The main findings of our research reveal an industry in profound transition: from an older "domestic" model of competition that allowed automakers to compete by exporting from supply-bases rooted in their home countries, to an emerging "global" model of competition that increasingly demands day-to-day production functions be organized on a regional and global basis; from an industry that once treated emerging markets as dumping grounds for old models and production equipment, to an industry that is building leading-edge productive capacity in far-flung corners of the globe; from an export-led industry where firms from different countries competed mainly through markets, to a network-led industry with each major firm producing within each major market. The rise of globalization as one of the central forces shaping the automotive industry is what motivated us—with support from the Alfred P. Sloan Foundation—to undertake this three-year study of globalization and jobs in the automotive industry.

As the source of competitive pressure shifts from the globalization of markets to the globalization of production, the key competitive advantage in the industry has also begun to shift from excellence at the point of production—now more or less assumed—toward excellence in governing spatially dispersed networks of plants, affiliates, and suppliers. The bottom line is this: under this new global model of competition, what matters is not just how effectively cars are produced, but how effectively global-scale production networks are built and managed.

To be more specific, our research has found that globalization is shifting the terms of competition in three fundamental respects:

First, globalization has meant rapidly *entering new and emerging markets*. The lure of huge, largely untapped markets in Asia, Eastern Europe, and South America is driving a race among automakers to establish local production. The end of the Cold War in 1989 ushered in a new era of hegemony for global capitalism. Besides opening East Europe and the countries of the former Soviet Union to investment from the West—and perhaps because of this opening—the drive toward investment liberalization and financial integration picked up steam, propelling the formerly isolated economies of India, Vietnam, and China to become much more open to foreign investment. Because of long experience with import barriers, and perhaps because they operate from home countries with trade barriers firmly in place, automakers, almost without exception, view long-run success in emerging markets as dependent on local manufacturing. There is consensus in the industry that massive exporting of finished vehicles to emerging markets will be unworkable in the face of lingering import restrictions, high transport costs, and nationalistic buying patterns. Automakers believe that local manufacturing builds "corporate citizenship" in each market, which in turn is seen to build consumer acceptance and loyalty. The prize of the Chinese, Indian, and Brazilian markets is indeed large, and as car ownership increases in such places with rising incomes, the dream of each automaker is that these first cars—and thus each subsequent car—will carry the Chevrolet, Ford, Toyota, or Volkswagen badge.

On the other hand, when the battle for large existing markets intensified radically in the 1980s, many automakers put programs in place to lower operating costs. Of particular importance are *regional integration strategies*, which have progressively shifted production to lower-cost locations within continental-scale trade arrangements such as Autopact, NAFTA and the European Union. The integration of lower-cost production sites such as Mexico and Spain with the largest existing markets and supply-bases in North America and Europe has created a powerful operating cost gradient that has been tipping key investment decisions toward these "peripheral" locations since the 1980s.

The simultaneous implementation of "build-where-you-sell" and regional integration strategies by nearly all leading automakers has led to an unprecedented burst of new assembly plant investment, both in the world's most promising nascent automotive markets, and in the lower-wage peripheries of the largest existing markets. The surge in investments, especially those made in emerging markets, have all the earmarks of a classic speculative over-extension, where groups of investors—all basing their decisions on the same assumptions and information—make similar investment moves at the same time. So, globalization is exacerbating a problem that is already severe for most automakers: *overcapacity*. The economic crisis in Asia, where many of the most recent and most speculative investments have been located, has brought overcapcity problems to a head faster than even the most dire warnings have predicted

Second, globalization, and its dark shadow—overcapacity, have placed new requirements and pressures on the vehicle and manufacturing *design* capabilities of automakers. The pressure to manage global-scale operations and produce high quality vehicles in an increasing number of locations has forced the industry to confront a new set of challenges. As production locations multiply, it is simply becoming too costly to construct redundant design, production, and supply infrastructures in each location. While automakers have by no means reached a consensus on how best to build and manage a truly global-scale enterprise, what is clear is that winning at the game of globalization will require new management tools, new efforts to coordinate affiliate and supplier activities, and new modes of corporate governance. Two of the most ubiquitous responses to the new pressures of globalization by automakers have been in the area of vehicle and assembly plant design.

Most automakers are trying to place a greater number of car models on *fewer underbody platforms*, allowing for greater commonalization of parts while retaining the ability to adapt specific vehicle models to local tastes and conditions. Such strategies call for global sourcing, tighter coordination of worldwide design efforts, and in cases where platform design activities have become geographically dispersed over time, consolidation of project management in core locations. At the same time, the need to respond to unique market requirements has created pressure to localize body design, prompting some automakers to set up regional design centers to cater to local tastes.

