Driving America's Renaissance

Human Resource Issues in Michigan's Automotive Industry

A Report for the
Michigan Automotive Partnership
and the
Michigan Jobs Commission

Office for the Study of Automotive Transportation
Transportation Research Institute
The University of Michigan

Driving America's Renaissance

Human Resource Issues in Michigan's Automotive Industry

a report for the

Michigan Automotive Partnership:
American Axle and Manufacturing, Inc.
APX International
Aztec Manufacturing
Chrysler Corporation
Ford Motor Company
Gilreath Manufacturing, Inc.
General Motors Corporation
Grand Haven Stamped Products
Kelsey Hayes Company
Prince Corporation
Lenawee Stamping Corporation

and the

Michigan Jobs Commission

Sean P. McAlinden
Brett C. Smith
David E. Cole
UMTRI - 95 - 37

Office for the Study of Automotive Transportation
Transportation Research Institute
The University of Michigan

This entire document is available on the world wide web at :

http://www.mjc.state.mi.us

TABLE OF CONTENTS

List of Figures

List of Tables

(THIS PAGE INTENTIONALLY LEFT BLANK)

Executive Summary and Acknowledgments

This report was commissioned by the Michigan Jobs Commission in August, 1994. It is part of an overall contract given to the Office for the Study of Automotive Transportation (OSAT) to assist the Jobs Commission in creating a special industry advisory body to be called the Michigan Automotive Partnership (MAP). Two sets of automotive firms were selected to participate in the MAP: the state's largest vehicle producing firms (the Big Three), and a representative group of automotive parts and engineering services supplier firms. The purpose of the MAP is to provide the Jobs Commission with real time communication with the state's critical automotive industry, especially on issues concerning structural change in the state's economic policy climate. The MAP is also meant to bring about close cooperation between the industry and the state in the area of human resource planning. This report represents the summary effort of the MAP in its first year of existence.

This report contains two sets of results. First, in section II, a special forecast of job openings at the Big Three is presented. This forecast was completed by OSAT with the assistance of the human resource planning departments of the three major vehicle companies. The Big Three supplied basic information or company forecasts of their expected attrition of employees in Michigan and the United States. OSAT developed an estimate of employment for 2003 to complete the forecast of job openings. The forecast contained in this study states that the Big Three automotive firms may hire up to 250,000 new employees in the United States during the period 1995-2003. Up to 129,000 of these hires should occur in Michigan if the state maintains its share of Big Three automotive activity.

The forecast of job openings set the stage for a compilation of direct industry input on automotive human resource issues in section III of this report. This section contains the consensus discussions of the MAP on such issues as technical labor needs, hiring criteria, the performance of Michigan's educational institutions, and recommendations for state human resource policies. The stated opinions and positions in section III reflect the direct input of over thirty company presidents and human resource executives. The information contained in Section III was reviewed at least twice by the participating MAP respondents.

The participating respondents from the MAP have willingly contributed their time and expertise to outlining the tasks ahead for Michigan's public institutions in education and jobs development. The statements and conclusions contained in section III of this

MAP report indicate an unequivocal desire to upgrade the quality of labor employed in Michigan's automotive industry. According to the MAP, the incentive now clearly exists for the state's educational institutions to reconnect with Michigan manufacturing. The most critical determinant of our state's automotive future will be the near and long term performance of its largest ongoing public investment — education.

Representatives of the MAP met with the Michigan Jobs Commission to review the contents of this report in mid-October 1995. At this meeting, it was agreed that the recommendations for state policies, listed at the end of the vehicle and supplier discussion sections in section III, should be subjected to further review by the MAP in the near future.

This report is the product of a true partnership. It represents the combination of the efforts and contributions, made over the period of twelve months, of over forty executives and staff members of nine Michigan automotive firms. Many of the participants are employees or managers of active adversaries in today's highly competitive world automotive industry. OSAT and the Michigan Jobs Commission deeply appreciate the generous contribution of these participants' valuable time and expertise. Their intentions in regard to this study were always focused on what is best for the automotive industry and the State of Michigan.

We must acknowledge the efforts and contributions of several OSAT staff. Diana Douglass contributed in a major way to the logistic coordination of the overall project and the creation of the report document. Chris Booms contributed heavily to the forecast analysis contained in section II, as well as to the production of the final report. We would also like to express our strong appreciation for the contributions, in data and time, given by Abel Feinstein of the Bureau of Research and Statistics at the Michigan Employment Security Commission. We would finally like to thank the Michigan Jobs Commission for the opportunity to carry out this project and wish them the best in their future efforts to improve the economic fortunes of the State of Michigan.

David E. Cole, Sean P. McAlinden and Brett C. Smith

I. Introduction

Michigan will soon celebrate the one hundredth anniversary of its special relationship with the automobile. The Michigan Department of Transportation states that the first automobile rolled on the streets of Detroit in March of 1896. However, a far more important event occurred in Detroit in 1899, when Ransom E. Olds founded the state's first commercial production site for automobiles. The following ten years saw the unprecedented rise of Michigan's mass production, automotive industry. By 1909, Michigan increased its share of national automotive production to 53 percent. By 1913, this U.S. percentage had risen to almost 80 percent.[1] Michigan's share of world production exceeded 60 percent as well on the eve of World War I. The creation of this special industry in Southeast Michigan by such pioneers as Ford, Durant, and the Dodge brothers is rightly considered by most historians as one of the most important economic events of the twentieth century.

Michigan's automotive industry produced over 3.4 million vehicles in 1994.[2] However, this impressive total represented only 31 percent of U.S. vehicle production, and only 6.5 percent of the almost 52 million vehicles built in forty-five countries around the world in 1994.[3] Almost five hundred thousand Michigan residents are directly employed by the automotive industry. However, Michigan's share of total world automotive employment is now less than 10 percent. The world auto industry, the largest manufacturing industry on earth, produces an annual value of one trillion dollars of vehicles and parts sourced from at least twenty-five major auto assemblers and three hundred thousand automotive supplier firms located across the globe. The rapid globalization of the world auto industry in the last fifteen years surely must match the historical significance of the first ten years of the industry's development in Michigan. In fact, Michigan's automotive workforce faces the prospect of competing with at least one new international competitor per year for years to come. Never has the state's premier industry faced such fierce and diversified competition.

Competition brings forth both challenges and opportunities. At the same time that Michigan's auto industry confronts ever increasing competition from new international

---

[1] James M. Rubenstein, *The Changing U.S. Auto Industry: A Geographical Analysis* (New York: Routledge, 1992), 27-41.

[2] Michigan Jobs Commission, Customer Assistance and Research Services, *Michigan Automotive Update*, (Lansing, Michigan: The Commission, April 1995).

[3] Crain Communications, *Automotive News 1995 Market Data Book* (Detroit: Crain Communications, 1995), 6.

producers, it faces new opportunities to participate in many growing world markets for vehicles and parts. These international markets will certainly grow faster in the years to come than the industry's primary sales venues of the past: the United States and Canada. In order to succeed in the future on a global basis, Michigan's auto industry must continue to quicken its efforts to improve productivity, quality, and technology in design and production. Above all, the state's auto industry must strive to both improve and manage its industrial competence. Not since the industry's origins will the talents and capabilities of Michigan's automotive human resources play such a critical role in the fortunes of its major companies.

Michigan's second automotive challenge and opportunity is the subject of this study, the first report commissioned by the Michigan Automotive Partnership (MAP). Commissioned in 1995, the MAP is a special panel, comprised of the state's three largest vehicle firms and eight representative auto supplier companies.[4] The members of the MAP have agreed to advise the Michigan Jobs Commission and the Governor on the state economic policies and conditions of the greatest significance to the auto industry. The activities of the MAP have been organized in its first year by the Office for the Study of Automotive Transportation (OSAT). Each year, the MAP will meet to decide on a special policy issue worthy of a special investigation or study to be submitted to the Michigan Jobs Commission. The issue chosen this year is the automotive human resource challenge.

This report will approach the future challenge in Michigan's automotive labor market in two ways. First, in section II, a special forecast of job openings at the state's largest vehicle producing firms (the Big Three) is presented. This forecast was completed by OSAT with the assistance of the human resource planning departments of the three major vehicle companies. The Big Three supplied basic information or company forecasts of their expected attrition of employees in Michigan and the United States. OSAT developed an estimate of employment in 2003 to complete the forecast of job openings. The forecast of job openings sets the stage for a compilation of direct industry input on automotive human resource issues in section III. This section contains the approved, consensus discussions of the MAP on such issues as technical labor needs, hiring criteria, the performance of Michigan's educational institutions, and recommendations for state human resource policies. The stated opinions and positions in section III reflect the direct input of over thirty company presidents and human resource executives. The information contained in section III was reviewed at least twice by the participating MAP respondents.

---

[4] The MAP was comprised of three vehicle producers and six auto supplier firms at the initiation of the study. Two additional Michigan supplier firms, Kelsey Hayes and American Axle, joined the MAP at the time of the study's conclusion. These two firms did participate in the final study review and discussion.

The special purpose of this report and its subsequent follow-up activities is to provide the Michigan Jobs Commission and the Governor of Michigan, with direct input and information from Michigan's auto industry that no other state or region in North America can or will receive. This should be the right of the undisputed birthplace and home of the United States motor vehicle industry. The MAP earnestly hopes that it can assist Michigan in its efforts to enjoy an even more successful second hundred years of automotive excellence.

(This page intentionally left blank)

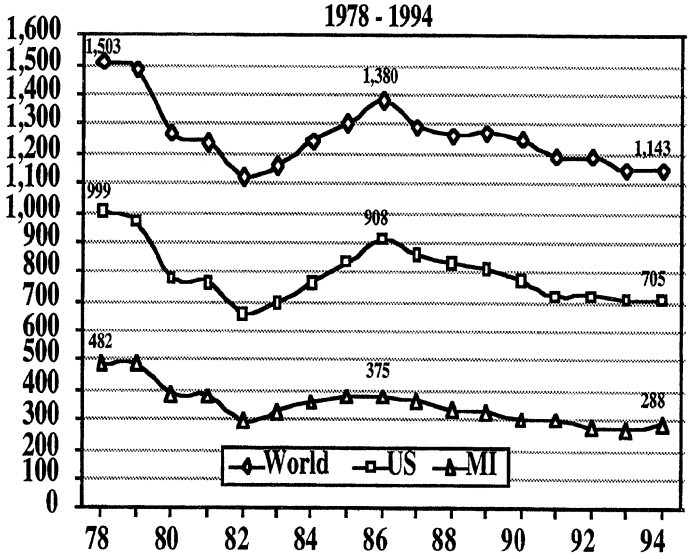
II. A Forecast of Big Three Hiring through 2003

Michigan's largest automakers have dominated the state's automotive and manufacturing employment for many years. This economic dominance has been reinforced by the relatively high levels of compensation earned by employees of the Big Three. Also, thousands of other Michigan manufacturing and service-producing jobs, outside of the Big Three, are directly dependent on the economic activities and fortunes of the state's largest auto producers. However, both Michigan's share of total Big Three employment and Big Three jobs as a proportion of total state manufacturing employment have declined in recent years. These developments are certainly consequences of globalization of the motor vehicle industry.

Figures II.1 and II.2 present information on Michigan's share of Big Three employment during 1978-1994. Total Big Three employment includes all employment at fully owned company subsidiaries, as well as general automotive employment. As shown in Figure II.1, worldwide employment at the Big Three declined from about 1.5 million in 1978 to 1.38 million in 1986. Employment then declined to a level of 1.14 million in 1994, a percentage decline of about 24 percent between 1978 and 1994. Big Three employment in the United States declined from about 999,000 in 1978 to 908,000 in 1986. U.S. employment then fell to a level of 705,000 by 1994, a percentage decline of about 30 percent between 1978 and 1994. In Michigan, Big Three employment first declined from 482,000 in 1978 to 375,000 in 1986, and then fell further to 288,000 in 1994. Total Big Three employment in Michigan, then, fell by about 40 percent between 1978 and 1994. Big Three employment declined by a greater percentage in Michigan than in the United States or worldwide from 1978 to 1994.

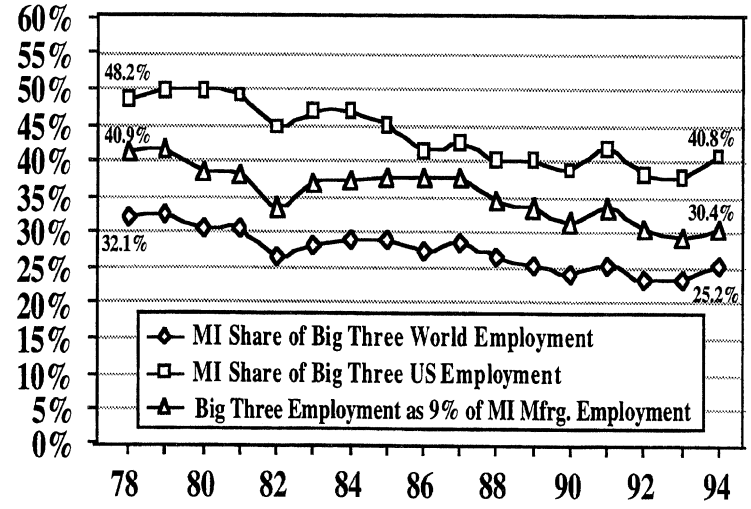
Figure II.2 shows Michigan's share of Big Three employment in the United States and worldwide during 1978-1994. As seen in this figure, Michigan's share of Big Three worldwide employment fell from about 32 percent in 1978 to 25 percent in 1994. Michigan's share of Big Three United States employment also fell from 1978 to 1994, from about 48 percent to 41 percent. Figure II.2 also shows the ratio of Big Three employment in Michigan to total Michigan manufacturing employment from 1978 to 1994. This ratio fell from about 41 percent in 1978 to 30 percent in 1994.

Figure II.1
Big Three Total Employment:
(including Subsidiaries)
1978 - 1994



Sources: Company Reports

Figure II.2
Michigan's Share of Big Three World and US Employment;
Michigan Big Three Employment as a % of Michigan
Manufacturing Employment



Sources: MESC, Company Report

Michigan's loss of Big Three employment and its declining share of total Big Three jobs can be attributed to several factors. To a certain extent, Michigan's falling share of Big Three total employment reflects major purchases of nonautomotive business concerns

by at least one of the Big Three during the mid-1980s. The employment decline also demonstrates an increased focus on global automotive sales and production by all three companies in recent years. Even more generally, the declines in employment can be attributed to the effects of severe international competition during the 1980s, and pressures on the Big Three to improve productivity in all operations to meet new challenges. Finally, a number of outside observers have noted a slow growth trend in sales of motor vehicles in the United States in recent years. Steady increases in productivity through restructuring and automation, matched against a flat trend in North America vehicle sales, provide a sufficient explanation for declining employment in the domestic operations of the Big Three auto producers.

It is believed that the Big Three have accomplished much of their employment restructuring since the mid-1980s through the natural attrition of employees. [5] Productivity improvements resulted in the replacement of only those employees who quit or retired in the case of two of the auto producers, and less than one-for-one replacement of leaves at the other producer. This pattern, it is thought, was especially prevalent in the case of hourly production employees. In order to accomplish restructuring goals, the companies reduced hiring of hourly employees to rates far below those in previous decades. As a result, the ratio of active employees to company retirees has fallen to unprecedented levels at all three companies.[6]

At least two of the auto firms significantly reduced domestic employment during 1979-1984 through a large indefinite layoff of production employees. These layoffs primarily affected employees with hire dates between 1973 and 1980 since production workers at the Big Three are laid off contractually by reverse seniority. Many of the laid off employees at these two firms were not recalled to the firms' employment. Production hiring at these same two firms was almost nonexistent between 1980 and 1984. The third firm has significantly reduced its United States automotive employment during the years 1985-1993 using a combination of layoffs, buyouts and retirement offerings. Thus, the ranks of employees, especially hourly workers, with low levels of service years were severely reduced during the 1980s. Consequently, since 1985, the domestic labor forces of all three companies have been largely composed of midlevel-seniority employees steadily moving towards near-term retirement.

---

[5] In the case of hourly workers, employment resizing at the Big Three through natural attrition was a direct consequence of contractual arrangements between the UAW and each of the Big Three regarding job security programs.

[6] In 1992, according to company sources, the count of hourly retirees reached 409,650. The Big Three carried 446,239 active hourly U.S. workers on their payroll in 1992.

Many of the conclusions stated above are suppositions, held to be true by many auto analysts and other researchers, but based on little hard evidence. If the suppositions regarding the age and seniority characteristics of Big Three employees are true, it would indicate that the companies are facing a formidable "retirement bubble" over the course of the next decade. Given recent gains in Big Three North American market share and production,[7] it must be true that the three companies will be forced to replace tens of thousands of retiring production and salaried employees (generally with hire dates previous to 1973) during the period 1995-2003. This would be the case even if Big Three labor productivity grew at a fairly impressive rate through 2003.

It is the purpose of this report to investigate the prospects of a future Big Three retirement bubble and a related increase in replacement hiring by the Big Three in the United States and Michigan. In order to accomplish this goal, a projection of permanent leaves[8] at the Big Three during the years 1995-2003 is estimated, and then combined with a forecast of Big Three total employment in the terminal year. The change in Big Three employment during the period 1994-2003 is added to the accumulation of current employees who will leave through 2003. The result provides a reasonable estimate of the number of job vacancies that will appear at Big Three facilities in the course of the next nine years.

Attrition or Permanent Leaves at the Big Three: 1995-2003

Government Information

State and federal labor researchers have noted the relatively high average age of employees in the motor vehicle industry. In a recent report on occupational projections by industry, the United States Department of Labor's Bureau of Labor Statistics (BLS) noted that:

> Compared to other industries, workers in motor vehicle and equipment manufacturing are somewhat older than average. In 1992, the average age was 41.6 years, compared to 37.6 years for all workers.[9]

---

[7] The market share of the U.S. light vehicle market for Big Three vehicles assembled in Big Three U.S. and Canadian assembly plants reached an all post war low of 65 percent in 1991. The U.S. market share for such vehicles averaged 70.7 percent in the first six months of 1995.

[8] Permanent leaves are defined as employees who permanently leave Big Three employment because they voluntarily quit or retired or due to serious illness or death.

[9] U.S. Department of Labor, Bureau of Labor Statistics, *Career Guide to Industries, Bulletin 2453* (Washington: Government Printing Office, December 1994.), 60.

In fact, only seven of the eighty-one other "3-digit" manufacturing industry groups tracked by the BLS were found to have a labor force as old or older than motor vehicle and equipment manufacturing in 1992-1993. On the subject of future employment, the BLS adds that:

> Employment in the motor vehicle and equipment manufacturing industry is expected to decline by 6 percent, or 50,000 jobs, over the 1992-2005 period. Nevertheless, the need to replace workers who transfer to jobs in other industries or stop working will result in many job openings. This is especially true in motor vehicle and equipment production, where nearly a quarter of the workforce is over fifty years old.[10]

The Office for Research and Statistics at the Michigan Employment Security Commission (MESC) has also closely tracked the changing age demographics of the motor vehicle industry in Michigan. In a recent special report on the subject of future industry hiring the MESC noted that:

> The average age of auto industry jobholders in Michigan has increased from thirty-eight years in 1980 to forty-two years in 1993. There are several reasons for this upward trend. Because the 1980s were a period of employment retrenchment, few new workers were hired. Older workers were less subject to layoff, as a result of seniority provisions. In addition, production worker turnover has been very low because the auto industry offers such superior wages and benefits.[11]

The Current Population Survey (CPS) performed by the United States Bureau of the Census is used to generate age distributions for individuals who report themselves as employed in the motor vehicle industry. These would include employees of not only the Big Three, but also individuals who work for independent auto suppliers or in firms in other industries, including service firms, that primarily work for the auto industry. A 1980-1981 and 1992-1993 distribution for the industry was obtained from the BLS,[12,13]

---

[10] Ibid., 63.

