

Relationship Performance in the Automotive Supply Chain

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Abstract

Dave Nelson the VP for Purchasing and Materials at Honda first raised the issue of the importance of being a good customer in the automotive supply chain. Subsequent discussions regarding being a high customers were held with Gunter Schmirler of General Motors and Dave Curry of Honda . Given the automobile industry as a research framework, the next step involved the establishment of the research design. The quality of the design is critical to the ultimate success of the study. To deliver this quality, the research team met with industry executives to validate the research design. Five automobile manufacturers (Daimler-Chrysler, Ford, General Motors, Honda, and Toyota) participated in the project. Telephone interviews were conducted with Ford and Toyota. Field visits were conducted with General Motors, Daimler-Chrysler, and Honda at their facilities.

The manufacturer meetings, as well as other industry research showed that the manufacturers had achieved different levels of success in implementing supply chain management.³ Some manufacturers, like Daimler-Chrysler and Honda, were already capitalizing on integrated supply relationships in order to gain competitive advantage in the industry.⁵ Others, like General Motors, however, still struggle to implement effective supply chain integration strategies. Given this disparity, it was decided to establish the research focus as benchmarking supply chain relationship effectiveness.

Thus the primary research question is as follows:

What are the important supply chain relationship assessment factors to benchmark from the supplier's point of view?

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I. Introduction

While it is useful to investigate the new economy enterprises such as Cisco Systems to in determine the future of e- manufacturing, it provides a distorted portrait of the state of change without considering the majority of manufacturing industries that are characterized by the old economy. The five largest manufacturing firms worldwide contribute over 600 billion dollars to the global economy, they also happen to be from the same manufacturing sector; the automobile industry.

While different industries are in varying stages of implementing supply chain management efforts, one of the more developed efforts is in the automobile industry. The import of high quality, fuel efficient, and competitively priced automobiles from Japan in the 1970's and 1980's forced American automobile manufacturers to become more competitive or go out of business. Subsequently, one critical success factor in the industry has proven to be effective supplier partnering. Furthermore, the industry retains a futile climate for technological integration. Given these two elements, the automobile industry served as an excellent source of study.^{3, 4, 5}

Table 2 shows the current state of competition in the U.S. automobile industry. One impression is that relatively few manufacturers account for most of the automobile production for the U.S. market. Although the U.S. Big Three (General Motors, Ford, and Daimler-Chrysler) have been hit hard by foreign competition, they still retain market share, and these numbers have strengthened since the early 1990's. Profitability has also been relatively strong for the Big Three over the last few years as well.¹ The Big Three,

along with the two primary Japanese transplant manufacturers (Honda and Toyota); sell over 85% of new automobiles, in the U.S. market (Figure 1). Given the high price of automobiles and the fact that over 1.35 million vehicles were sold in the United States in 1996, a tremendous amount of revenue is associated with just five manufacturers. This indicates a significant supply chain power advantage in favor of the manufacturers because they are an oligopoly.

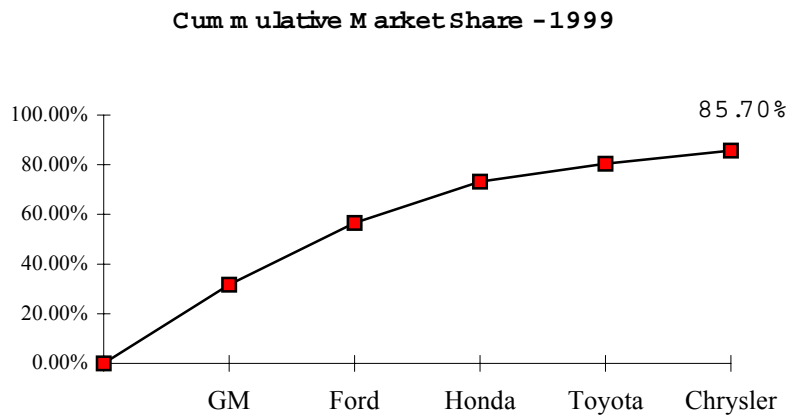
Given the market share of the larger automobile manufacturers, there are many critical industry-wide issues that affect supply chain processes in the United States. This has implications for manufacturer-supplier integration. First, both the U.S. and Japanese transplant firms are attempting to utilize supply chain management as a source of competitive advantage within the industry. Effective supply chain management involves the coordination of suppliers and manufacturers to decrease costs, increase quality, and accept more product design responsibilities.

In the management of an effective/coordinated supply chain relationship between suppliers and manufacturers there must be a way to assess what constitutes success from the suppliers' buyers' vantage points-. The suppliers' perception is important in spite of the relative difference in power between supply chain partners. One way to assess how suppliers view success is to benchmark the supply chain relationship.