Automakers are seeking to mitigate the risks of globalization-induced overcapacity by building a new breed of highly efficient low-volume assembly plants that are easily expandable and very flexible in terms of product mix. The reduction of minimum scale economies is being facilitated by a strong move toward *modular assembly*, particularly among American and European automakers. The logic is that assembly plants can be smaller and simpler when vehicles consist largely of pre-assembled modules. When module sub-assembly is taken off-line, it becomes geographically and organizationally separable from the final assembly plant, making initial automotive assembly investments less "lumpy," and the "deverticalization" of the industry more viable.

Third, because globalization is occurring at the same time as increased outsourcing and a move to sourcing modules and systems, suppliers are taking a larger role in the globalization process. As a result, we are witnessing the *rise of the global supplier*. Companies like Bosch, Denso, Johnson Controls, Lear, TRW, Magna, and others have become the preferred suppliers for automakers around the world. Some automakers, particularly American firms, have combined the move to modularity with increased outsourcing, giving increased responsibility to first-tier suppliers for module design and second-tier sourcing. Many first tier suppliers have responded by embarking on a wave of vertical integration (through mergers, acquisitions, and joint-ventures) and geographic expansion to gain the ability to provide their customers with modules on a global basis. Thus we are seeing simultaneous trends toward deverticalization (by automakers) and vertical integration (among first tier suppliers) that—in combination with globalization—is helping to create a new global supply-base capable of supporting the activities of final assemblers on a worldwide basis. More than any other characteristic, it is the simultaneous geographic spread of the supply-base—alongside newly established assembly plants—that differentiates the current wave of international investment from those that the automotive industry has seen in the past.

One of the most interesting and important aspects of globalization is the ways in which automakers use first tier suppliers to spread the risk of new investments. First-tier suppliers are being asked to supply new offshore assembly plants locally, shouldering part of the burden of meeting local content requirements and the often onerous task of finding and developing local second- and third-tier suppliers. Automakers are asking suppliers to provide “the same part, for the same price, anywhere in the world.” These new demands are putting a great deal of pressure on the first-tier, which is responding with massive consolidation and rapid globalization. Global suppliers are growing to the point where operation are beginning to mirror automaker operations (control and development centralized in core locations and globally dispersed production). Accordingly, global suppliers are facing many of the same challenges that automakers are facing, especially overcapacity risks, coordination and control problems associated with large and spatially dispersed organizations, management of multiple joint-venture relationships, and operation within multiple sets of national and regional regulatory domains. However, because they are usually smaller than automakers, suppliers often lack the resources to effectively deal with these problems.

Two of the key findings of the report—the globalization of the supply-base and the increased use of low-cost locations such as Mexico for final assembly—pose serious risks for automotive sector employment in the developed economies. While the supply sector has been a source of dynamic job growth in the industry, jobs at non-captive supplier plants in the U.S. are more likely to be non-union and pay about 40% less than final assembly jobs. The rapid growth in output at final assembly plants in lower-cost locations such as Canada, Mexico and Spain have a direct displacing effect on assembly jobs in core locations. So, we should not let the modest aggregate employment effects to date mask the fact that globalization is creating new opportunities and vulnerabilities for working people from Detroit to Shanghai. Although jobs have not migrated away from the United States or other advanced industrial nations in massive numbers—yet—there is a growing reliance on lower-wage countries within North America and Europe. While market-seeking investments in places such as China and India do not pose an immediate threat to jobs in advanced countries—and may well have employment benefits for the short- and medium-terms—lower-wage peripheral countries like Mexico and Spain have become increasingly attractive sites for cost-cutting regional production schemes aimed at home markets. Although the negative impact of these shifts have so far been mitigated to some degree by the continued export of parts from home to host countries, we cannot turn a blind eye to the distinct possibility that negative employment impacts at home will become more pronounced as more production shifts to lower-cost locations and host country supply-bases increase their capabilities over time.

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1. Appendix A: List of Field Interviews and Factory Visits

Note: all interviews and factory visits were conducted between July, 1996 and April, 1998.

1.1 List of Interviews

AUTOMAKERS:

Chrysler Corporation, Detroit, MI, USA

Daimler-Benz (DB): Technology, Stuttgart, Germany

Ford Motor Company: HQ #1 , Detroit, MI, USA

Ford Motor Company: HQ #2 , Detroit, MI, USA

General Motors: Intl. Operations: Capacity Planning, Russelshiem, Germany

General Motors: Intl. Operations: Manufacturing, Zurich, Switzerland

General Motors: Intl. Operations: Portfolio Management, Zurich, Switzerland

General Motors: Intl. Operations: Power-train and Chassis, Zurich, Switzerland

General Motors: NAO: Employment and Training, Detroit, MI, USA

General Motors: NAO: Purchasing, Detroit, MI, USA

General Motors: NAO: Technical Center: Design, Detroit, MI, USA

General Motors: NAO: Technical Center: Economist, Detroit, MI, USA

General Motors: NAO: Technical Center: New Plants/China, Detroit, MI, USA

General Motors: NAO: Technical Center: Platform Design, Detroit, MI, USA

General Motors: Opal AG: Platform Design, Russelshiem, Germany

General Motors: Opal AG: Purchasing, Russelshiem, Germany

General Motors: Opal AG: Training, Russelshiem, Germany

Nissan Motor Corporation, Tokyo, Japan

Toyota Motor Corporation, Tokyo, Japan

Volkswagen AG (VW): Central Planning, Braunsweig, Germany

LARGE SUPPLIERS:

3M Automotive (3MA), Detroit, MI, USA

Denso Corporation, Ikeda, Japan

Federal Mogul (FM), Detroit, MI, USA

Freudenberg/NOK, Detroit, MI, USA

General Motors: Delphi, Detroit, MI, USA (telephone interview)

ITT Automotive (ITTA), Detroit, MI, USA

Lear Corporation, Detroit, MI, USA

Robert Bosch AG, Stuttgart, Germany

Siemens Automotive (SA), Regensberg, Germany

Siemens Automotive North America (SANA), Detroit, MI, USA

United Technologies (UT), Detroit, MI, USA

OTHER INTERVIEWS:

Japan Automobile Manufacturers Association (JAMA), Tokyo, Japan

United Auto Workers: Research Department, Detroit, MI, USA

IG Metall: Research Department, Frankfurt, Germany

Comments of Ronald Pendalfi: Globalization of R&D, Washington D.C. (telephone interview)

1.2 List of Assembly Plant Field Visits

Chrysler Corporation, St. Louis North Assembly Plant, Fenton, MO, USA (questionnaire only)

Chrysler Corporation, Toluca Car Assembly Plant, Toluca, Mexico

Daewoo Motors, Vietnam-Daewoo Motors Co., Hanoi, Vietnam

Daimler Benz, Mercedes-Benz Vietnam Ltd., Ho Chi Minh City, Vietnam

Dihatsu Automotive Corporation, Vietindo Dihatsu Automotive Corp., Hanoi, Vietnam

Ford Motor Company, Ford Vietnam Ltd., Hai Duong Assembly Plant, Hai Duong, Vietnam

Ford Motor Company, Hermosillo Assembly and Stamping Plant, Hermosillo, Mexico

Ford Motor Company, Wixom Assembly Plant, Detroit, MI, USA

Hino Motors, Hino Motors Vietnam, Hanoi, Vietnam (questionnaire only)

Honda of America, Marysville Auto Plant, Marysville, OH, USA (questionnaire only)

Isuzu Motors, Isuzu Vietnam Co., Ho Chi Minh City, Vietnam

Mitsubishi Corporation, Vina Star Motors, Ho Chi Minh City, Vietnam

Nissan Motor Corporation, Kyushu Assembly Plant, Fukuoka Prefecture, Japan

Toyota Motor Corp., Toyota Motors Vietnam, Me Linh Plant, Vinh Phuc Province, Vietnam

Toyota Motor Corporation, Takaoka Assembly Plant, Toyota City, Nagoya, Japan

Vietnam Motors Corporation, Hanoi, Vietnam

2. Appendix B: Field Research Instruments

2.1 Headquarters Interview Questionnaire

MASSACHUSETTS INSTITUTE OF TECHNOLOGY /CARNEGIE MELLON UNIV.
PROJECT ON GLOBALIZATION AND JOBS IN THE AUTOMOTIVE INDUSTRY
~HEADQUARTERS INTERVIEW QUESTIONS~

1. New Plants

(1) What is the step-by-step decision-making process for the establishment of new assembly plants?

(2) How important are the following factors in location decisions (please use examples):
- market characteristics (high rate of economic growth, low market penetration)?
- a "ticket to sell"?
- local content requirements?
- import tariffs and duties?
- currency fluctuations?
- equalization of trade flows?
- incentives by governments?
- unionization rates?
- raw material availability?
- existing component supply base?
- human resources of host countries?
- labor rates host countries?
- learning about the markets of host countries?
- others?

(3) Step-by-step, what is the procedure for the establishment of new assembly plants?

(4) How are new plants' attributes determined (e.g. (complete) knock-down vs. integrated, labor vs. capital intensive, many vs. few models, etc.)?

(5) Do you see global overcapacity as a coming problem for the automotive industry? If yes/no, why?
  (a) Do you see global overcapacity as a coming problem for your company? ? If yes/no, why?
  (b) How do concerns about overcapacity affect your global investment decision-making?