[11] Michigan Employment Security Commission, *Research/Statistics, Special Report, Auto Industry Employment* (Detroit: The Commission, August 8, 1995), 5.

[12] U.S. Department of Labor, Bureau of Labor Statistics, *1992 Current Population Survey Annual Average Data - Selected Characteristics* (Washington: Government Printing Office, 1995).

[13] U.S. Department of Labor, Bureau of Labor Statistics *1980 Current Population Survey Annual Average Employment and Age Distribution, by Detailed Industry -- Both Sexes Characteristics* (Washington: Government Printing Office, 1995).

and a 1992-1993 distribution for the industry in Michigan was obtained from the MESC.[14] The results are condensed into three age groups and shown in table II.1.

Table II.1

CPS Age Distributions of Employees in the Motor Vehicle and Equipment Manufacturing Industry

Age	1980 Employ. (1,000s)	1980 % distn	1980 cum. %	1993 Employ. (1,000s)	1993 % distn.	1993 cum. distn. %
U.S.						
16-29	302	25.8	25.8	202	17.3	17.3
30-44	478	40.8	66.6	509	43.6	60.9
45+	391	33.4	100.0	456	39.1	100.0
Total*	1171	100.0		1167	100.0	
Mich.						
16-29	106	23.6	23.6	50	13.0	13.0
30-44	188	41.8	65.4	169	43.8	56.8
45+	156	34.7	100.0	167	43.3	100.0
Total*	450	100.0		386	100.0	

** sums may not match totals due to rounding.*

Remarkably, the percentage of U.S. motor vehicle industry employees who were age forty-five or older did not increase substantially between 1980 and 1993. This could reflect significant hiring by independent suppliers who opened many new facilities in the southeast region of the United States during these years, and who now perform manufacturing work once carried out within Big Three parts facilities (outsourcing).[15] Also, many new foreign owned automotive facilities, staffed by new hires, were started in the United States during the 1980s.[16] Nevertheless, the *number* of U.S. workers, age forty-five or older, increased by 65,000 between 1980 and 1993. In Michigan, over 43 percent of those who reported working in the auto industry were age forty-five or older in 1992-1993. This group of 167,000 Michigan automotive employees comprised almost 37 percent of auto workers 45 years or older in the United States.

---

[14] Michigan Employment Security Commission, Research/Statistics, *1992-1993 Average, Motor Vehicles and Equipment Industry Employment by Age Group, by Occupational Group.* Detroit, Michigan, July 31, 1995.

[15] See OSAT analysis contained in Sean P. McAlinden and Brett C. Smith, *The Changing Structure of the U.S. Automotive Parts Industry* (Washington, D.C.: U.S. Department of Commerce, Economic Development Administration, February 1993).

[16] Ibid., 37-49.

The MESC special report attempts to "control" CPS age-distribution results for Michigan for the "latest Michigan combined Big Three job totals." Based on their analysis, the MESC estimates that there are "approximately 98,000 Big Three auto company employees who are fifty years of age or older." The 1995 MESC analysis concludes that "a range of 90-100 thousand new hires (in Michigan) by the Big Three companies over the next decade appears reasonable."[17]

Company Information

In order to prepare an estimate of attrition of Big Three United States and Michigan employees for the 1995-2003 period, OSAT requested the direct assistance of the companies' employment and human resource planning departments or offices. Two types of information were requested. First, the offices were asked to provide the following current and historical demographic information on their United States and Michigan automotive (excluding subsidiaries) labor forces:

Requested Demographic Information on Big Three United States and Michigan Automotive Employees

- **1985 and 1995 Age and Service Years Distributions (5-year cohorts), Mean and Medians:**
  - ⇒ **Salaried employees (engineers/technicians, other salaried)**
  - ⇒ **Hourly Employees (skilled trades, other hourly)**
- **Historical Attrition, 1985-1994:**
  - ⇒ **Salaried employees**
  - ⇒ **Hourly employees**
- **Historical Employment, 1985-1994:**
  - ⇒ **Salaried Employees**
  - ⇒ **Hourly Employees**

The demographic information was provided by the companies to OSAT during the period April through September 1995. The 1995 distributions reflected current numbers for the month the information was delivered to OSAT. The most troublesome data collection problem occurred in the area of salaried employees. All three companies have changed their classifications for engineers and technicians in recent years. Also, address

[17] Michigan Employment Security Commission, *Research/Statistics, Special Report, Auto Industry Employment* (Detroit: The Commission, August 8, 1995), 6.

problems and other technical database changes made the information about salaried employees difficult to obtain.

Table II.2a-d shows combined distributions, for United States and Michigan automotive employment, for the various categories of hourly and salaried Big Three employees in 1995. The last column of each section of table II.2 shows a combined distribution of salaried and hourly employees. The average age of a Big Three employee in the summer of 1995 was 44.7 years. The average age of skilled trades workers was about 46.8 years and that for engineers and technicians about 41.1 years. The total number of Big Three employees older than fifty years in 1995, was about 31 percent. The number of Michigan Big Three employees (about the same percentage) older than fifty years in 1995 was 82,059, a somewhat lower figure than that cited previously in the MESC white paper.

The distributions by years of service shown in tables II.2b and II.2d are especially relevant to the purposes of this study. Forty-nine percent of Big Three employees had accumulated over twenty years of company service by the summer of 1995. Over 52 percent of Big Three hourly workers had accumulated more than twenty years of service. In Michigan, the percentage of hourly workers with over twenty years of service rises to almost 55 percent. Hourly workers, of course, can generally retire with a full pension at thirty years of service, although they are not required to do so. In contrast, only 16 percent of Big Three employees had accumulated six through fifteen years of service by 1995. Only 11 percent of Michigan hourly workers fell into this category. In 1985, almost 37 percent of Big Three workers, and 39 percent of Michigan hourly workers had six to fifteen years of service (1985 distributions shown in Appendix 1). These numbers would indicate that the attrition of Big Three employees will rise dramatically over the next ten years.

Table II.2b shows about 89,000 Big Three employees (58,000 hourly workers) with five years or less company service in 1995. This indicates an impressive rate of hiring by the Big Three (especially by two of the firms) in the last five years.

Table II.2a

Big Three 1995 - Age Distribution - United States

Age	Hourly Trades	Hourly Non-trades	Hourly Total		Salaried Eng./Tech.	Salaried Other	Salaried Total		Total Hourly & Salaried	
18-20	4	2,275	2,279	0.5%	9	141	150	0.1%	2,429	0.4%
21-30	1,700	28,499	30,199	6.8%	9,558	8,504	18,062	13.2%	48,261	8.3%
31-40	14,637	69,951	84,588	19.1%	15,779	19,370	35,149	25.6%	119,737	20.6%
41-50	37,995	146,734	184,729	41.7%	14,572	32,491	47,063	34.3%	231,792	40.0%
51-60	31,511	88,840	120,351	27.2%	10,216	23,415	33,631	24.5%	153,982	26.5%
61-65	5,798	11,366	17,164	3.9%	987	1,746	2,733	2.0%	19,897	3.4%
65+	1,259	2,139	3,398	0.8%	169	307	476	0.3%	3,874	0.7%
Total	92,904	349,804	442,708	100.0%	51,290	85,974	137,264	100.0%	579,972	100.0%
Average Age	**46.8**	**44.7**	**45.1**		**41.1**	**44.5**	**43.3**		**44.7**	

Table II.2b

Big Three 1995 - Service Distribution - United States

Service Years:	Hourly Trades	Hourly Non-Trades	Hourly Total		Salaried Eng./Tech.	Salaried Other	Salaried Total		Total Hourly & Salaried	
0-5	7,780	50,380	58,160	13.1%	15,978	15,045	31,023	22.6%	89,183	15.4%
6-10	7,918	18,240	26,158	5.9%	8,631	11,313	19,944	14.5%	46,102	7.9%
11-15	9,579	23,589	33,168	7.5%	5,162	7,791	12,953	9.4%	46,121	8.0%
16-20	19,511	74,704	94,215	21.3%	6,091	14,119	20,210	14.7%	114,425	19.7%
21-25	15,683	70,275	85,958	19.4%	5,879	14,501	20,380	14.8%	106,338	18.3%
26-30	18,717	86,445	105,162	23.8%	6,100	16,824	22,924	16.7%	128,086	22.1%
31-35	9,498	19,926	29,424	6.6%	2,443	4,824	7,267	5.3%	36,691	6.3%
36+	4,218	6,245	10,463	2.4%	1,006	1,557	2,563	1.9%	13,026	2.2%
Total	92,904	349,804	442,708	100.0%	51,290	85,974	137,264	100.0%	579,972	100.0%
Average Service	**20.1**	**19.2**	**19.4**		**13.8**	**17.5**	**16.1**		**18.6**	

Table II.2c

Big Three 1995 - Age Distribution - Michigan

Age:	Hourly Trades	Hourly Non-Trades	Hourly Total		Salaried Eng./Tech.	Salaried Other	Salaried Total		Total Hourly & Salaried	
18-20	3	902	905	0.5%	2	86	88	0.1%	993	0.3%
21-30	930	10,761	11,691	6.1%	7,552	4,993	12,545	13.3%	24,236	8.4%
31-40	7,816	31,538	39,354	20.4%	12,541	12,865	25,406	26.9%	64,760	22.5%
41-50	19,200	64,399	83,599	43.3%	10,956	20,796	31,752	33.6%	115,351	40.1%
51-60	15,299	33,619	48,918	25.4%	7,772	14,596	22,368	23.7%	71,286	24.8%
61-65	2,492	4,386	6,878	3.6%	826	1,132	1,958	2.1%	8,836	3.1%
65+	593	977	1,570	0.8%	147	220	367	0.4%	1,937	0.7%
Total	46,333	146,582	192,915	100.0%	39,796	54,688	94,484 94,484	100.0%	287,399	100.0%
Average Age	**46.6**	**44.6**	**45.1**		**41.0**	**44.2**	**42.8**		**44.3**	

Table II.2d

Big Three 1995 - Service Distribution - Michigan

Service Years:	Hourly Trades	Hourly Non-Trades	Hourly Total		Salaried Eng./Tech	Salaried Other	Salaried Total		Total Hourly & Salaried	
0-5	3,544	19,481	23,025	11.9%	13,029	9,606	22,685	24.0%	45,710	15.9%
6-10	3,024	6,446	9,470	4.9%	6,833	7,138	13,971	14.8%	23,441	8.2%
11-15	4,008	8,118	12,126	6.3%	3,802	4,450	8,252	8.7%	20,378	7.1%
16-20	9,656	33,189	42,845	22.2%	4,535	9,224	13,759	14.6%	56,604	19.7%
21-25	7,654	31,550	39,204	20.3%	4,310	9,248	13,558	14.3%	52,762	18.4%
26-30	10,716	37,293	48,009	24.9%	4,571	10,788	15,359	16.3%	63,368	22.0%
31-35	5,608	8,379	13,987	7.3%	1,911	3,119	5,030	5.3%	19,017	6.6%
36+	2,123	2,126	4,249	2.2%	805	1,065	1,870	2.0%	6,119	2.1%
Total	46,333	146,582	192,915	100.0%	39,796	54,638	94,484	100.0%	287,399	100.0%
Average Service	**20.5**	**19.2**	**19.6**		**13.4**	**17.4**	**15.8**		**18.3**	

Table II.3							
Big Three Historical Attrition: 1985 - 1994							
United States Permanent Leaves				**Michigan Permanent Leaves**			
	Hourly	Salaried	Total		Hourly	Salaried	Total
1994	24,456	4,102	28,558	1994	11,187	2,646	13,833
1993	22,266	7,234	29,500	1993	10,273	4,291	14,564
1992	22,922	11,520	34,442	1992	10,334	6,451	16,785
1991	24,708	9,576	34,284	1991	10,685	5,589	16,274
1990	23,971	7,341	31,312	1990	10,637	4,064	14,701
1989	25,439	2,501*	27,940*	1989	10,774	1,608*	12,382*
1988	25,680	3,634*	29,314*	1988	10,841	2,323*	13,164*
1987	27,161	4,000*	31,161*	1987	11,954	2,529*	14,483*
1986	26,436	3,186*	29,622*	1986	11,982	2,165*	14,147*
1985	24,907	2,061*Δ	26,968*Δ	1985	11,252	1,364*Δ	12,616*Δ
Total	247,946	55,155	303,101	Total	109,919	33,028	142,947
Excludes Chrysler Salaried 1985Δ and GM Salaried prior to 1990*.							

Table II.3 contains combined totals for Big Three permanent leaves during the period 1985-1994. However, only hourly figures in this table are complete, since two of the firms supplied incomplete figures for salaried attrition during this period. Total U.S. hourly employment in 1985 was 623,133. This total had dropped to 442,708 by 1995, a decline of 180,425. Total permanent leaves of hourly workers during this period numbered 247,946, or about 39 percent of 1985 employment. Perhaps 68,000 of the 248,000 leaves were replaced, or about 27 percent. The number of actual hires was certainly higher than 68,000 during this period because of a high natural leave rate for new hires. Given the large number of low seniority employees present in 1995, it is also clear that the majority of replacement hires have been made in the last five years.

Company Forecasts of Attrition

OSAT also requested that the companies provide detailed forecasts of their expected permanent leaves (quits and retirements) for the 1995-2003 period. Forecast attrition was requested for salaried employees, separately for engineering and nonengineering classifications, and for hourly workers, broken out by skilled trades and an "all other" classification. A separate forecast for Michigan was also requested for each of these four occupational groups. OSAT opted to use firm generated forecasts because of the specific experience possessed by the three company human resource staffs working with this information.

Two of the companies were able to provide forecasts of future attrition. One company produced a detailed forecast through 2003, the other firm a detailed forecast for the 1995-2000 period. The third company did not produce a forecast of its future permanent leaves. This incomplete response was anticipated, and was a major reason for requesting the historic demographic information. That information was used to estimate detailed attrition for the firm that did not produce a forecast, and was also used to complete an attrition forecast through 2003 for another firm. These supplementary estimations involved a computation of leave rates based on a comparison of the 1985 and 1995 service-years distributions by occupational category. The leave rates were applied to companies' 1995 employee distributions. The firm that did not supply a forecast was asked to review OSAT estimation of future attrition of their labor force. Adjustments were suggested by the company's human resource staff and were used to modify our results.

The results of the combined Big Three/OSAT estimation of permanent leaves for the 1995-2003 period are shown in detail in table II.4.

Table II.4

Total Big Three Forecast Attrition or Permanent Leaves during 1995 - 2003

	U.S.	MICHIGAN
Total	**241,969**	**122,195**
Hourly	*190,827*	*86,766*
Trades	37,886	20,580
Other	152,941	66,186
Salaried	*51,142*	*35,429*
Engineers/Tech.	14,167	11,256
Salaried/Other	36,975	24,173

The forecast of 190,827 permanent leaves of Big Three hourly workers during the years 1995-2003 is actually lower than the company-reported, historic total of 248,000 hourly leaves for 1985-1994 shown in table II.3. Yet the forecast total for 1995-2003 represents about 43 percent of the current (summer 1995) Big Three hourly count of 443,000. That percentage can be compared to an attrition ratio of 39 percent of 1985 hourly employees during the period 1985-1994. Also, the forecast was made for a nine-year period rather than the ten-year total shown in table II.3. Finally, it is expected that a greater percentage of leaves will be replaced in the next nine years than was the case during the 1985-1994 period. In order to make this projection, which leads to a forecast of

expected Big Three hiring, a forecast of future Big Three employment in the United States is presented below.

Big Three Employment and Employment Change: 1994-2003

A number of state and federal agencies regularly forecast employment in the United States motor vehicle and equipment industry. However, except within the individual companies, reliable projections of future Big Three employment are unavailable. The purpose of the following OSAT forecast of Big Three automotive employment is to simply provide a reasonable benchmark against which the attrition totals shown above in table II.4 can be gauged. The employment forecast is also needed to estimate potential Michigan hiring[18] by the state's largest automotive producers through 2003.

Seven major sets of assumptions are made to inform our forecast of future Big Three employment. In general, these assumptions concern future output, sourcing, productivity, and occupational structure of the Big Three in the United States during the years 1994-2003. A major purpose of this modeling effort is to provide a transparent forecast method, amendable to changes in major assumptions by policymakers and others with different expectations regarding the future. Six of our major assumptions are listed in table II.5 and are described below.

[18] We will refer to future Big Three "hiring" and "job openings" variously throughout the remainder of this section. Because the Big Three attrition forecast includes employees who are hired and also leave during the 1995 - 2003 time period, job openings and hires can be taken as equivalents.

Table II.5

Employment Forecast Assumptions

1. Actual and forecast North American Big Three Vehicle Production

	Car	Truck	Total
1994 Actual	6,190,000	6,200,000	12,390,000
2003-1	6,670,000	6,182,000	12,852,000
2003-2*	7,196,000	6,552,000	13,748,000

*assumes 5% market share gain

Source: Delphi VIII, 1st round, Question 31.

2. U.S. Sourcing

Assembly:

Car	0.776
Truck	0.813
Engines*	0.828
Transmissions	0.792

Source: 1994 sourcing from Harbour Report 1995

*Adjusted by OSAT for engine sourcing change through 2003.

3. Vehicle Content: 1994-2003

14.51% value increase in car assembly

16.28% value increase in truck assembly

15.36% value increase in operations

Source: Delphi VIII, 1st round, Questions 13, 32 and 33.

4. 2003: Best Practice Assumptions, Major Operations

Assembly:	1994	2003
Cars	81.2 per employee	88.8 per employee
Trucks	83.1 per employee	90.9 per employee
Engines*	411.4 per employee	450.0 per employee
Transmissions*	391.3 per employee	428.0 per employee
Stampings**	269.0 per employee	294.2 per employee

*Components **North American vehicles assembled

Source for 1994 Best Practice: Harbour Report

5. Parts Ratios

Assumption: Annual average labor productivity growth of 2.4% during 1994-2003

Source: U.S.DOL, BLS, Monthly Labor Review, 8-95, p. 10.

1994	87.29 North American vehicles per parts employee
2003	108.06 North American vehicles per parts employee

6. Other Automotive Employment

Assumption: Annual average labor productivity growth of 2.4% during 1994-2003

Source: U.S.DOL, BLS, Monthly Labor Review, 8-95, p. 10.

1994	70.99 North American vehicles per other automotive employee
2003	87.88 North American vehicles per other automotive employee

Output, Sourcing and Content

Results from the first round of OSAT's major survey product, *DELPHI VIII, Forecast and Analysis of the North American Automotive Industry* (DELPHI VIII),[19] were used to project future Big Three vehicle production in the forecast model. Question thirty-one of our marketing volume asked respondents to forecast Big Three passenger car and light truck sales in the United States and Canada in 2000 and 2005. The median responses to these forecast years were averaged and used to estimate Big Three North American vehicle production in 2003.[20] We added additional production figures for Big Three sales in Mexico. To do this, we simply assumed a Mexican market of 500,000 (66.2 percent car and 33.8 percent truck sales) vehicle sales. Big Three 1994 car and truck market shares in Mexico were applied to this expected Mexican sales total to complete our analysis of future Big Three vehicle production in North America.

We developed two production scenarios for 2003, the end year in the forecast. Our first vehicle-production scenario, which assumes constant market share, calls for the Big Three to assemble 12.85 million vehicles in North America in 2003, compared to a production total of 12.39 million vehicles in 1994. This projection is labeled scenario 2003-1 throughout the analysis. A second output scenario calls for the Big Three to improve their North American market share from 71.7 percent of North American vehicle sales in 1994 to 76.7 percent in 2003, a gain of five full percentage points. This scenario is labeled 2003-2 and results in an estimated Big Three North American vehicle production total of 13.75 million. The two production scenarios are shown on table II.5 (assumption 1).

Our second set of output assumptions concerns U.S. sourcing of vehicles, engines and transmissions. Sourcing ratios for U.S. vehicles, engines, and transmissions were computed using production figures for U.S. Big Three plants found in *The Harbour Report 1995*.[21] Sourcing ratios are U.S. production totals as shares of Big Three North American vehicle production. We assume that the 1994 sourcing ratios will apply to 2003 except in the case of engines. We increase the 1994 sourcing ratio for engines to a higher figure to allow for several announced replacements of high-volume, imported engine types by two of the Big Three firms. The sourcing ratios are applied to total Big Three North American

---

[19] David E. Cole et al., *Delphi VIII, Forecast and Analysis of the North American Automotive Industry. 3 Vols.* (Ann Arbor: University of Michigan Transportation Research Institute, Office for the Study of Automotive Transportation, 1996). The major reason for our selection of the forecast time period, 1995-2005, was the availability of Delphi VIII results pertaining to this period.

[20] See *Appendix D* of *Delphi VIII, Marketing Volume, Round 2 results, Question 31* on Big Three passenger and truck sales in the United States and Canada..

[21] Harbour and Associates, *The Harbour Report 1995* Troy, Michigan: Harbour and Associates, 1995).

production to project U.S. production for car and truck assemblies, engines and transmissions. The vehicle-, engine-, and transmission- sourcing ratios are shown in table II.5 (assumption 2).[22]

The average value or content of vehicles is assumed to be higher in 2003 than in 1994. The content increase is assumed to require a directly proportional labor increase as a result of the added complexity. We base this general increase in value on additional results from questions thirteen, thirty-two and thirty-three in our marketing volume of DELPHI VIII.[23] The questions ask DELPHI VIII respondents to estimate the average real increase in list prices during the period 1994-2005 for a range of car and light-truck segments, and to estimate the relative size of these segments by 2000-2005. Separate adjustments were made to the value of car and light-truck assemblies (14.5 percent for cars and 16.3 percent for light trucks), and a general increase of about 15.4 percent was applied to the value of components, parts and other automotive activity in the productivity analyses described below. The vehicle content or value increases for 1994-2003 are shown in table II.5 (assumption 3).

Best Practice Productivity in 2003 —Major Operations: Assembly, Engines, Transmissions and Stamping.

The model of Big Three employment is separable and additive for the sake of simplicity and because certain types of information regarding Big Three operations were unavailable. We estimate future Big Three employment separately for major operations in vehicle assembly, engine production, transmission production, and stamping. It is understood that productivity changes in operations are not independent in effect. Many manufacturing experts believe that improved productivity in one area of operations can lead to efficiency gains upstream and downstream from a single stage of production. However, the physical information is unavailable, at this time, to estimate interdependent effects. Employment in other automotive activities such as parts manufacturing, central administration, parts distribution, and vehicle engineering are estimated together using a different method from that for major production operations.

OSAT used information contained in *The Harbour Report 1995* on plant output and employment by company to determine best practice in major operations. Each firm contributed at least one 1994 best-practice ratio to our estimate of industry productivity in

---

[22] See *Appendix C* of Delphi VIII for a description of the engine sourcing changes.

[23] See *Appendix D* of *Delphi VIII, Marketing Volume, Round 2 results, Questions 13, 32, 33*; on change in vehicle content/value through 2003.

major operations. We assume equivalent best practice in major operations will be attained by all three companies in 2003. We assume that in the long run, competition will induce each firm to adopt industry best practice in each area of operations. If differences in productivity between firms continue to exist, we assume that market shares will adjust accordingly until best-practice is attained. Section four of table II.5 shows our best practice assumptions for each major area of operations.

An example of our best practice method is that for car assembly. First, 1994 U.S. passenger car production was totaled by company and divided by company total employment in car assembly plants.[24] This produced three separate company ratios of cars assembled per assembly employee. The highest ratio was determined to be "best practice." The best practice ratio was increased at a rate of 1 percent per year for 1994-2003 to determine standard employment productivity in car assembly in 2003. The 2003 ratio, 88.81 cars per assembly employee, was applied to total expected U.S. car production, adjusted for an increase in value (a U.S.-build total of 5,926,946 in 1994 units)[25] to estimate an employment total of 66,739 for scenario 1 Big Three U.S. car assembly plants in 2003. The same method was used to estimate future truck assembly employment.

Table II.6 shows separate results of our estimates of future U.S. car and truck assembly employment. The Big Three employed 148,847 employees in their U.S. assembly plants in 1994. Our scenario 1 estimate of Big Three assembly employment is 131,017, a decline of 17,830. However, our scenario 2 estimate of U.S. assembly employment is 140,128, or a decline of just 8,719. As stated, this scenario assumes a Big Three North American market share gain of 5 percentage points. Change in Michigan assembly employment was estimated by applying the same percentage changes computed for U.S. car and truck assembly employment during 1994-2003 to 1994 Michigan employment. Table II.7 shows 52,280 employees in their Michigan car and truck assembly plants in 1994. Our scenario 1 estimate of Michigan Big Three assembly employment is 45,981, and our scenario 2 estimate is 49,274.

[24] We did not adjust for the obvious, heavy use of overtime in U.S. assembly operations in 1994.

[25] Scenario 1 forecasts a Big Three North American production total of 6.67 million passenger cars. We assumed that 77.6% of these cars, 5.18 million, would be assembled in U.S. plants. We also assumed that the content/value of these vehicles would increase by 14.51%. The 1994 equivalent U.S. production build total would be 5.926 million, 23.7% higher than that for 1994.

Table II.6

Big Three U.S. Forecast Employment - 2003

	Total Employment	Hourly Employment	Salaried Employment
Car Assembly:			
1994 actual	76,089	70,173	5,916
2003-scenario 1	66,739	61,550	5,189
2003-scenario 2	72,002	66,404	5,598
Truck Assembly:			
1994 actual	72,758	66,779	5,979
2003-scenario 1	64,278	58,996	5,282
2003-scenario 2	68,126	62,527	5,598
Total Assembly			
1994 actual	***148,847***	***136,952***	***11,895***
2003-scenario 1	***131,017***	***120,546***	***10,471***
2003-scenario 2	***140,127***	***128,931***	***11,197***
Engine:			
1994 actual	26,172	23,413	2,759
2003-scenario 1	27,267	24,393	2,874
2003-scenario 2	29,168	26,093	3,074
Transmissions:			
1994 actual	26,483	23,954	2,529
2003-scenario 1	27,437	24,817	2,620
2003-scenario 2	29,350	26,547	2,803
Stamping:			
1994 actual	53,126	47,920	5,206
2003-scenario 1	50,394	45,455	4,939
2003-scenario 2	53,907	48,624	5,283
Operations Subtotal			
1994 actual	***254,628***	***232,246***	***22,382***
2003-scenario 1	***236,115***	***215,361***	***20,755***
2003-scenario 2	***252,552***	***230,353***	***22,199***
Parts:			
1994 actual	141,939	124,253	17,686
2003-scenario 1	137,205	120,109	17,096
2003-scenario 2	146,771	128,483	18,288
Other:			
1994 actual	174,634	54,765	119,869
2003-scenario 1	168,810	52,939	115,871
2003-scenario 2	180,579	56,630	123,949
Grand Total:			
1994 actual	***571,201***	***433,313***	***137,888***
2003-scenario 1	***542,130***	***411,260***	***130,870***
2003-scenario 2	***579,902***	***439,913***	***139,998***

Table II.7

Big Three Michigan Forecast Employment - 2003

	Total Employment	Hourly Employment	Salaried Employment
Car Assembly:			
1994 actual	32,436	29,914	2,522
2003-scenario 1	28,450	26,238	2,212
2003-scenario 2	30,694	28,307	2,386
Truck Assembly:			
1994 actual	19,844	18,213	1,631
2003-scenario 1	17,531	16,091	1,441
2003-scenario 2	18,581	17,054	1,527
Total Assembly			
1994 actual	***52,280***	***48,127***	***4,153***
2003-scenario 1	***45,981***	***42,329***	***3,653***
2003-scenario 2	***49,274***	***45,361***	***3,913***
Engine:			
1994 actual	14,392	12,875	1,517
2003-scenario 1	14,994	13,414	1,580
2003-scenario 2	16,039	14,349	1,691
Transmissions:			
1994 actual	12,688	11,476	1,212
2003-scenario 1	13,145	11,890	1,255
2003-scenario 2	14,062	12,719	1,343
Stamping:			
1994 actual	26,477	23,882	2,595
2003-scenario 1	25,115	22,654	2,461
2003-scenario 2	26,866	24,233	2,633
Operations Subtotal			
1994 actual	***105,837***	***96,534***	***9,303***
2003-scenario 1	***99,236***	***90,513***	***8,723***
2003-scenario 2	***106,241***	***96,903***	***9,339***
Parts:			
1994 actual	62,399	54,081	8,318
2003-scenario 1	60,318	52,278	8,040
2003-scenario 2	64,523	55,922	8,601
Other:			
1994 actual	133,350	41,819	91,531
2003-scenario 1	128,903	40,424	88,479
2003-scenario 2	137,889	43,242	94,647
Grand Total:			
1994 actual	***301,586***	***190,029***	***111,557***
2003-scenario 1	***288,456***	***181,756***	***106,700***
2003-scenario 2	***308,654***	***194,483***	***114,171***

The same method was applied to engine and transmission production to produce "best practice" estimates of employment in those operations in 2003. Two employment estimates were also generated for these operations, one for scenario 2003-1 and one for 2003-2, and a separate set of Michigan figures was computed as well. However, our estimate of future Big Three U.S. employment in the production of automotive stampings was problematic due to large differences in best practice ratios across the companies. These apparent differences owed much to existing differences between companies in stamping integration. The company with the highest productivity was excluded due to its abnormally low level of integration.[26] Consequently, the company with the second highest best practice ratio was used as the standard. This ratio was increased for 1994-2003 at the assumed productivity improvement rate of 1 percent per year.

An operations subtotal for Big Three employment change in vehicle assembly, and the production of engines, transmissions and stampings is given in table II.6 for U.S. employment, and table II.7 for Michigan employment. The Big Three employed 254,628 in their major U.S. operations in 1994. Our scenario 1 estimate of Big Three employment in major operations is 236,115, or a decline of 18,513. However, our scenario 2 estimate totals 252,552, or a decline of just 2,076. Table II.7 shows 105,837 Michigan employees working in Big Three major operations in 1994. Our scenario 1 estimate of Michigan Big Three employment in these operations is 99,236, or a decline of just 6,601 from 1994. Our scenario 2 estimate is 106,241, or an increase of 404.

Parts Manufacturing and Other Automotive Activity

Big Three employment in parts manufacturing and other automotive activities actually exceeds major operations employment. Parts manufacturing generally includes the production of a wide variety of parts, subassemblies and components used in the assembly of vehicles, powertrains, and drivetrains. Excluding tires, almost every type of part or component used in the production of motor vehicles is manufactured by at least one of the Big Three. However, large differences exist between the Big Three firms in the extent to which they produce their own parts, or outsource parts work to independent suppliers. The degree to which the three firms differ in their integration of parts manufacturing is generally not well known, even within the firms. Independent sources of information on

[26] We made this selection on the basis of evidence that the apparent best practice company was currently "insourcing" many stamping parts formerly produced by independent suppliers.

the subject of parts integration at the Big Three are of questionable validity.[27] This is especially true regarding what constitutes best practice in parts manufacturing or where it might be performed. In fact, accurate information on the number of Big Three employees engaged in parts manufacturing is scarce even among independent auto analysts.

Little information or analysis is available regarding employment in other automotive activities at the Big Three. These activities would include vehicle, divisional, and research engineering, divisional and central administration, and the distribution of aftermarket parts. In addition, automotive employees on temporary leaves of absence, or temporary layoffs would be included in this category. Discussions of "best practice" in a number of these activities, especially vehicle engineering, are very popular in many industry forums, but hard information is once again unavailable. Finally, the subject of productivity in both parts manufacturing and other automotive activities is often confused with "outsourcing." The sourcing by vehicle producers of parts manufacturing or vehicle engineering to independent contractors may be only partly determined by differences in physical productivity.[28] In fact, there is reason to believe that the rate of outsourcing is largely determined by differences in wage rates, not differences in productivity. Since OSAT did not possess reliable forecasts of future relative wages in the auto industry, no attempt can be made to predict employment change at the Big Three due to changes in outsourcing or changes in integration.

The BLS has recently published a revised estimate of average annual percentage change in output per hour (labor productivity) for the motor vehicle and equipment industry during the years 1973-1990. This long term labor productivity growth rate, 2.4 percent per year, was calculated by the BLS after revising their industry output measures for changes in prices and quality during the eighteen year period.[29] This rate was used to estimate future productivity change in both parts manufacturing and other automotive activities for several reasons. First, the BLS growth rate was calculated for a long period, characterized by increasing international competition, and took into account large changes in the value of output during this period. Second, a long-term growth rate is somewhat immune to cyclical problems associated with selecting a recent base year. Finally, the growth rate for this particular industry group (United States Department of Commerce Standard Industrial Classification (SIC) 371) is likely higher than that for general auto-parts manufacturing,

---

[27] For the best known estimate of outsourcing, see Daniel Luria, *Calculating Big Three Vertical Integration* (Ann Arbor, Michigan: Industrial Technology Institute, August 1990).

[28] For a comprehensive discussion of outsourcing and productivity, see Daniel Luria, *Technology, Work Organization and Competitiveness: Automotive Subsystems Lost Reduction.* (Ann Arbor, Michigan: Industrial Technology Institute, December 1987).

since only about half of automotive-parts manufacturing is covered by this classification. Other published, BLS, productivity growth rates for separate auto-parts industries, outside of SIC 371, are much lower (except for the tire industry) than that for the motor-vehicle and equipment manufacturing industry.[30] This is almost certainly due to the fact that SIC 371 includes vehicle assembly and major component manufacturing, activities that have shown far higher productivity growth rates in recent years than parts manufacturing.

Our employment totals for Big Three employment in parts manufacturing are from different sources than those used for employment in major operations. We used both *The Elm Guide to Automakers in North America*[31] totals for 1994 U.S. Big Three parts plants and direct company information to estimate a total of 141,939 employees in Big Three parts manufacturing facilities in 1994. Our scenario 1 estimate has parts employment falling to 137,205 by 2003, or a decline of 4,734. It should be pointed out that we forecast a rise in vehicle production and in vehicle content during the period 1994-2003, which mitigates the accumulated 24 percent (nine years at 2.4 percent per year) increase in parts manufacturing labor productivity during this period. Our second scenario actually calls for parts employment at the Big Three to rise during the years 1994-2003 to 146,771. Our scenario 1 estimate for Michigan calls for state parts employment to fall from 62,399 in 1994 to 60,318 by 2003. However, our scenario 2 estimate calls for parts employment to rise to 64,523, an increase of over 2,100 jobs.

Employment in other automotive activities was determined by subtracting 1994 employment in major operations and parts manufacturing from the 1994 total overall employment numbers provided by the companies. As was the case for parts manufacturing, the BLS historic growth rate is used to increase labor productivity in other automotive activities by almost 24 percent for 1994-2003. As shown in table II.6, our scenario 1 estimate has employment in other automotive activities falling from 174,634 in 1994 to 168,810 in 2003, a decline of 5,824. Our second scenario calls for other automotive employment to increase at the Big Three to 180,579 by 2003. Our scenario 1 estimate in table II.7 shows Michigan automotive employment falling from 133,350 in 1994, to a level of 128,903 in 2003. However, our scenario 2 estimate shows state automotive employment in this area rising to 137,889 by 2003, a net increase of over 4,500 jobs.

---

[29] Kent Kuntz, Mary Jablonski, and Virginia Klarquist, "BLS Modernizes Industry Labor Productivity Programs," *Monthly Labor Review* 118, no. 7 (July 1995): 10.
[30] Ibid. 9-11.
[31] Elm International, *The Elm Guide to Automakers in North America* (East Lansing, Michigan: Elm International, 1994).

Salaried and Hourly Employment

Table II.6 shows an actual Big Three U.S. automotive employment total of 571,201 in 1994. Our combined scenario 1 forecast is 542,130 in 2003, a decline of 29,071. However, our scenario 2 forecast (which presumes a five-point gain in percentage market share for the Big Three in North America) is 579,902, an increase of 8,701. We further separate the employment totals in table II.6 into separate salaried and hourly figures by using published counts in *The Harbour Report 1995*, and similar information for parts and other automotive activity supplied to us by the firms. These numbers were used to compute a salaried/hourly split by area of operations. As shown in table II.6, we expect hourly employment in 2003 to reach 411,260 in our first scenario, and 439,913 in our second scenario.

Table II.7 shows an actual Big Three Michigan automotive employment total of 301,586 in 1994. Our combined scenario 1 forecast is 288,456 in 2003, a decline of 13,130. However, our scenario 2 forecast, is 308,654, an increase of 7,068. As in the U.S. results, we further separate the employment totals in table II.7 into separate salaried and hourly figures. A comparison of tables II.6 and II.7 shows a higher share of salaried employees in Michigan Big Three employment than in U.S. Big Three employment, as might be expected. As shown in table II.7, we expect hourly employment of 181,756 in our first scenario, and 194,483 in our second scenario.

Hiring by the Big Three through 2003

We combine our results for future employee attrition, shown in table II.4, and our results for changes in employment, shown in tables II.6 and II.7, to produce a forecast of total hiring by the Big Three in their U.S. and Michigan automotive operations during the period 1995-2003. Our final results for U.S. Big Three hiring are shown in table II.8 and for Michigan hiring in table II.9. Hires are estimated by adding employment change to attrition. For example, in table II.8, our scenario 1 forecast of 1994-1995 U.S. employment change is a decline of 29,071. This negative figure is added to forecast attrition for 1995-2003 of 241,969 to produce a hiring estimate of 212,898. Our scenario 2 estimate for U.S. hiring is 250,670. Michigan Big Three hiring is estimated at 109,066 in

scenario 1 and rises to 129,263 in scenario 2.[32] We forecast the Big Three to annually hire between 12,100 and 14,360 individuals in Michigan during the period 1995-2003.