2. Offshore Plants Operations and Coordination

(1) Offshore knock-down (KD or CKD) kit assembly plants:
  (a) Are some of your vehicles assembled offshore from KD kits? If yes, which plants?
  (b) Who has operational control of the KD plants (headquarters, own subsidiaries, JVs, or contract manufacturers) and why?
  (c) What reasons are there to establish a KD facility and not an integrated one?
  (d) Is it a general strategy for KD plants to evolve into integrated plants? If yes/no, why?
  (e) Under what conditions would a KD plant evolve into an integrated plant?

(2) Offshore integrated production plants[12]:
   (a) Is operational control located at headquarters or at offshore plants?
   (b) Are some offshore assembly plants more capital intensive than others? If yes/no, why?
   (c) In what ways are offshore plants more or less advanced than domestic plants?
(3) Localization:
   (a) Do you try to increase local content over time? If yes, why?
   (b) How do you increase local content?
   (c) Are JVs effective means to increase local content?
   (d) Are suppliers effective means to increase local content?
(4) Global Coordination:
   (a) How are production schedules determined and balanced among plants in various places?
   (b) Are processes common among all of your worldwide assembly plants? If not, how do they differ?
   (c) Are efforts underway to commonalize processes among all of your worldwide assembly plants?
   (d) How is global sourcing balanced with the need to source locally?

3. Supplier Relations

(1) Cooperation with Suppliers:
   (a) Has your reliance on suppliers for design work increased? If yes/no, why and how?
   (b) Have you asked your suppliers to proceed with modularization? If yes/no, why?
   (c) How is modularization affecting your relationships with suppliers?
   (d) Do you want your suppliers to be captive? If yes/no, why?
   (e) Are you worried about technology or design leakage to competitors through your "independent" suppliers who are involved in design or technological development process for your firm as well as other firms?
   (f) Have you decided to develop in-house capability where you traditionally have relied on suppliers? If yes/no, why? If yes, how did this decision affect your relationships with the suppliers?
(2) Cooperation with Suppliers in Offshore Plants:
   (a) Have you asked your domestic suppliers to co-locate with your offshore assembly plants? If yes, why?
   (b) What kinds of components need to be manufactured or sub-assembled close to final assembly plants?
   (c) What kinds of components do not need to be manufactured or sub-assembled close to final assembly plants?
   (d) Would you prefer to use the same supplier in all of your worldwide plants manufacturing the same platform? If so, would you require the supplier to deliver the part for the same price in all locations?
   (e) Do you outsource more or less of a vehicle's parts in offshore plants as compared to domestic plants?

[12] Integrated facilities have a "free-flow" of parts to the final assembly facility. Parts are not shipped to the facility in "kits."

(f) Do suppliers help to meet local content goals? How?

4. Design

(1) Model Development, Selection, and Modification:

(a) How do you incorporate various needs of foreign markets into one design?
(b) Where is the primary design work conducted?
(c) What is the role of overseas design centers to develop the design?
(d) How do you modify the design to meet specific needs in foreign markets (give examples)?
(e) If designs are altered for local markets, where is this design work done?
(f) How do suppliers contribute to the process of redesign for foreign markets?

(2) The Commonalization of Vehicle, Component, and Process Design

(a) How common is re-engineering for foreign markets? Do you have any alternative to re-engineering (e.g. global design)?
(b) Do you promote or plan to promote commonalization of vehicle, component, and process design across various production locations? If yes/no, why?

5. Work-force

(1) Work-force Selection:

(a) How do you select your work-force for offshore plants?
(b) Do you use outside firms to help recruit and select the work-force for offshore plants?
(c) Do host governments help recruit and select the work-force for offshore plants? If so, how?
(d) What personal attributes are you looking for in offshore production workers?
(e) What is the composition of the initial team that is deployed to establish an offshore plant?

(2) Work-force Training and Organization:

(a) How do you train your work-force in foreign plants?
(b) Do host governments help with the training of your work-force in foreign plants?
(c) How do you manage the work-force in foreign plants (e.g. personnel management policy)?
(d) Is shop floor organization different in offshore plants than in domestic plants?
(e) Is shop floor organization different among offshore plants in various locations?
(f) Is an effort being made to rotate management among offshore and domestic plants?

(3) Work-force Localization:

(a) Do you try to localize your work-force in foreign plants? If so, why?
(b) What positions do you try to localize first, and how quickly is it done?
(c) What positions do you not try to localize?

2.2 Plant-level Questionnaire

3. Appendix C: List of Project Papers

3.1 Research Note #1: Globalization and Overcapacity in the Automotive Industry. Timothy Sturgeon

3.2 Research Note #2: Internationalization in the Automotive Industry: Motivations, Methods, and Effects. Teresa Lynch

3.3 Research Note #3: Does Globalization Improve Employment and the Quality of Jobs in India? Aya Okada

3.4 Research Note #4: The Automotive Industry In Vietnam: Prospects for Development in a Globalizing Economy. Timothy Sturgeon