Table II.8

Big Three
U.S. Employment Change, Attrition and Hiring Through 2003

	U.S. Emplymt. Change	U.S. Hourly Emplymt. Change	Hourly Trades	Hourly Other	U.S. Salaried Emplymt. Change	Salaried Engin/ Tech	Salaried Other
Employment Change							
through 2003-1	-29,071	-23,008	-4,829	-18,179	-6,063	-2,266	-3,797
through 2003-2	8,707	4,061	852	3,208	4,640	1,734	2,906
Attrition							
1995-2003	241,969	190,827	37,886	152,941	51,142	14,167	36,975
Hires							
through 2003-1	212,898	167,819	33,057	134,762	45,079	11,901	33,178
through 2003-2	250,670	194,888	38,738	156,149	55,782	15,901	39,881

[32] Some reviewers of this study have recently suggested that it is traditional for a forecast of this type to include a "low" as well as a "high" scenario to contrast with the major, and most probable, forecast results. Our "high-end" scenario, of course, is scenario 2 in Tables II.8 and II.9. We have now calculated a "low-end" scenario with our simple model of future Big Three employment and hiring. This scenario assumes that the Big Three will lose 5 points of North American market share during 1994-2003, or the complete reverse of our assumption for scenario 2. The "low-end" scenario results in a Big Three U.S. employment decline of -66,843, and a decline in Michigan Big Three employment of -33,327. However, since our attrition totals through 2003 do not change, the "low-end" scenario forecasts 1995-2003 U.S. Big Three replacement hiring to total 175,126, and Michigan replacement hiring to total 88,868. We did not originally calculate this "low-end" scenario because we considered the market-share loss assumption to be highly improbable.

Table II.9							
Big Three Michigan Employment Change, Attrition and Hiring Through 2003							
	MI Emplymt. Change	MI Hourly Emplymt. Change	Hourly Trades	Hourly Other	MI Salaried Emplymt. Change	Salaried Eng./Tech	Salaried Other
Employment Change							
through 2003-1	-13,129	-9,299	-2,234	-7,065	-3,831	-1,613	-2,217
through 2003-2	7,068	3,592	863	2,729	3,476	1,464	2,012
Attrition							
1995-2003	122,195	86,766	20,580	66,186	35,429	11,256	24,173
Hires							
through 2003-1	109,066	77,467	18,346	59,121	31,598	9,643	21,956
through 2003-2	129,263	90,358	21,443	68,915	38,905	12,720	26,185

We also break out our estimates of employment, attrition, and hiring in tables II.8 and II.9 by the four major occupational groups originally shown in table II.2. We make the simple assumptions that employees in skilled trades and engineers/technicians will make up the same shares of total employment in 2003 as was the case in 1995. These proportions are applied to hourly figures in each area of operations shown in tables II.6 and II.7. This additional detail is essentially straightforward except for the category of skilled trades. We estimate up to 38,738 U.S. openings (21,443 in Michigan) for skilled trades workers at the Big Three during the period 1995-2003. However, the Big Three typically train a very high percentage of their skilled trades workers in contractual apprenticeship programs within the company. Since there is no reason to expect this pattern to change, openings for skilled trades positions should be added to the "Hourly Other" totals for the United States and Michigan. It can be assumed that unskilled hourly workers who are placed in apprenticeship programs will be replaced by new hires needed to fill the apprentices' prior job assignments. Finally, hourly workers have been transferred to salaried technician classifications in the past. This would indicate that our forecast for engineers and technicians is somewhat high since a number of openings may be filled internally from the ranks of current hourly workers. On the other hand, we expect hourly workers who are transferred to salaried classifications to be replaced in turn by new hourly hires. This would imply that our forecast for total hourly hires is somewhat low.

Supply and Demand for Automotive Labor during the years 1995-2003

The MESC provided OSAT with a recent set of employment projections for the Michigan labor economy that covers the period 1992-2005. The MESC estimates that annual net jobs openings in Michigan will average 147,685 during this time span.[33] If so, our Big Three forecast would estimate openings at the Big Three to contribute from 8.2 to 9.7 percent of these annual openings. The MESC estimates annual job openings in the professional and technical occupations (equivalent to salaried engineering and technical employment) to average 28,405, and openings for skill trades and other production occupations to average 36,245 per year. If so, our forecast would indicate a Big Three contribution to technical and professional openings of 3.8 to 5.0 percent, and a contribution to openings in production occupations of 23.8 to 27.7 percent. But, OSAT's estimate of future openings at the Big Three is higher than that forecast by the MESC. However, these openings are significant because they provide roughly twice the total compensation of an average Michigan job. The high level of earnings available through Big Three employment may produce a far larger range of "spillover" effects than any equivalent group of openings located in other Michigan industries.[34]

Our study of future job openings at the Big Three firms addresses the many comments regarding labor scarcity made to OSAT by Michigan automotive parts suppliers during 1994 and the first half of 1995. An apparent shortage of acceptable applicants for manufacturing positions developed in many regional markets in Michigan in the fall of 1994. To a certain extent, this shortage reflects a cyclical rise in production last year and the increased market success of Michigan auto producers in the North American market. It is also possible that the complaints about "labor shortages" merely reflect a reluctance to raise wage rates in Michigan's independent supplier sector of the auto industry. However, there is reason to believe that current labor shortages experienced by Michigan auto suppliers are also due to a decline in new entrants to the labor market. Information

---

[33] Michigan Employment Security Commission, *Research/Statistics. "Occupational Employment Projections," in Michigan Employment Projections 2005.* (Detroit: The Commission, September 8, 1995.) See Appendix B.

[34] The high level of Big Three compensation of employees should produce many related labor market effects as a result of increased hiring by the three companies. We should expect wages to rise, not only in Michigan manufacturing, but in the retail and service sectors, especially in local labor markets that contain Big Three facilities. We can also expect Michigan's labor force to increase due to higher participation rates. Enrollment in post secondary education programs may also fall. On a very positive note, the combination of higher wages and increased payouts to tens of thousands of new Big Three retirees who stay in Michigan should increase state and local tax collections by a considerable amount. However, the effect on state unemployment levels or rates, is almost impossible to predict.

contained in table II.10 presents some of the details in the development of this decline.

Table II.10

Michigan Auto Employment and New High School Graduates

Year	High School Graduates** (1,000's)	Auto-Related Employment* (1,000's)	Big Three Employment*** *(1,000's)	Supplier Employment*,* ***(1,000's)
80	124.3	507	384	123
85	105.9	519	374	145
87	102.7	483	363	120
88	106.2	471	330	141
89	101.8	474	323	151
90	93.8	456	297	159
91	88.2	431	299	132
92	86.7	439	272	167
93	89.7	438	267	171
94	83.3	462	288	174

Sources: *MESC, Research/Statistics; **U.S. National Center for Education Statistics, *Digest of Education Statistics*, annual, *** preliminary estimate, ****company reports

As table II.10 shows, the number of public high school graduates in Michigan has steadily declined since 1980. About 124,000 individuals graduated from high school in Michigan in 1980 and only 83,000 in 1994, a decline of roughly one-third. This reflects the fall in state birth-rates in the 1970s, compared to higher rates in the 1960s. Big Three Michigan employment also fell during 1980-1994, by almost 96,000. An MESC estimate of total direct employment in the Michigan auto industry, shown in column 2 of table II.10, allows for an estimate of supplier automotive employment outside of the Big Three. Based on these numbers supplier employment actually grew by over 41 percent during 1990-1994. Michigan suppliers did not encounter much difficulty in recruiting in Michigan during the 1980s because of the reduction in Big Three hiring. However, the relative ease experienced by Michigan suppliers in expanding their employment may soon end, or may have already ended in 1994.

About 58 percent of current Michigan public high school graduates do not immediately enter the labor force.[35] These graduates typically transition to some form of post secondary education or training. About 35,000 current high school graduates do enter the Michigan labor force on an annual basis. Our forecast, shown in table II.9, estimates that the Big Three will hire between 8,600 and 10,000 hourly workers per year in Michigan

[35] Michigan State Board of Education, Condition of Michigan Education: 1992, (Lansing Michigan, 1992). 74.

during the years 1995-2003. If recent high school graduates were the only source of new hires, the Big Three would hire approximately 25 to 29 percent of the available graduates in the state. Yet it is clear that recent graduates are not the only source of new hires. The potential pool of new hires can be increased currently by at least 35,000 GED and community college graduates per year.[36] On the other hand, the number of potential hires from these sources has also dwindled in recent years due to low birth rates in the 1970s. It is also very possible that the percentage of individuals who enter the labor force after graduating from high school will increase due to the greater availability of high-wage production employment. The large number of Big Three jobs, relative to supplier production jobs, will induce a number of Michigan employees in the service and retail sectors of the state economy to enter manufacturing. However, the last two sources of new hires presupposes an increase in the expected average wage for manufacturing work in Michigan.

Michigan faces both an opportunity and a challenge in the next decade. There is an opportunity for the state to get more than its share of job openings at the Big Three. Our forecast estimates Michigan's share at about 50 percent of Big Three job openings during the period 1994-2003. However, the Big Three still maintain facilities in no less than twenty-five states, two Canadian provinces, and a number of Mexican states. The automotive firms know that total openings do not have to be distributed across locations in the same proportion as current employment. If Michigan leads the way in improving the quality of the new automotive labor force, the state could have a good chance to get more than its share. The challenge to Michigan is larger than just filling our state's forecast need for new automotive employees at the Big Three. The state's continued dominance in automotive activity owes much to the efforts of its independent suppliers in the 1980s and early 1990s. They, too, wish to improve the quality of their performance and their people. Michigan's final challenge will be to satisfy its entire automotive industry, both vehicle producers and parts suppliers.

[36] Michigan Department of Education, 1992.

III. Focus on Automotive Human Resource Issues in Michigan: MAP Response

The Office for the Study of Automotive Transportation (OSAT) has traditionally used consensus methods of research to explore public policy, technology and general business issues of concern to the automotive industry. This method collects information about industry practice, policy, and expectations from corporate managers and staff directly involved in the focus research area. Our study of current and future automotive human resource issues employs separate techniques for the Michigan Automotive Partnership (MAP) parts suppliers and for vehicle producers.

The supplier firms were asked to schedule a time to participate in an in-depth personal interview on automotive human resource issues. OSAT requested that the respondents at each firm include the chief executive and the personnel or human resource manager. Six interviews were completed, on company sites, in the fall of 1994. In five cases, the president or chief executive of the supplier firm was the primary respondent. At four firms, the manager of human resources also participated in the interview. An interview instrument was developed and sent to respondents prior to the interview. The purpose of the instrument was to generally guide the discussion and allow respondents some time to prepare their responses. However, the actual discussions were not limited to items contained in this instrument. The average duration of the supplier firm roundtables was about two hours.

A different method of consensus measurement was employed for the vehicle producer interviews. Intergovernmental and public affairs managers were initially asked to identify a principal contact from their firm's human resource management group or staff who could and would serve as the principal study contact and study organizer for their firm. Two of the firms did furnish human resource executives for this critical role. A state and municipal affairs executive filled this function at the third firm.

The principal contact at each vehicle firm was asked by OSAT to organize a round-table focus group of human resource managers from a number of different areas: central human resource planning; human resource management—North American operations, parts and component operations, technical center operations; and external education affairs. Twenty-one human resource staff executives, across the three vehicle producer firms, volunteered their time to participate in the roundtable discussions. Essentially, a representative group of human resource managers, knowledgeable in almost every area of

employee hiring, training, and education participated in the separate company roundtable discussions. The roundtable focus group discussions were held at company headquarters locations and each lasted for about two hours. A list of recommended discussion issues was circulated prior to the roundtable discussions. As was the case with supplier interviews, the vehicle firm participants were not restricted in their comments on the circulated list of topics. In fact, in each roundtable, respondents quickly developed their own emphasis on critical developments in automotive human resources at their firm.

OSAT staff compiled two or three individual records of each vehicle roundtable discussion. A report was prepared by comparing the frequency and elaboration of concerns and examples mentioned, central issues highlighted, and level of perceived importance of specific issues. Based on these comparisons, a narrative was produced from the input of eight roundtable trip reports prepared by OSAT staff. The content of the final consensus report is heavily dependent on OSAT's past experience in gathering executive opinion.

A draft report of the results of the focus discussions with all three vehicle producers was sent to our primary study contact at each firm. This contact was asked to circulate a copy of the draft report to the roundtable participants. Participants were asked to edit and review the entire report. They were also asked for any general comments or additional details they could provide regarding the issues described in the report. These comments and changes were then collected and incorporated into the final report. The same process was repeated for the supplier focus paper.

The remainder of this report consists of summaries of discussion taken directly from the interviews with MAP firms. These summaries depict the statements, reflections and opinions of the respondents that were interviewed, and personally, of their respective firms in general. In a number of cases, firms provided the insight of specific experts on particular human resource issues. We typically gave the statements of these experts extra weight. If experts were not provided, and if the consensus on an issue was not unanimous, we attempted to express differing opinions as completely as possible. Consensus across the participants and the firms was frequently not achieved in many areas of human resource issues covered in the interviews. This was more the case in this study than in other research efforts carried out by OSAT on other automotive topics. The suppliers and vehicle producers are natural competitors in Michigan's automotive labor markets, and this competition and difference of opinions became readily apparent. The vehicle producers often did not agree on state policy or school performance issues. We attribute this lack of consensus to differences in experience, human resource practice, and

the stage of development in which each firm finds itself in pursuing its own internal goals for automotive excellence. As a result of these frequent differences in opinion, we have often stated individual company experience and attitudes on various issues separately in the focus group discussions below.

As noted earlier, the focus groups were prompted with a variety of issues developed by OSAT staff to guide the roundtable discussions. These issues are listed in the summary discussion below. As we also note, participants were not restricted to these issues and were allowed to develop any topic they wished. The major areas of discussion that the vehicle producers brought up follow and are discussed in the remainder of this report.

Recruiting and training automotive engineers and technicians

-Current needs for technical and engineering labor

-New engineering skills

-Performance of engineering and technical education

Hiring the New Autoworker

-The nature of future automotive work

-The hiring process and required qualifications

-Sources of applicants

Educating and Training the New Autoworker

-Performance of the Michigan K-12 system

Automotive Skills Initiatives and State Public Policy

-School-to-Work

-Joint company initiatives

-Specific state policy initiatives

Michigan Motor Vehicle Producers

Recruiting and training automotive engineers and technicians

Focus group participants were asked to consider and discuss major issues for state policy in the areas of recruiting and training automotive engineers and technicians. The following topics were suggested as issues:

-Michigan's relative position as a source of engineering and technical labor
-Regional patterns
-Adequacy of supply; special state efforts to locate applicants
-Retraining of engineers from other industries
-Technician training
-Outside engineering services
-Leveraging supplier engineering
-Joint R&D/joint training centers for engineering
-Retention of young engineers
-Alternatives to four-year degreed engineers
-Skill inventory of retired engineers and designers
-Performance of state universities and community colleges

Current needs for technical and engineering labor

All three vehicle producers reported that they are not experiencing significant attrition of their current engineering and technical employees. It is true that technical employees leave at a higher rate than nontechnical, salaried employees, but the difference is not critical. One company reported receiving at least 1,000 resumes per week from applicants for engineering and technical positions. The current flow of new resumes is considered adequate and allows selectivity. The market for engineering labor is national and Michigan seems to be an acceptable location for conducting hiring efforts.

However, two companies identified a growing shortage in capable (experienced) manufacturing engineers. The higher level of automation currently in their plants requires a correspondingly higher level of engineering support on site. Attempts to redeploy vehicle-design engineers to manufacturing have met with resistance from degreed engineers. One of these two firms reported that, at present, demand for manufacturing engineers is being met with hires of "seasoned" engineers from contract firms that perform work for the corporation. Experienced, and "known," engineers are thus brought into the firm, attracted

by higher salaries and benefits than those paid by manufacturing firms outside of the Big Three.

Another company reported that it is currently redeploying its technical labor force. "Core" and "noncore" areas or specialties are being defined. In fact, the corporation is providing incentives to many noncore specialists to retire early, or to retrain to function in new assignments in core areas. The definition of "core" seems to center on major activities that are especially critical to the operations of the company as a full-line motor vehicle producer. Many "quasi-engineers" or technicians, such as drafters or CAD/CAE design technicians, are not considered core employees. Employees in these specialties demonstrate a naturally high rate of turnover under any circumstances, since they pursue overtime opportunities to increase their compensation. At times, shortages of these technicians do occur, but needs can be met by using contract workers and engineering service firms. Contracting allows managers to use their restricted headcounts for only the most critical, or core, assignments.

A core area where this company is experiencing some personnel needs is in body engineering. The breakup of the company's major stamping division a number of years ago resulted in a shortfall in training, and subsequently in a shortage of experienced technical personnel in this area. New technologies in body engineering and stamping have developed in the interim. The company has also identified a need for "safety engineering." Some corporate recruitment of supplier and other vehicle producer employees in these areas (body and safety engineering) has occurred in recent years.

One of the groups reported that a major source for their new engineering hires (over 50 percent) has been students involved in summer internship programs. Summer internship programs allow managers to make selections based on a two-to-four month appraisal. Internships were also described as a means for shortening the process of "making" an engineer into an "automotive engineer." Other new hires are drawn from contract employees who may have worked with the corporation for up to five years before being "brought on board" as a regular company employee.

New engineering skills

One company has perceived a need for "multicultural" engineers. These were described as automotive engineers with multilingual capabilities and the capacity to operate in an international environment. The development of a world motor-vehicle market and

industry, and company efforts to globalize, explain the rising need for multicultural engineers.

One of the vehicle producers indicated that its engineers are now encouraged to pursue higher degrees in advanced engineering rather than MBAs. Young vehicle engineers are also strongly encouraged by several of the companies to "get manufacturing experience" early on in their careers as a necessity for later advancement. An important component of this experience, it was pointed out, was the development of "employability" skills for engineers. Such skills would include a capacity for personnel management and teamwork.

Another issue is the narrow focus in training and capability of most manufacturing skilled trades workers. Skilled trades workers, it is thought, should be more broadly trained and flexible in practice to cope with the highly technical plants of today. Interest was also shown by two of the vehicle firms in the development of career ladders for nondegreed engineering technicians. Presumably this would include alternatives to the formally trained college educated engineer.

One corporation's refocus on core activities presents it with two solutions for the provision of required technical labor: retrain noncore and excess nontechnical employees for new assignments in technical/core activities, a process that can take up to three years, or hire new employees for these roles. While this corporation does "top-recruit" from the best universities, experienced employees are also needed. The corporation will attempt to hire these needed personnel away from other manufacturing firms. Because of the corporation's attractive salary and benefits levels, it does not expect to experience serious difficulty in retaining current core employees. This company also does not expect to lose core engineers and technicians to automotive suppliers.

Two of the companies identified assistance in retraining or educating current employees for core assignments as a major role for the Michigan Jobs Commission. Many of these employees are state residents and any type of technical assistance or subsidy directed toward retraining or placing noncore technical employees would be greatly appreciated. The bulk of the retraining should take place within the company. Although Michigan community college programs are very responsive to needs for technician training and some of the retraining of noncore employees, it has been very difficult for these institutions to always keep up with the technological pace of the industry. It was stated that "the only way to keep the industry moving is for the training to come from within."

Performance of engineering and technical education

The vehicle producers discussed in detail their opinions on technical and engineering education. One company stated that it is presently involved with eight major American universities in developing degree programs that further develop the skills of company engineers. This focus group stated that current Michigan university engineering programs tend to overemphasize design engineering and ignore manufacturing engineering. Respondents also maintained that future corporate funding of education of engineers will primarily stress technical education for the purpose of upgrading current engineering skills. The education should take place increasingly on site through the application of distance learning technology.

The company is also meeting with eight engineering deans in North America to see how employees can continue their education even if they are moved to locations in Europe or elsewhere. Although European engineering programs are automotive in focus, there is a critical shortage of degreed engineers in Europe, and the company is interested in the potential of distance learning for advanced education worldwide.

Discussants from two focus groups indicated a growing and strong dissatisfaction with the products of higher education for engineers or engineering programs. Current education for mechanical and electrical engineers is excellent for careers in vehicle product engineering, but clearly not a good match for manufacturing needs. Respondents indicated that universities typically stress "theory not application." One respondent stated that "incoming engineers have no idea what manufacturing engineering may involve—the pressure of production, and the factory environment."

Yet it was pointed out that different types of engineering require different styles of work. Vehicle engineering is closer to "pure" engineering with the attraction for individuals of producing a very visible and high-prestige product. Process or manufacturing engineering often involves working in the plant without a large team of degreed colleagues and often requires on-the-spot problem solving. On the other hand, it was pointed out by a respondent from another group that manufacturing engineers must now be able to work more closely with divisional staff and with independent suppliers than in the past.

One company reported that its manufacturing arm is reviewing manufacturing technology and other related programs at its recruiting schools. Unfortunately, the company failed to find an acceptable university manufacturing program in Michigan. A strong program at the University of Dayton was listed as an excellent example of the

"vibrant mix" of the technical and technological, as well as a program that has given strong emphasis to industry input. The best attempt to connect theory to application on the part of a four-year Michigan engineering program may be located at Oakland University. Ten Oakland University professors served internships in company manufacturing plants in and around Detroit. This is part of an initiative to strengthen the manufacturing "literacy" of engineering schools.

All three firms rely heavily upon Michigan community colleges for training technicians. Michigan's community college system was described as "very responsive," compared to community college systems in other states such as Ohio or Indiana. The community colleges were also ranked very favorably against four-year universities in terms of responsiveness, the involvement of faculty, and the relevancy of their material. One company listed Oakland Community College's two-year CAD program as an example of training that is superior to internal company programs in terms of breadth and competitiveness.

Hiring the New Autoworker

Focus group participants were asked to consider and discuss major issues for state policy related to the selection and hiring of new production workers. The following topics were suggested as issues:

-Adequacy of screening services from MESC relative to other states
-Hiring criteria:
    -Education
    -Aptitudes
    -Experience
    -Commitment
-Michigan's relative position as a source of automotive labor
-Regional patterns
-Early selection and commitment from school-to-work programs
-Inside versus outside selection pools
-Importance and types of labor quality

The nature of future automotive work

All three focus groups stated strongly that the nature of automotive production work will change markedly in the future. Autoworkers will use their skills and abilities to a

greater degree than in the past, in order to think and learn on the job. The focus groups generally listed three major changes to the automotive workplace that make this true:

1. The plants of the future will operate with far less supervision. Autoworkers must be self-motivated and able to self-manage their activities. Any remaining supervisors will, in the future, act primarily as facilitators.

2. The manufacturing plants of today are already significantly automated and the use of programmable automation will increase in the future. Autoworkers will possess a far wider range of technical skills and it is critical that they also possess a strong aptitude for learning new skills. The company does not have the time to train workers on every new piece of equipment. A certain level of technical proficiency is now a necessity.

3. In the future, autoworkers will work together increasingly in teams. Many workers will perform within the team framework and must communicate to a greater extent than in the past. These teams include diverse individuals. Workers must be able not only to accept diversity, but to take advantage of its strengths.

All three focus groups said their firms are very aware that a "retirement bubble" is coming and that thousands of new production employees will have to be selected and hired. All three firms clearly stated that standards for new hires are certainly higher now than in the past.

The hiring process and required qualifications

The focus groups commented further on their corporations' commitments to upgrading their future production labor forces. They believe that the public is aware of a change in standards or hiring criteria. Screened applicants are now required by auto companies to take a battery of aptitude tests. The focus groups reported that the assessment process (performed by an outside service firm) is a screening process meant to replace the aptitude tests once given by the MESC. Up until 1991, the state employment service in Michigan was willing to prescreen applicants for automotive openings using the GATB and SATB battery of tests. However, since 1991 the state has suspended this service.

The assessment tests measure applicant and skills aptitudes in literacy (reading comprehension), numeracy (basic mathematics), and manual dexterity, as well as their

ability to communicate and work in a team setting. The assessment process contains several essential phases. First, applicants are tested for mathematics skills and their aptitude for understanding spatial relationships or reading and using technical manuals. This is a paper and pencil exercise whose essential purpose is to measure the candidates' aptitude for problem solving, forms checking, and the potential mastery of critical manufacturing techniques such as Statistical Process Control systems (SPC). A second assessment is carried out as a group participation exercise meant to measure communication skills and the ability to interact with other employees. Finally, manual dexterity and hand-eye coordination are assessed since, of course, much production work will remain largely physical in nature.

Critical skills in team work and problem-solving are naturally very difficult to test. It is also necessary, given the requirements of modern technology in the plants, to test for compatibility with digital communication, or the ability to work with CRTs and keyboards, and even a fear of these devices.

A record of previous work experience, especially in manufacturing, is considered to be an advantage for many applicants. One firm reported that to date, over 50 percent of its new hires left full-time jobs to take a position at the company. Formal education and relevant training is also considered an advantage, especially a high school diploma or its equivalent. More than 55 percent of recent new hires at one firm, for example, have received education beyond a high school diploma. On the other hand, a college education is certainly not a requirement, and may not even be a good indicator for a potentially productive autoworker. The large percentage of new hires that have taken some college training may merely reflect the larger percentage of these individuals in the total applicant pool relative to fifteen years ago.

Sources of applicants

Two of the companies have a great deal of experience in recent years in hiring new autoworkers. These two companies report the existence of a formal system or company-wide guidelines for selecting new employees. However, plant managers and their operational managers are allowed some flexibility in their final selections. This process calls for a careful balance between public and employee perceptions of equity. A fair number of new hires come from neighborhoods close to the plant and current employees also expect a significant number of hires to be members of company families willing to carry on a tradition of service.

One company stated that it reviews applicants from two major sources: applications drawn from community offices of the employment service near the facilities, and employee referrals. Another reported that it drew applicants for production positions from three sources: applicants from the state employment service, referrals from current employees, and randomly selected former temporary workers. Applicants from the local employment service office are becoming increasingly important to assure that plants hire workers that reflect the background characteristics of the local community population.

The three corporations have been overwhelmed by a crushing volume of applications ("tens of thousands") for new openings. New workers must still perform satisfactorily during a contractual ninety-day probationary period, but at least one of the firms stated its desire for a longer probationary period on the order of nine months ("Anyone can look good for ninety days.").

The employment service does attempt, generally, to be of assistance but has no real way to test for the employability skills and aptitudes most required by the company. All three companies have a strong interest in hiring applicants with the right type of "employability skills." Some of these skills are traditional basics such as a strong work ethic, punctuality, and reliability. Other skills are new, such as the abilities to assume increasing responsibility and to work cooperatively with others. All three companies are highly confident, and have the record to expect to find these types of individuals. The industry's relative level of compensation is such that it can attract the best workers, of all types, from other manufacturers outside the Big Three.

Two of the firms reported that the major MESC offices that take applications for their Michigan facilities have performed "heroically" and "bent over backwards" to process the huge volume of applications and send the company an adequate number of prescreened candidates. One of the companies reported that the MESC recently responded to a request to reinstate the administration of a paper and pencil test as a prescreen to the assessment process, and that the employment service has also performed well in assisting the company with its workforce diversity efforts. These MESC offices have provided great assistance to the two vehicle firms and could do more, the respondents stated, if given additional resources. Even so, it was said that the MESC has been more helpful than other state employment services, such as those in Missouri and Ohio.

Educating and Training the New Autoworker

Focus group participants were asked to consider and discuss major issues for state policy related to the education and training of new automotive employees. The following topics were suggested as issues:

-General manufacturing skills
-Specific skills
-The role and extent of training
-State programs
-Shared industry programs for apprentices
-Involvement of local educational communities
-Distance learning

Clearly, the future human resource needs of the industry have changed from those of the past. All vehicle producers now possess a far greater commitment to the quality of the product, to safety on the job, and to mutual respect between fellow employees. The last mentioned commitment certainly reflects an important and much needed cultural change in the automotive workplace. New employees must be sensitive to female and minority issues, as well as issues regarding child care and families. Also, manufacturing engineers have been too insensitive to workplace safety (sadly indicative of their formal training); this can no longer be tolerated.

Two of the three focus groups strongly expressed their unhappiness with the current performance of Michigan's K-12 school systems. These groups expressed their view that it has become obvious that the school systems are "not in step" with the corporations' hiring needs. They admitted that the average Michigan K-12 graduate could be currently hired as a production worker, but there are strong concerns about long-term performance of the average graduate. Many of the new essential broad-based skills, especially employability skills discussed above, are not provided to students by Michigan schools.

One of the two critical human resourcess groups now realizes that it may be dealing with a "lost generation" from which to select new production workers. To a considerable extent, this is the fault of the current K-12 educational system, not only in Michigan, but in all states in which the company has facilities. A large number of applicants lack basic skills—not only mathematics and reading/writing skills—but also "employability" skills that include work ethics, attentiveness, and the abilities to learn on the job and to deal with

diversity in the workplace. The focus group felt that this situation is clearly not a financial problem, since school funding levels in most U.S. states exceed those expended in other developed nations. Furthermore, they stated, the poor performance of K-12 systems cannot be attributed to a lack of awareness, for it must be true that K-12 administrators and teachers are aware of the current demands of employers in the market. Instead, they concluded the failure of K-12 education to keep pace can be attributed to a lack of will or even a lack of simple competence.

Another worrisome long-run problem is the philosophical, overemphasis of schools on the college-bound students and their programs. In fact, manufacturing in general appears to be disparaged or ignored by school administrators and teachers, and the dignity of physical work—actually making things—is not valued. Finally, one company raised some serious questions about the current status of Michigan's competency exams for high school graduates and, specifically, whether there has been any industry input into the design and content of the programs.

Several of the groups are not so sure that formal education systems have awakened to the realities of the new automotive workplace. It is critically important that an awareness of industry needs be developed. A policy should be promoted to encourage the participation of plant managers and superintendents on school boards and state education committees. School administrators and top automotive executives must drive the needed changes through their own active, personal involvement. This would impart a strong credibility to the process of change. Currently, there is little evidence that Michigan schools educate future employees in problem-solving, team skills, or the ability to work with others. It would seem that summer employment of students through internship programs would provide an excellent opportunity for school systems and the corporations to make a link. However, it was stated that there must be a similar commitment by teachers and school administrators to this process.

It was admitted that some of the blame for the poor performance of applicants, and the school systems that produce them can be attributed historically to the automotive firms themselves. For many years, the customer (vehicle firms) asked for very little from new production hires. For example, a current requirement that new hires demonstrate a capacity and a willingness to learn throughout their careers was hardly a major hiring criterion in the past. Also, for many years management did not require workers to demonstrate much beyond a minimal degree of literacy. Since unskilled workers received very little or no training in the course of their tenure with the firm, academic skills were not required.

Finally, in recent years, domestic automotive firms simply did not hire new workers. School systems and students had little incentive to prepare for jobs that were not available.

In general, the company employment staffs are disappointed in the number of Michigan candidates with diplomas who are unable to demonstrate competency with materials written at the 6th to 9th grade level. However, several round-tables did see some opportunity to make up for the poor performance of K-12 education with the development and use of preemployment training programs. Such programs are designed for high school graduates or equivalents and are meant to impart the basic skills necessary to perform satisfactorily in the skills assessment testing for well qualified, new production employees. One such program has been successfully developed in Detroit by one of the companies and its joint UAW human resource center with the assistance of the Michigan Education Commission. Another program for a "Focus Hope for autoworkers" has been developed with the assistance of Ferris State University and contains three, sixteen-week modules designed to raise applicant skills to the well qualified level. Finally, this company looks forward to its involvement in school-to-work programs aimed at production worker skill sets. But again they ask, "Why is this necessary? We want reading, communication and math skills."

A third company group did not complain about K-12 system performance in Michigan or in any other state. However, this group stated that the basic elements required in the new automotive workplace could provide a blueprint to participating school systems. Basics must be stressed, but so should employability skills such as work ethics, the ability to arrive on time, and the capacity to "assume responsibilities." This company is currently active in redefining voc-tech programs within states and communities in which it has facilities. Models of work-based learning are being developed, and the process of determining needed metric skills is still underway. The company works actively within the Michigan business leaders program to determine core academic courses for future production employees in modern manufacturing. However, several members of this group expressed their view that local education systems must work very hard to keep informed of changes in technology and required skills so that they can adapt their programs.

Automotive Skills Initiatives and State Public Policy

Finally, focus group participants were asked to consider and discuss major opportunities for state policy related to the education and training of new automotive employees. The following topics were suggested as issues:

-Design of automotive academies/charter schools/school-to-work programs
-Refocus of state K-12 curriculum
-Required local and state funding
-State efforts to recruit skilled labor
-Extent of company commitment to participants
-Executive commitment to industry and company coordination

School-to-Work

All three vehicle producers have now assigned human resource managers or executives to coordinate corporate responses to the school-to-work federal/state initiatives. However, all three corporations have expressed some dismay and confusion regarding the wide variety of activities and directions associated with the concept. In fact, two focus groups stopped their discussion and asked the study facilitators point-blank for a workable definition of "school-to-work." One focus group expressed some degree of cynicism about the "school-to-work" initiative, labeling it as a new "buzz-word" that appears to be overworked. This group claimed that there is lack of clarity about what school-to-work means and it is being used to cover anything that seems at all related to work.

Two of the groups pointedly complained of a lack of coordination from the school-to-work initiatives. Various plant school-to-work programs are being proposed to these companies by a bewildering variety of counties, school systems, and training academies. This lack of coordination results in a duplication of efforts and a great waste of time—including the time of senior executives. There appears to be no internal, unified, state-wide approach to what the companies are being asked to do or what is being offered. These two firms expect these programs to organize themselves before the corporations can make major, significant commitments beyond summer "seasoning" programs.

Yet all three vehicle producers expressed their strong support of increasing industry involvement in local education. This activity is perceived as a critical means to increasing the level of quality in education and thus the corresponding quality of future automotive

labor forces. One producer proposed that the organization of school-to-work could be controlled locally by existing intermediate school districts. Another wondered if core skills for future journeymen could be imparted by the school systems, cutting short the very long training period (four years) needed to fully train these workers. The actual specific and technical skills needed to complete the training of skilled tradespeople, it was thought, may be too company oriented. Such training may lead to too few jobs to justify a massive public school commitment. However, many basic, generic skills could be imparted in the voc-tech programs, and such skills could prove useful for many other occupations.

All three focus groups were asked about their firms potential linking of actual automotive employment to automotive school-to-work programs. Only one firm indicated a strong willingness to directly link future jobs to successful graduates of automotive academies. These envisioned programs could start as early as seventh or ninth grade and lead to hiring or further specific training at age eighteen. Yet the quality of the participants and the content of such a program would have to be ensured. The autoworkers union must also be heavily involved and in agreement with the goals and mechanics of the program. This particular focus group strongly recommended a meeting between the Governor and the automotive CEOs to sponsor a new approach to automotive trade schools. After this "chartering," the educators and the corporate staffs could be brought into the design and coordinate a new system.

All three corporations stated the belief that the economy of southeast Michigan is "dominated" or heavily dependent on employment and other activities of their firms and several other large automotive suppliers. In the same vein, they admitted that their companies were also just as reliant on the labor and policy environment of this area of Michigan. There was general agreement that coordinated policies and programs had much to offer to the entire spectrum of the automotive community.

Joint company initiatives

All three producers maintained that sharing and cooperation were underway across the three vehicle companies in the area of human resources. Of course, new applicants for production positions were being assessed for all three companies by the same consulting firm, using similar test batteries. The management directors of all three joint UAW/company human resource centers participated in the focus groups and indicated the presence of communication between these unique joint company/union education and training centers. One company internship/training effort that drew praise from various participants in the other focus groups was the Ford Academy for Manufacturing Sciences

(FAMS) program. The other companies did claim to have similar technology programs underway. Ford's new emphasis and work in the area of distance learning also drew favorable comments from the other focus groups.

Cooperation between firms seems to be very possible in the area of educational reform, the setting of curricula and standards. It also appears that the sharing of possible preemployment training programs can be accomplished. The specific, technical training of employees or academy students in joint skill centers, however, was not identified by participants as a possible future cooperative effort between the firms.

Specific State Policy Initiatives

Focus group participants identified four potential human resource efforts that would give Michigan an advantage over other automotive states.

MESC Screening of Job Applicants

The MESC was identified as very helpful and competitive vis-à-vis other state employment services. However, participants generally felt that the service should be provided with greater resources to more effectively screen job applicants before final selection. This was considered especially critical in the area of qualified minority applicants since all three vehicle producers are firmly committed to maintaining, and perhaps even increasing, their current employment of minorities and women. Some return to skills testing by the MESC, of the type provided previous to 1991, was also identified as potentially very helpful.

State sponsored preemployment qualification programs

In the short term, the state should participate in the design, coordination and funding of preemployment training programs designed to produce well qualified applicants for automotive employment. Well designed programs may have the potential to relatively quickly improve the basic skills of many applicants not fully prepared by their K-12 education.

Retraining of current "noncore employees" for core employment

Two vehicle producers identified the retraining of current employees as a critical area for the state's attention and assistance. The industry is currently redefining its areas of required expertise or competence for technical personnel. Hundreds, if not thousands, of current Michigan employees may find their positions redefined as nonessential. On the other hand, hundreds, if not thousands, of new positions in core areas of expertise will be created. If noncore employees are not retrained in new core competencies, they will generally be replaced by new hires from outside the firm and, perhaps, recruited from outside the state. It should benefit the state to participate in the retraining of these noncore employees or to assist in their placement in automotive supplier firms that will assume the responsibility of maintaining competence in these areas.

One vehicle producer has proposed four separate, retraining-assistance proposals to the state for the purpose of retraining current employees, to no avail. A general message was imparted from the state to this firm: It was not the government's business to pay for corporate training of current employees. On the other hand, the other two focus groups praised the efforts of the Michigan Jobs Commission. One of these firms stated that it has received adequate training assistance from the Commission. The other firm stated that the major problem in this area was not the Commission's willingness to assist, but the size of the Commission's overall retraining budget. Both of these firms maintained that they have met with relative success in eliciting the Commission's support by carefully consolidating their individual plant requests into larger and coordinated proposals.

It is now recognized throughout the industry that the technology of automotive design and production will never cease to change, and that the pace of change will continue to accelerate. What is considered to be a vital skill or competence today may be outdated five or ten years from now. Employees must recognize that they must continue to learn, develop, and adapt throughout their working lives. States and other governments should accept the fact that their role in public education does not stop when a citizen turns eighteen or twenty-two. The public sector must contribute to its citizens' human resource needs throughout their working careers. The fact that the knowledge needed for acquisition often resides within the companies, and is not available through public institutions, should not disqualify employee retraining from public assistance. In fact, the knowledge usually exists only within the firms themselves. Yet the companies still require assistance in transferring this knowledge to hundreds, perhaps thousands, of current Michigan employees.

State efforts to reform and involve education with industry

In the long run, the state's strongest human resource efforts should be directed at improving the performance of its K-12 and university systems. This task is understood to be highly complex and will require careful, strong political leadership. Education reform is especially important for Michigan if it is to maintain its dominance in automotive employment. When automotive firms hire in other states, aside from Ohio, they can pick and choose, or skim, the best applicants in the state because automotive wages and salaries exceed those of any other local industry. However, firms cannot just skim the labor force in Michigan because of competition from other automotive firms and the heavy employment needs of the industry in this state. In other words, it is less important currently for Alabama or Kentucky to improve the quality of their average school graduates than it is for Michigan.

Finally, the importance of reforming public education to meet the needs of industry and graduates makes it especially important that the new school-to-work programs be formally linked to education reform. An honest assessment of these programs will underline their limited funding (perhaps $40 million) in Michigan. However, there is a greater potential to reform and redirect Michigan's far larger, existing voc-tech education system. Since one in every three Michigan high school students is meant to pass through voc-tech, the actual state education budget directed towards students meant to transition directly from K-12 to work must be seen as one-third of the total state K-12 budget. This would amount to more than $4 billion a year. School-to-work, then, can be used as an agent of change or as an opportunity to refocus industry and educational cooperation. Perhaps not since the trade high schools of the 1940s has Michigan been offered such a chance to make education work by making education lead to work.

Michigan Automotive Suppliers

Introduction

Focus group participants were asked to consider and discuss major issues for state policy in the areas of automotive human resources in the 1990s. The following topics were presented as discussion topics:

-Change in employment through 2003
- Change in occupational structure
- Michigan versus other states
- Age of labor force

-Quality of future automotive labor
- Critical skills
- Hiring criteria
- Initial and ongoing training
- Possible cooperative training

-The role of public education, training, and placement
- MESC screening
- The school-to-work model
- Performance of K-12 education
- The state as an innovator/facilitator

Participants, however, were not required to address any of the suggested topics, and were actively encouraged to discuss human resource issues that were of greatest importance to their firm.

Six supplier members of the Michigan Automotive Partnership (MAP) participated in the focus interviews. The six automotive firms constituted a reasonable cross section of Michigan's automotive supplier industry. Two suppliers were from mid-Michigan, two in southeast Michigan, and two were in west Michigan. The group included an engineering service firm, one small and one mid-sized steel stampings parts supplier, one small and one mid-sized plastics parts processor, and a small machining supplier. The typical participants in our focused interviews included the president of the company and the human resource (HR) manager.

In a project such as this, it quickly becomes apparent that there is no such thing as a generic supplier. Each supplier discussed its company's unique needs and objectives.

However, we did obtain consensus on many major issues. An excellent example of this pattern was displayed by our only participating engineering service firm. It was very different in many aspects from the five manufacturing firms. Yet this respondent discussed many important issues regarding shortages in technical labor that were later echoed by our other suppliers. In addition, while much of this discussion of future employment focused on production jobs, many of the same human resource issues also applied to technical and managerial employees. The following is an attempt to form a consensus from our six supplier interviews.

Change in Employment Through 2003

> "We have been waiting two weeks for the weather to clear—as soon as it does, we are going to pour concrete for the new facility."

At the time of their interviews all six suppliers were experiencing rapid growth. Several suppliers reported projects, either underway or pending, to add manufacturing space and additional employment. The outlook for short-term hiring was strong. Five of the six suppliers intended to increase employment by 20 to 30 percent in the next few years.

Two major factors were responsible for our suppliers' plans to expand. First, vehicle producers continue to source manufacturing, once performed within the vehicle firms, to suppliers. Second, the industry was experiencing strong sales during the time of our interviews. Despite this positive trend, most respondents foresaw many potential problems in the current restructuring of the supplier tier system. The pressure to consolidate, combined with additional pressure to reduce costs, could lead to financial difficulties for many smaller suppliers. However, our discussants also suggested that suppliers that are competitively strong will survive and absorb the capacity of those unable to adapt. In fact, MAP suppliers saw many opportunities in the changes to come. They also observed that jobs may shift location, but total supplier employment might not substantially increase.

An explicit concern with the recent restructuring was the fear that increased outsourcing was an attempt by the vehicle manufacturers to shift the fixed costs of higher production (including cost of hiring and training new employees) to independent suppliers. By moving work to suppliers, manufacturers will be better able to withstand inevitable downturns. Still, vehicle producers will maintain control of the product and the bulk of

profits. Some suppliers fear they will be the ones burdened with human resource costs in economic downturns. Suppliers were aware of the traditional cyclical nature of their industry. They felt that it was important not to overextend.

Several discussants expressed concern over the use of contract (or temporary) employees to cover increased employment needs during business cycle peaks. At least one supplier stated that his company used the temporary status as a time to evaluate an employee's potential. This company filled most permanent positions out of its temporary workforce. Although this practice has gained favor throughout the industry, it may present a significant training dilemma. Suppliers cannot afford to hire permanent workers because of inevitable downturns; however, it may not be cost-effective to continually retrain new temporary employees.

Michigan vis-à-vis Competitors

Although each supplier was well aware of the strengths and weaknesses of competing automotive states, only one supplier was currently having discussions with states outside Michigan. Each company expected that it would continue to do business in Michigan, if for no other reason than to be close to its customers.

Age of the Suppliers' Employees

Our discussants did not foresee any significant turnover due to retirement, in the near future. Only one supplier, in west Michigan, expected any significant future retirement. However, this supplier did not expect this labor turnover for another ten years. Our respondents' low rate of turnover may be more a reflection of the suppliers interviewed than the supplier industry in its entirety. The survey sample did not include any of the large Detroit area suppliers that have been active in the state for decades, including those whose operations are largely composed of former Big Three facilities. It is expected that these companies would likely report more expected turnover due to retirement than our discussants reported.

The Human Resourcess Food Chain

"The smaller suppliers are having both plant and management raided by the first-tier suppliers, who are in turn being raided by the manufacturers. It is a human resourcess food chain."

For many years, the Big Three have traditionally used their Michigan suppliers as a resource from which to obtain trained and tested employees. This practice has obvious benefits for both the Big Three and employees. By skimming the best employees from their suppliers, the Big Three are able to capture proven, capable talent that can quickly be used in production or engineering operations. Employees typically gain increased pay and other benefits by reemploying with the Big Three. The supplier is often the only loser. They have invested time and resources in training the employee, only to see the rewards of the investment realized by the vehicle manufacturers. Suppliers are especially concerned about Big Three competition for technical employees. This concern was related to the high cost of training engineers and the lack of qualified replacements. At least one supplier has been forced to look outside the state to find electricians and skilled-trades candidates.

It would seem that an obvious solution would be for suppliers to raise the wages and salaries of their best employees to reduce labor turnover. Yet all our suppliers reported strong pressure from customers to either cut or hold the line on costs. This would be markedly the case for labor costs. Suppliers who share local labor markets with the Big Three must fight the perception that all automotive workers earn Big Three union wages. According to one respondent, if all auto industry workers were paid the same wage rate, the Big Three would not be so willing to outsource. A representative of a small supplier firm located in the Detroit area said that his firm's low wage rates made it difficult to find workers with needed skill levels and commitment. This supplier felt that high wages and generous benefits at nearby Big Three facilities made it difficult for many workers to assess their own value in the independent supplier market.

Our two west Michigan (Holland and Grand Haven) suppliers did not report any significant raiding of employees by vehicle makers. Yet they did complain of a lack of proximity to their major customers. Significant communication and marketing costs were reported by these firms. A supplier must pay in other ways, it seems, to remain out of reach of the human resource departments of the Big Three. Finally, these two firms also reported the scarcity of technical labor (engineering) in their local labor markets. Once again, the lure of high salaries with the Big Three and other larger suppliers in Southeast

Michigan may make it difficult for west Michigan firms to find needed technical labor. On the other hand, the two west Michigan suppliers reported that their area did enjoy an advantage (over southeast Michigan) in "quality of life" that does mitigate somewhat the problem of attracting qualified labor.

As the industry undergoes further change leading to a more structured supplier tier system, first- and second-tier suppliers will also adopt the human resource food chain strategy. Our supplier interviews provided an actual example of this food chain and the effect it may have on suppliers. A small second-tier supplier stated that the company had just lost an engineering candidate to their customer, a first-tier supplier. The same first-tier supplier was interviewed the following day, and in turn mentioned that they had recently lost an engineer to their customer, a vehicle manufacturer.

Several of our discussants felt the Big Three practice of raiding lower-tier suppliers for human resources was detrimental to the overall industry. While all respondents admitted that raiding was standard industry practice, they also stated that it worked to reduce employee training by smaller suppliers. The small supplier may be less willing to invest in training without the certainty of long-term rewards. The practice of using lower-tier suppliers as a training and evaluation source for larger companies has significant implications as more critical work is being moved down to lower tiers. One supplier said that the quality of the product is only as good as the weakest link. If the higher-tier employers continue to skim top quality employees from the small suppliers, it will be difficult for lower-tier suppliers to maintain quality and other performance standards.

Some suppliers suggested that human resource training for lower-tier suppliers be subsidized by funding from the state or possibly from manufacturers. One argument was that since the automotive industry treats the lower supplier tiers as a "minor league" for employee evaluation and training programs, the state should support these suppliers as effective school-to-work programs. Direct support from the Big Three, they argued, would pay off in higher quality components, as well as a better trained pool of individuals.

Quality of Future Automotive Labor

Skills of the Future Automotive Worker

"Companies of the future must be fast, flexible and frugal. In order to do that workers must be informed and empowered decision-makers."

All six suppliers reported that they were actively working to increase the quality of their manufacturing labor force. One small supplier in mid-Michigan stated that the "skill set" for production workers is much higher and very different from just five years ago. Moreover, a company president was convinced that his company, like many others, had a long way to go to improve labor quality. One supplier demonstrated an exceptional commitment to the requirements of the Toyota Production System (TPS). We were shown several examples of how his firm's traditional workforce has used the TPS to achieve world-class quality and productivity levels. This firm (a Toyota supplier) has spent a substantial amount of time benchmarking its direct competition in Japan. The manager of this firm felt that many companies and their employees are not adequately trained in competitive benchmarking. In the same vein, another suggested that the state should help train the labor force in "best practice," or methods in determining what is "best practice."

A different supplier stated that they felt it was important for their employees to continue their education, not only to acquire specific knowledge, but also to become more practiced at learning. This supplier felt the ability to learn was itself a learned skill, and by practicing to learn, their employees would be better able to adapt to, and even improve, their work environment. Several supplier representatives supported that theory, but their companies were not actively pursuing a policy of encouraging nonjob-related training.

Several respondents commented that future automotive industry workers must be "competitively smart," not necessarily "academically smart." The definition of competitively smart included knowledge and understanding of competitors (both local and international), modern manufacturing practices, and the economic environment. Other respondents said that it was not traditional academic education that was most useful. Instead the best mix for industry would be education that includes both applied technical training and the traditional disciplines. This certainly applies to those trained at four-year engineering schools. One supplier suggested that there was a significant difference in graduates from applied engineering programs such as GMI or Michigan Tech compared with theory-oriented engineering programs such as those at the University of Michigan or Purdue. GMI, Michigan Tech and Ferris State graduates were seen as "quicker off the mark," compared to Michigan graduates, an advantage that continued long into their work careers.

Emerging Design Engineering Skills

"It takes two years of post-high school education to train a designer—but five years total to produce a good designer."

According to the design engineering representative, designers will need to possess an aptitude for spatial relations, and the ability to work in complex, three-dimensional designs. This will require designers to master mathematics through analytical geometry. He also suggests that there will be a merging of traditional engineering and design skills.

The engineering service respondent revealed several insights that were repeated by the others. According to this discussant, the state of Michigan faces a severe long-term shortage of qualified technical people. A combination of early buy-outs at the Big Three and the rapid adoption of computer-aided design technology has led to a shortage of technically capable applicants. To emphasize the point, the representative described the shortage in terms of supply and demand. He stated that a number of young designers with two years of college and over five years of experience were making six-figure salaries because demand for their skills was high. All six supplier firms made it very clear that they were experiencing critical shortages of experienced technical people, and felt the state should take both short- and long-term actions.

Critical Skills

Our respondents independently listed the same critical needs for autoworkers in the future. Problem solving, team skills, and employability skills were listed as the most critical skills required for future employment.

1. The auto worker of the future must be capable of solving problems. According to the representatives, the automotive industry has, for too long, failed to use the brain-power of its hourly workforce. If suppliers want to remain competitive, they must train their workforce to proactively solve problems. The use of continuous improvement systems requires employees to be capable of identifying and solving problems with limited guidance. No longer will it be acceptable for employees to rely only on brawn to be competitive.

One supplier said that not only will employees need to be more "trainable," but they will also need to be capable of training themselves—quite a change from the demands placed on previous generations of autoworkers. Schools will need to prepare students to deal with change. One representative openly wondered if flexibility can be taught using traditional methods, or if the capacity for lifelong learning can be effectively taught as well.

2. A direct complement to problem-solving skills is the ability to work in a team setting. The automotive industry, led in part by what is perceived to be the Japanese model, has increasingly reorganized work into self-guided teams. Industry, and to a large extent society, has never placed a high value on team skills. For many years, team activities in formal education were considered cheating. The only team-focused activities were athletics. Industry's recent adoption of teamwork is not reflected or matched by practice in education. Team socialization skills are still not taught by K-12 systems. This education task has therefore been placed entirely on industry.

These new requirements will change what is expected from current workers and the hiring criteria for new workers. The traditional tests and measures for identifying appropriate new employees are no longer useful. All respondents felt that the state must proactively work to assist industry in developing testing, and training programs, for these new skills.

Some of the supplier representatives had reservations about whether the current workforce was capable of change. Also, they wondered if it would take at least a generation before their companies were to find or develop new autoworkers. However, all agreed that there was no time for such a transformation, and every effort was being made to adapt current workers.

3. A final category of critical skills that will be required for future auto workers is best described as employability skills. Several representatives said that there was a minimum level of common sense, discipline, and work ethic skills that "are required." There was some consensus that it was becoming more difficult to find job candidates with these skills. It important to note that an employability skills shortage was emphasized primarily by respondents located in southeast Michigan. The representatives on the state's west side did not report a lack of employability skills as strongly as the others.

Several respondents felt that it was their responsibility to coach, push, and build up inexperienced, unskilled employees. The supplier representative felt that the best way to develop small business employees was to treat them like family, and to operate the company much like a caring parent oversees the well-being of a household. Unfortunately, according to one discussant, it is often those individuals who best respond to the coaching who are skimmed by larger suppliers.

Traditional Academic Skills

Most suppliers required new workers to have at least ninth-grade reading and mathematics skills. All of the suppliers interviewed would like to have the opportunity to hire employees with better academic skills, but they do not believe that the present K-12 system is capable of producing such candidates.

Academic hiring criteria varied across the firms. Not surprisingly, the smaller suppliers were less rigorous in their preemployment testing than the larger companies. One supplier required applicants to complete their application in the presence of a company employee to ensure that they were capable of at least reading. Other larger suppliers were more demanding, and had difficulty locating qualified workers. For example, one company reported that only one in ten applicants was able to pass the screening tests. The respondent at this company rated the quality of the Michigan labor market as "not very high."

In recent years, the automotive industry has significantly increased the implementation of quality programs, including statistical analysis of processes. All supplier respondents reported that future employees would not need higher level math skills. Instead, workers must possess a substantially stronger level of core mathematical skills. Several suppliers currently have implemented training programs that teach employees these basic skills.

Respondents also identified a need for improved communication skills. Suppliers are asking workers to assume increased responsibilities, which requires an ability to communicate information. The auto worker of the future must be capable of presenting information in both written and verbal forms. The ability to communicate clearly and concisely is not usually associated with ninth-grade writing skills.

The Role of Public Education, Training and Placement

MESC screening

A number of suppliers used Michigan Employment Security Commission (MESC) screening of applicants, with mixed results. One west Michigan firm did report a special relationship with a nearby MESC office and rated the assistance as very helpful. A mid-Michigan company was benchmarking another Livingston county supplier that was reporting excellent results from a two-day interviewing/testing process located at the Howell MESC office. Another discussant flatly suggested that the screening process should be made more flexible and should specifically test for problem-solving and communication skills.

Finally one supplier suggested that his experience has been that the MESC is viewed "universally" as a negative by suppliers. According to this discussant, when attempting to fill job vacancies, suppliers he is familiar with will choose to avoid the MESC. This discussant said that the MESC needs to be revamped, and focus more on the needs of the customer.

School-to-Work

"You tell us— what does school-to-work mean?"

There was a great deal of uncertainty expressed by the respondents about the definition of "school-to-work." All of the supplier respondents felt that there is a strong need for the state to better define what school-to-work programs entail and to make that definition clear. However, the automotive industry is actively involved in various forms of school-to-work. Michigan Automotive Partnership (MAP) suppliers are no exception. Each supplier had at least one program either underway or under development. The MAP supplier firms are very active in working with both K-12 systems and community colleges in their areas.

One supplier said that school-to-work was a critical element in reviving the K-12 system. However, this representative was concerned that the state needed to focus its program on younger students. It was his assertion that many of the mathematical skills needed in modern manufacturing are taught as early as the seventh grade. A good school-to-work program should start in "middle school, move through high school, and into a community college and real-world work experience."

The same respondent suggested that education and industry needed to work together to develop a "*kanban,*" or demand-pull structure for school-to-work. By working together to develop a reliable forecasting method, the two groups could arrange to have qualified graduates with the skills that are in demand by employers. For this purpose, this supplier also called on the Big Three to share their hiring needs five years into the future with the state.

One supplier has developed a strong working relationship with several community colleges, and regularly uses these institutions to assist in developing training programs. The supplier was very pleased with the proactive response of the college. The supplier was also involved in a training education consortium that was able to act as an ombudsman for training. If the consortium did not have specific training that matched a company's needs, it used a network to locate the required training elsewhere. In general, all six suppliers rated their local community college programs very highly in terms of cost, response, and attitude. Michigan's K-12 systems and large four-year universities fared poorly in comparison with the community colleges.

The Current Education System

According to our respondents, both government and educators have difficulty in accepting the fact that the current academic system is not working to fill industry needs. In particular, educators were described as treating industrial firms as outsiders and assuming that they, the educators, are the only group that can resolve the problem.

Several interview participants said that teachers must learn to become responsive to their customers—students, parents, and industry. If the current K-12 system continues to ignore its fundamental customers and block education reform, Michigan industry and high school graduates will be at a significant disadvantage vis-à-vis more progressive states.

There was some concern that current K-12 teachers are not capable of teaching effectively. It was suggested that teaching is a "lost skill." Students have different ways of learning, and most teachers cannot recognize these differences; and even fewer are skilled enough to be capable of adapting their methods to fit individual students.

All suppliers interviewed said that a critical barrier to overcome is the perception among educators that manufacturing is a second-rate career choice. One discussant referred to an antimanufacturing bias—or elitism—within education. There was general agreement that Michigan educators, at all levels, must change their opinion of manufacturing as a

career choice. Until that happens, it will be difficult to convince highly skilled individuals to pursue a manufacturing career.

Several suppliers suggested that the state fund internships for educators. Specifically, teachers and professors would be required to spend summers with local manufacturing companies. Our respondents maintained that educators have far too little contact with the "real world" and usually do not understand how skills apply to industry. Unfortunately for the auto industry, there is no mechanism for these educators to gain industry knowledge. Even if there were, several suppliers feared that the interns may not be competent enough to gain from the experience. Most of our suppliers felt that university professors and K-12 teachers were very poorly informed about industry. In contrast, they felt that community college teachers were far more knowledgeable about real-world issues than university professors, and thus better able to effectively respond to the needs of industry.

One supplier, located on the west side of the state, has developed a special internship program with a nearby university. This program is meant to acquaint faculty, first hand, with the technologies used in modern manufacturing. This supplier felt that it was critical for the company to develop these relationships, and encouraged the educators to gain a better understanding of the "real world." The same supplier has established a branch campus of a local college on company grounds. According to this respondent, instructors at this collocated facility have a deep understanding of both company and employee human resource needs.

Conclusions and recommendations

Our respondents recommended at least three major state policies in the area of human resources and the automotive parts and engineering industries.

1. *There should be a proactive commitment by the state to train current employees to compete.*

The new, competitive, domestic automotive industry requires many new methods and related skills in production. The state should identify and organize the most general forms of training and subsidize their use at small-to-medium automotive suppliers within the state. This would include programs on the nature of competition, team skills, and quality control methods, as well as remedial education in basic academic skills. One

supplier mused on the possibility of timing this training during industry downturns, when many workers are temporarily on layoff and funded by unemployment compensation.

2. *The state should mitigate the consequences of the "automotive food chain."*

If the large vehicle producers are initiating a period of massive replacement hiring of their older labor forces, suppliers will clearly face a human resource crisis in Michigan. Larger suppliers will, of course, adapt to this development by locating their production outside Michigan to avoid labor competition from the Big Three. Small suppliers, who cannot relocate, will face increased competition from non-Michigan suppliers with higher quality labor.

To meet this potential crisis, the state should continue its efforts to locate and recruit experienced manufacturing and design engineers (and perhaps skilled trades workers) in other states, for possible employment in Michigan's automotive supplier industry. Outstate (central and western Michigan) suppliers should receive communication and logistical support to enable their operations to make effective use of these local labor markets far from southeastern Michigan.

3. *The state should continue its strong efforts to reform Michigan education to become competitive.*

Michigan must compete. The nature of this competition is international in scope and includes every area of state policy including K-12 and higher education. School-to-work programs should be linked to the viable reform of K-12 vocational education in Michigan. Years of neglect and indifference to industry needs must be overturned. School administration and faculty must be made aware of and must become involved in the needs of industry and students in the real world of competition. University education also must become more relevant. If the state funds these programs with millions or billions of public dollars, it has the right to a higher return than at present.

The community college system in Michigan provides an excellent model of education and industry working together. These institutions treat business and students as customers for the education/training dollar. Community college faculties are involved and informed, and their administrations are highly proactive. Yet, a greater potential may exist in the state's K-12 systems if they can be reformed. All students, not just the college-bound, must expect to benefit from greater effort and academic accomplishment in their K-12 education. This can happen if employers are convinced of the market worth of high

school graduates. If automotive employers know that graduates possess not only the essential basic skills, but also employability skills, team skills, and the ability to learn so needed in the automotive workplace of the future, Michigan will certainly benefit for years to come.

(This page intentionally left blank)

IV. Conclusion

It is clear that Michigan's second century of automotive history will be very different than its first. In its first one hundred years, Michigan's auto industry revolutionized transportation, put a nation on wheels, and while doing so, transformed manufacturing, the economy and the very nature of work in the United States. These developments, which first began in southeastern Michigan, led to changes in the very pattern of modern life for much of the developed world. In the last twenty years, a mature Michigan auto industry, was one of the first sectors of the U.S. economy to confront an emerging and inescapable global competition which has forced many painful changes on those within the industry as well as those outside. Indeed, millions of Americans have now been affected by restructuring, or "downsizing," in almost every industry, corporation, or government throughout the economy. This pattern of economic "reengineering" may have first appeared in our state's auto industry and its partners in the steel and metal fabrication industries. It is only natural that the auto industry should provide the first indications of a reversal in this trend.

The forecast contained in this study states that the Big Three automotive firms may hire up to 250,000 new employees in the United States during 1995-2003. Up to 129,000 of these hires should occur in Michigan if our state just maintains its share of Big Three automotive activity. Tens of thousands of new skilled trades people must be trained, and tens of thousands of technicians and engineers must be educated. The forecast could be altered by the movement of work, now performed within the Big Three, to independent supplier firms. Yet we believe that even if this happens, the same number of openings will occur in the industry as a whole, and the same opportunities and challenges will remain. In fact, our forecast is based on an estimate of only the production needs of the North American market in 2003. If by then, our state auto industry is successful in capturing a reasonable share of the rapidly expanding world market for motor vehicles, then our jobs forecast will have underestimated the industry's future employment needs. Taken as a whole, the period of retrenchment and decline for Michigan's auto industry has certainly ended.

Our forecast of job openings for the Big Three only sets the larger stage for Michigan's future human resource challenge. The members of the Michigan Automotive Partnership have willingly contributed their time and expertise to outlining the tasks ahead for Michigan's public institutions in education and jobs development. The statements and conclusions contained in section III of this MAP report unequivocally indicate a desire to

upgrade the quality of labor in Michigan's automotive industry. The members of the MAP certainly are not denigrating the contributions and efforts of the industry's current and past employees. Instead, they are primarily concerned with redefining the nature of work or the jobs to be created in the auto industry of the future. Future automotive jobs will not require the creation of "new" automotive workers, but rather the use of different skills and the assumption of different responsibilities in the workplace. This is as much a managerial and union challenge as it is a challenge for future auto workers. It is also a major responsibility of the state's educators. The incentive now clearly exists for the state's educational institutions to reconnect with Michigan manufacturing. The most critical determinant of our state's automotive future will be the near- and long-term performance of its largest ongoing public investment—education.

Representatives of the MAP met with the Michigan Jobs Commission to review the contents of this report, in mid-October, 1995. Two essential results were produced at this meeting. First, it was agreed that the recommendations for state policies, listed at the end of the vehicle and supplier discussion sections in section III, should be subjected to further MAP review in the near future. This process will begin with a special round-robin process in January, 1996. Second, it was also agreed that future MAP reports and activities will never again separate vehicle producers and parts suppliers in forecasts or discussions. The current structure of this report, in other words, is old fashioned and unsystematic. Indeed, if the Michigan Automotive Partnership itself is to live up to its name, industry consensus must be developed with the full and simultaneous contribution of all the members of the MAP. Perhaps the most important finding in this initial MAP report arose in the supplier portion of the focus group discussions. In this discussion, the MAP suppliers state that, to a certain extent, their efforts to more effectively partner with their customers are being frustrated by competition from these same customers for needed human resources. An important reason for the MAP, then, is to provide another forum for MAP members to communicate with each other, and not just with the Jobs Commission and other public institutions.

V. Appendices

Appendix A
1985 Age & Service Distribution - United States

1985 - Age Distribution - U.S.										
Age:	Hourly Trades	Hourly Non-Trades	Hourly Total		Salaried Eng./Tech	Salaried Other	Salaried Total		Salaried & Hourly Total	
18-20	10	1,384	1,394	0.22%	1	116	117	0.16%	1,511	0.22%
21-30	6,644	68,501	75,145	12.06%	1849	7,209	9,058	12.52%	84,203	12.11%
31-40	31,901	178,041	209,942	33.69%	3798	16,349	20,147	27.86%	230,089	33.08%
41-50	40,542	155,449	195,991	31.45%	3960	19,314	23,274	32.18%	219,265	31.53%
51-60	30,077	84,849	114,926	18.44%	3185	13,817	17,002	23.51%	131,928	18.97%
61-65	7,669	15,354	23,023	3.69%	538	1,941	2,479	3.43%	25,502	3.67%
65+	1,053	1,659	2,712	0.44%	61	182	243	0.34%	2,955	0.42%
Total	117,896	505,237	623,133	100.00%	13,392	58,928	72,320	100.00%	695,453	100.00%
Average Age	**45.3**	**41.1**	**41.9**		**43.0**	**43.0**	**43.0**		**42.0**	
1985 - Service Distribution - U.S.										
Service Years:	Hourly Trades	Hourly Non-Trades	Hourly Total		Salaried Eng./Tech	Salaried Other	Salaried Total		Salaried & Hourly Total	
0-5	13,644	58,050	71,694	11.51%	2,234	9,057	11,291	15.61%	82,985	11.93%
6-10	22,075	106,353	128,428	20.61%	2,559	8,641	11,200	15.49%	139,628	20.08%
11-15	16,698	89,307	106,005	17.01%	2,144	8,580	10,724	14.83%	116,729	16.78%
16-20	22,094	120,965	143,059	22.96%	2,390	13,693	16,083	22.24%	159,142	22.88%
21-25	20,727	73,026	93,753	15.05%	1,636	7,818	9,454	13.07%	103,207	14.84%
26-30	10,344	29,290	39,634	6.36%	1,357	6,498	7,855	10.86%	47,489	6.83%
31-35	7,900	20,675	28,575	4.59%	787	3,382	4,169	5.76%	32,744	4.71%
36+	4,414	7,571	11,985	1.92%	285	1,259	1,544	2.13%	13,529	1.95%
Total	117,896	505,237	623,133	100.00%	13,392	58,928	72,320	100.00%	695,453	100.00%
Average Service	**16.7**	**15.0**	**15.3**		**15.5**	**16.5**	**16.3**		**15.4**	

1985 - Age Distribution - MI

Age:	Hourly Trades	Hourly Non-Trades	Hourly Total		Salaried Eng./Tech	Salaried Other	Salaried Total		Salaried & Hourly Total	
18-20	4	306	310	0.13%	1	58	59	0.12%	369	0.12%
21-30	3,245	28,625	31,870	13.00%	1548	4,279	5,827	11.57%	37,697	12.76%
31-40	14,711	74,350	89,061	36.34%	3206	11,433	14,639	29.06%	103,700	35.10%
41-50	17,937	53,827	71,764	29.28%	3193	12,718	15,911	31.59%	87,675	29.67%
51-60	12,210	30,106	42,316	17.27%	2571	9,315	11,886	23.60%	54,202	18.34%
61-65	2,14	5,780	8,694	3.55%	454	1,402	1,856	3.68%	10,550	3.57%
65+	419	661	1,080	0.44%	56	135	191	0.38%	1,271	0.43%
total	51,440	193,655	245,095	100.00%	11,029	39,340	50,369	100.00%	295,464	100.00%
Average Age	**44.6**	**40.6**	**41.5**		**42.8**	**43.4**	**43.2**		**41.8**	

1985 - Service Distribution - MI

Service Years:	Hourly Trades	Hourly Non-Trades	Hourly Total		Salaried Eng./Tech	Salaried Other	Salaried Total		Salaried & Hourly Total	
0-5	4,989	21,966	26,955	11.00%	1,763	4,862	6,625	13.15%	33,580	11.37%
6-10	8,798	39,639	48,437	19.76%	2,210	6,314	8,524	16.92%	56,961	19.28%
11-15	7,247	40,095	47,342	19.32%	1,806	6,122	7,928	15.74%	55,270	18.71%
16-20	11,023	46,795	57,818	23.59%	1,950	9,403	11,353	22.54%	69,171	23.41%
21-25	10,079	26,939	37,018	15.10%	1,313	5,154	6,467	12.84%	43,485	14.72%
26-30	3,642	7,178	10,820	4.41%	1,053	4,038	5,091	10.11%	15,911	5.39%
31-35	3,721	7,863	11,584	4.73%	671	2,456	3,127	6.21%	14,711	4.98%
36+	1,941	3,180	5,121	2.09%	263	1,001	1,264	2.51%	6,385	2.16%
Total	51,440	193,655	245,095	100.00%	11,029	39,350	50,379	100.00%	295,474	100.00%
Average Service	**17.1**	**14.7**	**15.2**		**15.4**	**16.9**	**16.6**		**15.4**	

excludes one company which failed to report

Appendix B
MICHIGAN EMPLOYMENT PROJECTIONS 2005 *

OCCUPATIONAL EMPLOYMENT PROJECTIONS

Occupation Title	Employment		Change		Average Annual Openings
	1992	2005	Level	Rate %	
Total Employment	4,319,075	4,966,175	647,100	15	147,685
Managerial	441,150	522,700	81,150	18	13,530
Professional	755,850	955,050	199,200	26	28,405
Sales	441,125	507,150	66,025	15	1,330
Administrative Support/Clerical	753,150	805,950	52,800	7	20,400
Service	690,875	839,350	148,475	21	30,110
Agricultural	110,900	105,475	-5,425	-5	2,595
Precision Prod./Craft/Repair	465,650	515,900	50,250	11	15,660
Operator/Fabricator/Laborer	660,000	714,600	54,600	8	20,585

INDUSTRY EMPLOYMENT PROJECTIONS

Industry	Employment		Change	
	1992	2005	Level	Rate %
TOTAL WAGE & SALARY EMPLOYMENT	3,926,300	4,593,200	666,900	17
Goods Producing	1,036,000	1,098,800	62,800	6
Mining	8,800	8,700	-200	-2
Construction	127,700	151,100	23,300	18
Manufacturing	899,600	939,200	39,600	4
Durable Goods	669,100	678,700	9,600	1
Motor Vehicles	270,604	254,000	-16,600	-6
Non-Durable Goods	230,500	260,500	30,000	13
Private Service Producing	2,252,000	2,811,300	559,300	25
Transportation/Communication/Utilities	153,800	161,900	8,100	5
Wholesale Trade	200,400	226,500	26,100	13
Retail Trade	730,200	858,600	128,500	18
Finance/Insurance/Real Estate	189,700	219,900	30,300	16
Services	978,200	1,344,200	366,000	37
Government	638,200	683,500	45,300	7

* Source: Bureau of Research and Statistics, Michigan Employment Security Commission

Appendix C
Engine Sourcing Changes

Chrysler

Chrysler will stop importing Mitsubishi 3.0 engines by 1999, with most of the decrease coming in 1998. This capacity will be replaced with an expansion at Kenosha. They are currently installing the capacity to produce approximately 500,000 2.7 and 3.2 V6 engines. It is assumed that there will be some increase in employment. However, the plant will lose its 2.5 I4 engine sometime in that time period. Production of that replacement will go to Tuluca. New Mack will also get a new product, the V8 truck (and large car). According to corporate reports, there will be minimal hiring for this facility, with much of the work possibly done at Mound Road.

Overall Chrysler should gain approximately 500,000 units of new capacity.

Added:	
Kenosha	400,000
New Mack	600,000
Total	1,000,000
Lost:	
Kenosha	110,000
Trenton	400,000
Total	510,000

Ford:

The big change at Ford will be the reduction of a portion of the 400,000 V6 engines imported from Germany. These engines will be replaced by a new Mod 2.5 V6, 3.8 V6 and a new MTEP 5.0 V8. However, the 3.8 production will be at Essex, Canada. 100,000 5.0L V8 engines will be produced at Cleveland, which does count as an increase in capacity. Another consideration is the increase of 3.0 Duratec replacing Essex 3.8 car engines — in effect giving the U.S. a higher capacity than it had previously. Other than that, it looks like Ford will not change drastically.

Overall changes.

Added:		
5.0 V8	100,000	
3.0 Duratec	350,000	From 3.8 Essex production
Total	450,000	

Appendix D
Delphi VIII, Marketing Volume, Round 1 Results
Questions 13, 31, 32, 33

MKT-13. Please estimate in constant 1994 dollars the *manufacturers' suggested retail prices* (MSRP) in 2000 and 2005 of a base model in each of the given segments. Please turn to page 39 for the definition of segments.

MSRP	Estimated 1995**			Median Response 2000			Interquartile Range 2000		
	Big Three	Japanese	European	Big Three	Japanese	European	Big Three	Japanese	European
Passenger Car									
Entry level	$10,452	$11,493	n/a	$12,000	$12,689	$14,000	$11,000/12,475	$12,000/13,500	$12,500/15,000
Intermediate/ family	17,438	14,867	20,890	19,000	17,000	22,000	18,000/20,000	16,000/18,250	21,877/23,717
Luxury	27,425	30,260	27,346	30,000	33,000	31,000	30,000/32,000	31,000/35,000	30,000/33,000
Light Truck									
Pickup	$14,403	$10,969*	n/a	$16,000	$13,000	$15,000	$15,000/16,648	$12,000/14,000	$12,375/17,000
Sport utility	18,461	20,533	37,400	20,100	22,000	39,000	20,000/22,000	21,000/24,000	35,000/41,396
Van	17,332	18,278	—	19,135	20,000	24,000	18,000/20,000	19,000/21,000	20,250/30,375

MSRP	Median Response 2005			Interquartile Range 2005		
	Big Three	Japanese	European	Big Three	Japanese	European
Passenger Car						
Entry level	$13,000	$14,000	$16,000	$11,250/14,500	$12,000/15,800	$12,500/17,500
Intermediate/ family	21,000	19,000	24,121	19,000/23,000	18,000/22,000	23,000/26,743
Luxury	33,500	36,000	35,000	32,000/37,800	33,000/41,000	32,000/40,000
Light Truck						
Pickup	$17,500	$15,000	$18,000	$15,500/19,000	$13,468/17,000	$15,000/23,500
Sport utility	23,000	25,000	26,750	21,000/25,000	22,375/27,250	21,750/33,750
Van	21,000	23,000	20,000	19,000/23,000	19,625/25,000	19,000/21,326

* Compact only

** Source: Edmund's Van, Pickup, Sport Utility Prices, Nov. 1994

Appendix D (cont.)

MKT-31. Please forecast, in thousands of units, the number of passenger cars and light trucks which will be sold in the United States and Canada by traditional domestic dealer networks and import dealer networks for 2000 and 2005.

Please note, it is a characteristic of medians that the sum of the individual estimates may not be equal to the total estimate.

Vehicle Sales by Market/Network	Est. 1994* (000's)	Median Response 2000 (in thousands)	Median Response 2005 (in thousands)	Interquartile Range 2000 (in thousands)	Interquartile Range 2005 (in thousands)
U.S. total passenger car sales	8,992	9,200	9,500	8,900/10,000	9,000/10,500
Big Three	5,808	5,950	6,100	5,600/6,150	5,637/6,500
Japanese	2,656	2,700	2,700	2,500/3,000	2,500/3,000
European	389	400	500	400/500	400/600
Other imports	138	150	200	100/200	139/369
U.S. total light truck sales	6,098	6,500	6,915	6,215/6,850	6,400/7,280
Big Three	5,229	5,500	5,700	5,300/5,805	5,258/6,027
Japanese	851	910	1,000	876/1,000	859/1,200
European	18	25	50	20/100	20/125
Other imports	0	0	2	0/10	0/50
U.S. total vehicle	15,089	15,720	16,275	15,250/16,450	15,600/18,000
Canadian total passenger car sales	749	800	837	754/857	771/907
Big Three	490	500	523	499/550	496/586
Japanese	194	200	213	200/225	200/240
European	45	50	50	47/55	49/60
Other imports	20	25	26	20/35	20/50
Canadian total light truck sales	482	520	568	500/600	502/646
Big Three	440	460	480	448/500	447/550
Japanese	39	49	50	40/50	42/71
European	3	5	5	3/10	3/15
Other imports	0	0	0	0/5	0/12
Canadian total vehicle	1,232	1,310	1,400	1,271/1,415	1,300/1,550

* Source: Automotive News Jan. 9 & Jan. 16, 1995

Appendix D (cont.)

MKT-32. Please estimate total *passenger car* market share percent. We suggest that you first consider segment shifts, making sure that the total market adds to 100%. Next, consider the sources of vehicles within each segment, making sure that these add to 100% for each segment. Please see page 39 for market segment definitions.

Passenger Car Sales by Segment	Est. 1994* (in percent)	Median Response 2000 (in percent)	Interquartile Range 2000 (in percent)
Lower small	8.4%	9%	8/10%
Traditional domestic	70.9%	70%	69/72%
Foreign	29.1	30	28/31
Upper/specialty small	20.8	21	20/22
Traditional domestic	77.6	77	75/78
Foreign	22.4	22	21/25
Lower middle	16.0	16	15/18
Traditional domestic	93.1	93	90/94
Foreign	6.9	7	6/10
Upper/specialty middle	29.5	30	28/30
Traditional domestic	83.8	84	82/85
Foreign	16.2	16	15/18
Large	11.7	11	10/12
Traditional domestic	80.2	80	80/82
Foreign	19.8	20	18/20
Lower/middle luxury	9.8	10	9/10
Traditional domestic	58.6	59	56/60
Foreign	41.4	41	40/44
Upper Luxury/Luxury Specialty	3.8	4	3/5
Traditional domestic	39.4	40	38/45
Foreign	60.6	60	56/62

* Source: Ward's Automotive Reports, Jan. 9, 1995

MKT-32. (cont.)

Passenger Car Sales by Segment	Median Response	Interquartile Range
	2005 (in percent)	2005 (in percent)
Lower small	9%	8/11%
Traditional domestic	70%	66/73%
Foreign	30	27/34
Upper/specialty small	21	19/22
Traditional domestic	77	74/79
Foreign	23	21/25
Lower middle	16	15/18
Traditional domestic	92	90/93
Foreign	8	6/10
Upper/specialty middle	30	26/31
Traditional domestic	84	81/85
Foreign	16	15/19
Large	10	8/11
Traditional domestic	80	79/84
Foreign	20	16/20
Lower/middle luxury	10	9/10
Traditional domestic	59	55/60
Foreign	41	40/45
Upper Luxury/Luxury Specialty	4	3/5
Traditional domestic	40	38/49
Foreign	60	51/61

Note: Totals may not add to 100% due to rounding.

Appendix D (cont.)

MKT-33. Please estimate total *light truck* market share percent. We suggest that you first consider segment shifts, making sure that the total market adds to 100%. Next, consider the sources of vehicles within each segment, making sure that these add to 100% for each segment. Please see page **79** for market segment definitions.

Light Truck Sales by Segment	Est. 1994* (in percent)	Median Response 2000	Interquartile Range 2000
Small/middle sport utility	18.0%	20%	18/20%
Traditional domestic	81.6%	80%	80/83%
Foreign	18.4	20	17/20
Large/luxury sport utility	7.8	8	8/10
Traditional domestic	95.1	95	93/95
Foreign	4.9	5	5/6
Minivan	21.0	21	20/22
Traditional domestic	96.0	95	94/95
Foreign	4.0	5	5/6
Large van	6.8	6	5/7
Traditional domestic	100.0	100	100/100
Foreign	0.0	0	0/0
Small pickup	19.9	20	19/21
Traditional domestic	91.2	90	90/91
Foreign	8.8	10	8/10
Large pickup	26.5	25	24/26
Traditional domestic	99.0	98	97/99
Foreign	1.0	2	1/3

* Source: Ward's Automotive Reports, Jan. 9, 1995

MKT-33. (cont.)

Light Truck Sales by Segment	Median Response 2005	Interquartile Range 2005
Small/middle sport utility	20%	19/22%
Traditional domestic	80%	78/84%
Foreign	20	15/22
Large/luxury sport utility	9	7/10
Traditional domestic	95	90/95
Foreign	5	5/10
Minivan	21	18/23
Traditional domestic	94	90/95
Foreign	6	5/10
Large van	6	5/7
Traditional domestic	100	100/100
Foreign	0	0/0
Small pickup	20	18/22
Traditional domestic	90	88/91
Foreign	10	8/12
Large pickup	25	21/26
Traditional domestic	98	95/99
Foreign	2	1/5

DEFINITIONS–MARKET SEGMENT EXAMPLES

Passenger Car Segment	Domestic	Import
Lower small	Dodge Neon Saturn	Toyota Tercel Mazda Protoge
Upper/Specialty small	Mercury Tracer Pontiac Sunfire	Volkswagen Golf Honda Civic
Lower middle	Dodge Stratus Pontiac Grand AM	Subaru Legacy Honda Accord
Upper/Specialty middle	Ford Taurus Pontiac Firebird	Nissan Maxima Toyota Celica
Large	Dodge Intrepid Chevrolet Caprice	Toyota Avalon
Lower/Middle luxury	Lincoln Continental Buick Park Avenue	Acura Vigor Mazda 929
Upper luxury/Specialty	Cadillac Seville Lincoln Mark VIII	Jaguar XJ6 Lexus SC400

Light Truck Segment	Domestic	Import
Small/Middle sport utility	Jeep Wrangler Ford Explorer	Suzuki Sidekick Nissan Pathfinder
Large/Luxury sport utility	Chevrolet Blazer GMC Yukon	Toyota Land Cruiser Range Rover
Minivan	Dodge Caravan Ford Aerostar	Mazda MVP Volkswagen Eurovan
Large van	Dodge Ram Van Ford Econoline	No entries
Small pickup	Ford Ranger Chevrolet S-10	Isuzu Pickup Mitsubishi Pickup
Large pickup	Ford F-Series Dodge Ram Pickup	Toyota T-100

Appendix E
Employment Forecast Model

	NA Big 3 Car Production	NA Big 3 Truck Production	NA Big 3 Vehicle Production	Sourcing Ratio	Source Production	Content Value Adjustment	Content Value Equivalent 1994 Units	Best Practice 2003
Car Assembly								
	car	truck	total					
1994 - actual	**6190000**	6200000	12390000	0.776	4803440			
2003-1	**6670000**	6182000	12852000	0.776	5175920	1.1451	5926946	88.808
2003-2	**7196000**	6552000	13748000	0.776	5584096	1.1451	6394348	88.808
Truck Assembly								
	car	**truck**	total					
1994 - actual	6190000	**6200000**	12390000	0.8127	5038740			
2003-1	6670000	**6182000**	12852000	0.8127	5024111	1.1628	5842037	90.8865
2003-2	7196000	**6552000**	13748000	0.8127	5324810	1.1628	6191690	90.8865
Engines								
	car	truck	**total**					
1994 - actual	6190000	6200000	**12390000**	0.8275	10252725			
2003-1	6670000	6182000	**12852000**	0.8275	10635030	1.1536	12268571	449.9482
2003-2	7196000	6552000	**13748000**	0.8275	11376470	1.1536	13123896	449.9482
Transmissions								
	car	truck	**total**					
1994 - actual	6190000	6200000	**12390000**	0.792	9812880			
2003-1	6670000	6182000	**12852000**	0.792	10178784	1.1536	11742245	427.964
2003-2	7196000	6552000	**13748000**	0.792	10888416	1.1536	12560877	427.964
Stamping								
	car	truck	**total**					
1994 - actual	6190000	6200000	**12390000**	1	12390000			
2003-1	6670000	6182000	**12852000**	1	12852000	1.1536	14826067	294.2053
2003-2	7196000	6552000	**13748000**	1	13748000	1.1536	15859693	294.2053
Parts								
	car	truck	**total**					
1994 - actual	6190000	6200000	**12390000**	1	12390000			
2003-1	6670000	6182000	**12852000**	1	12852000	1.1536	14826067	108.0576
2003-2	7196000	6552000	**13748000**	1	13748000	1.1536	15859693	108.0576
Other								
	car	truck	**total**					
1994 - actual	6190000	6200000	**12390000**	1	12390000			
2003-1	6670000	6182000	**12852000**	1	12852000	1.1536	14826067	87.827
2003-2	7196000	6552000	**13748000**	1	13748000	1.1536	15859693	87.827
Total								
	car	truck	**total**					
1994 - actual	6190000	6200000	**12390000**	1	12390000			
2003-1	6670000	6182000	**12852000**	1	12852000	1.1536	14826067	*27.35*
2003-2	7196000	6552000	**13748000**	1	13748000	1.1536	15859693	*27.35*

Appendix E (cont.)

	U.S. Employment	Hourly Employment Ratio	Salaried Employment Ratio	U.S. Hourly Employment	U.S. Salaried Employment	MI Employment	MI Hourly Employment	MI Salaried Employment
Car Assembly								
1994 - actual	*76089*	0.92224895	0.07775105	70173	5916	32436	29914	2522
2003-1	66739	0.92224895	0.07775105	61550	5189	28450	26238	2212
2003-2	72002	0.92224895	0.07775105	66404	5598	30694	28307	2386
Truck Assembly								
1994 - actual	*72758*	0.91782347	0.08217653	66779	5979	19844	18213	1631
2003-1	64278	0.91782347	0.08217653	58996	5282	17531	16091	1441
2003-2	68126	0.91782347	0.08217653	62527	5598	18581	17054	1527
Engines								
1994 - actual	*26172*	0.89462769	0.10537231	23414	2758	14392	12875	1517
2003-1	27267	0.89462769	0.10537231	24393	2873	14994	13414	1580
2003-2	29168	0.89462769	0.10537231	26094	3073	16039	14349	1690
Transmissions								
1994 - actual	*26483*	0.90449726	0.09550274	23954	2529	12688	11476	1212
2003-1	27437	0.90449726	0.09550274	24817	2620	13145	11890	1255
2003-2	29350	0.90449726	0.09550274	26547	2803	14062	12719	1343
Stamping								
1994 - actual	*53126*	0.90208184	0.09791816	47924	5202	26477	23884	2593
2003-1	50394	0.90208184	0.09791816	45459	4934	25115	22656	2459
2003-2	53907	0.90208184	0.09791816	48628	5278	26866	24235	2631
Parts								
1994 - actual	*141939*	0.87538981	0.12461019	124252	17687	62399	54623	7776
2003-1	137205	0.87538981	0.12461019	120108	17097	60318	52802	7516
2003-2	146771	0.87538981	0.12461019	128482	18289	64523	56483	8040
Other								
1994 - actual	*174634*	0.31528986	0.68471014	55060	119574	133350	42044	91306
2003-1	168810	0.31528986	0.68471014	53224	115586	128903	40642	88261
2003-2	180579	0.31528986	0.68471014	56935	123644	137889	43475	94414
Total								
	571201							
1994 - actual	571201	*0.7205104*	*0.2794896*	411556	159645	301586	193031	108555
2003-1	542130	*0.7167061*	*0.2832939*	388548	153582	288457	183732	104725
2003-2	579902	*0.7167024*	*0.2832976*	415617	164285	308654	196622	112032

Appendix E (cont.)

	U.S. Employment Change	U.S. Hourly Employment Change	Hourly Trades	Hourly Other	U.S. Salaried Employment Change	Salaried Engin/Tech	Salaried Other
Car Assembly							
1994 - actual							
2003-1	-9350	-8623	-1810	-6813	-727	-272	-455
2003-2	-4087	-3769	-791	-2978	-318	-119	-199
Truck Assembly							
1994 - actual							
2003-1	-8480	-7783	-1634	-6149	-697	-260	-436
2003-2	-4632	-4252	-892	-3359	-381	-142	-238
Engines							
1994 - actual							
2003-1	1095	979	206	774	115	43	72
2003-2	2996	2680	563	2117	316	118	198
Transmissions							
1994 - actual							
2003-1	954	863	181	682	91	34	57
2003-2	2867	2593	544	2049	274	102	172
Stamping							
1994 - actual							
2003-1	-2732	-2465	-517	-1947	-268	-100	-168
2003-2	781	704	148	557	76	29	48
Parts							
1994 - actual							
2003-1	-4734	-4144	-870	-3274	-590	-220	-369
2003-2	4832	4230	888	3342	602	225	377
Other							
1994 - actual							
2003-1	-5824	-1836	-385	-1451	-3988	-1490	-2498
2003-2	5945	1874	393	1481	4070	1521	2549
Total							
1994 - actual							
2003-1	-29071	-23008	-4829	-18179	-6063	-2266	-3797
2003-2	8701	4061	852	3208	4640	1734	2906

Appendix E (cont.)

	MI Employment Change	MI Hourly Employment Change	Trades	Other	MI Salaried Employment Change	Engin/Tech	Other
Car Assembly							
1994 - actual							
2003-1	-3986	-3676	-883	-2793	-310	-131	-179
2003-2	-1742	-1607	-386	-1221	-135	-57	-78
Truck Assembly							
1994 - actual							
2003-1	-2313	-2123	-510	-1613	-190	-80	-110
2003-2	-1263	-1160	-279	-881	-104	-44	-60
Engines							
1994 - actual							
2003-1	602	539	129	409	63	27	37
2003-2	1647	1474	354	1120	174	73	100
Transmissions							
1994 - actual							
2003-1	457	414	99	314	44	18	25
2003-2	1374	1243	298	944	131	55	76
Stamping							
1994 - actual							
2003-1	-1362	-1228	-295	-933	-133	-56	-77
2003-2	389	351	84	267	38	16	22
Parts							
1994 - actual							
2003-1	-2081	-1822	-438	-1384	-259	-109	-150
2003-2	2124	1859	447	1413	265	111	153
Other							
1994 - actual							
2003-1	-4447	-1402	-337	-1065	-3045	-1283	-1762
2003-2	4539	1431	344	1087	3108	1309	1799
Total							
1994 - actual							
2003-1	-13129	-9299	-2234	-7065	-3831	-1613	-2217
2003-2	7068	3592	863	2729	3476	1464	2012

Appendix E (cont.)

	U.S. Employ-ment Change	U.S. Hourly Employ-ment Change	Hourly Trades	Hourly Other	U.S. Salaried Employment Change	Salaried Engin/Tech	Salaried Other
Employment Change							
through 2003-1	-29071	-23008	-4829	-18179	-6063	-2266	-3797
through 2003-2	8701	4061	852	3208	4640	1734	2906
Attrition							
1995-2003	241969	190827	37886	152941	51142	14167	36975
Hires							
through 2003-1	212898	167819	33057	134762	45079	11901	33178
through 2003-2	250670	194888	38738	156149	55782	15901	39881

	MI Employment Change	MI Hourly Employment Change	Trades	Other	MI Salaried Employment Change	Engin/Tech.	Other
Employment Change							
through 2003-1	-13129	-9299	-2234	-7065	-3831	-1613	-2217
through 2003-2	7068	3592	863	2729	3476	1464	2012
Attrition							
1995-2003	122195	86766	20580	66186	35429	11256	24173
Hires							
through 2003-1	109066	77467	18346	59121	31598	9643	21956
through 2003-2	129263	90358	21443	68915	38905	12720	26185

(This page intentionally left blank)

VI. References

Cole, David E. et al., *Delphi VIII, Forecast and Analysis of the North American Automotive Industry. 3 Vols.* (Ann Arbor: University of Michigan Transportation Research Institute, Office for the Study of Automotive Transportation, 1996).

Crain Communications, *Automotive News 1995 Market Data Book* (Detroit: Crain Communications, 1995).

Elm International, *The Elm Guide to Automakers in North America* (East Lansing, Michigan: Elm International, 1994).

Harbour and Associates, *The Harbour Report 1995* Troy, Michigan: Harbour and Associates, 1995).

James M. Rubenstein, *The Changing U.S. Auto Industry: A Geographical Analysis* (New York: Routledge, 1992).

Kuntz, Kent; Jablonski, Mary; and Klarquist, Virginia, "BLS Modernizes Industry Labor Productivity Programs," *Monthly Labor Review* 118, no. 7 (July 1995).

Luria, Daniel, *Calculating Big Three Vertical Integration* (Ann Arbor, Michigan: Industrial Technology Institute, August 1990).

Luria, Daniel, *Technology, Work Organization and Competitiveness: Automotive Subsystems Lost Reduction.* (Ann Arbor, Michigan: Industrial Technology Institute, December 1987).

McAlinden, Sean P. and Smith, Brett C., *The Changing Structure of the U.S. Automotive Parts Industry* (Washington, D.C.: U.S. Department of Commerce, Economic Development Administration, February 1993).

Michigan Department of Education, 1992.

Michigan Employment Security Commission, Research/Statistics, *1992-1993 Average, Motor Vehicles and Equipment Industry Employment by Age Group, by Occupational Group.* Detroit, Michigan, July 31, 1995.

Michigan Employment Security Commission, *Research/Statistics, Special Report, Auto Industry Employment* (Detroit: The Commission, August 8, 1995).

Michigan Employment Security Commission, *Research/Statistics. "Occupational Employment Projections," in Michigan Employment Projections 2005.* (Detroit: The Commission, September 8, 1995.)

Michigan Jobs Commission, Customer Assistance and Research Services, *Michigan Automotive Update*, (Lansing, Michigan: The Commission, April 1995).

Michigan State Board of Education, Condition of Michigan Education: 1992, (Lansing Michigan, 1992).

U.S. Department of Labor, Bureau of Labor Statistics *1980 Current Population Survey Annual Average Employment and Age Distribution, by Detailed Industry -- Both Sexes Characteristics* (Washington: Government Printing Office, 1995).

U.S. Department of Labor, Bureau of Labor Statistics, *1992 Current Population Survey Annual Average Data - Selected Characteristics* (Washington: Government Printing Office, 1995).

U.S. Department of Labor, Bureau of Labor Statistics, *Career Guide to Industries, Bulletin 2453* (Washington: Government Printing Office, December 1994).