Manufacturer	Vehicles Sold U.S. Market	Percentage Of Total	Cumulative Percentage
GM	435,897	31.74%	31.74%
Ford	341,963	24.90%	56.63%
Honda	228,828	16.66%	73.29%
Toyota	98,315	7.16%	80.45%
Daimler-Chrysler	72,891	5.31%	85.76%
Nissan	65,122	4.74%	90.50%
Mazda	27,062	1.97%	92.47%
VW/Audi	18,492	1.35%	93.82%
Hyundai	14,311	1.04%	94.86%
Mitsubishi	13,751	1.00%	95.86%
Other	56,866	4.14%	100.00%
TOTAL	1,373,579	100.00%	100.00%

Source: *Automotive News*, July 7, 1999

Table 2: U.S. New Car Sales - 1999



Source:

Automotive News, July 7, 1999

Thus the primary research question is as follows:

What are the important supply chain relationship assessment factors to benchmark from the supplier's point of view?

In the early 1900's automobile manufacturers transformed the entire manufacturing industry from a craft orientation to mass manufacturing. Half a century later, the same industry revolutionized manufacturing again, steering manufacturing from mass production to lean production. Now, these same producers offer the next revolution in e manufacturing. These automotive giants were not the first to embrace the information economy. However, over the past several years; they have contributed to its development. This development has experienced difficulties and roadblocks at every stage. Nevertheless, the automobile industry will be a leading indicator of what lies ahead for the application of networking and information technology to manufacturing and supply chain management.

The study is structured as follows. The following section provides the motivation for the study. The research plan is presented in section III. The analysis is given in

section IV. The results and managerial insights are discussed in section IV and the conclusions will be given in section V.

II. Motivation for Research

It takes approximately 60 days to build and deliver an automobile to a customer, although only one to two of those days are spent assembling the car. Approximately 58 days are spent scheduling production, ordering materials, and purchasing supplies. The top five automotive manufacturers, on average, currently process approximately 250 billion dollars worth of raw materials and 59 billion dollars worth of work in process inventory each year. These automakers are also experiencing declining levels of efficiencies. Currently, 30 percent of the cost of an automobile is derived solely from inventory staged in a warehouse waiting for the next appropriate queue in process.⁴ In essence; the vast majority of the cost for an automobile is non-value added inefficiencies (e.g. slow inventory turns, delays, queue times, and etc.) in the manufacturing process. These areas are prime targets for e manufacturing. In 1999 GM, Ford, and Daimler-Daimler-Chrysler joined together in a venture that attempted to take advantage of the promises of e manufacturing. The venture was given the name Covisant, COmmunication VISion INTegration. This online market place was expected to connect more than 35,000 suppliers, partners, and manufacturers worldwide in a virtual market that would process over 300 billion dollars worth of transactions annually. To date Covisant has not worked for at least two reasons:

1. A majority of the suppliers were skeptical and did not sign up.
2. The manufactures themselves did not appear to trust sharing information among them.

With the increase in globalization, ironically driven in part by IT, competition has increased at accelerated rates. Increased competition has led to firms focusing more on their core competencies becoming less and less on vertically integration. This focus has led to increased specialization within the firm, which drives the need for firms to outsource more of their non-core functions. The result is that a firm must build more collaborative business relationships with constituencies beyond its formal boundaries. Moreover, tightly integrated sharing of information facilitates these relationships. As competition increases, the range of integration expands and the need to manage information becomes increasingly critical. The rise of MRP, MRP2, CRM, SCM, and ERP are evidence of the need for information sharing and the fact that e manufacturing is becoming a reality.

Given the automobile industry as a research framework, the next step involved the establishment of the research design. The quality of the design is critical to the ultimate success of the study. To deliver this quality, the research team met with industry practitioners to validate the research design. Five automobile manufacturers (Daimler-Chrysler, Ford, General Motors, Honda, and Toyota) participated in the project. Telephone interviews were conducted with Ford and Toyota. Field visits were conducted with General Motors, Daimler-Chrysler, and Honda at their facilities.

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management.³ Some manufacturers, like Daimler-Chrysler and Honda, were already capitalizing on integrated supply relationships in order to gain competitive advantage in the industry.⁵ Others, like General Motors, however, still struggle to implement effective supply chain integration strategies. Given this disparity, it was decided to establish the research focus as benchmarking supply chain relationship effectiveness.

III. Research Plan

A mailing list for 548 of the most critical tier 1 supplier's in the automobile industry was used as the sample for the study. The research team assured the anonymity of the sample. This list consisted of individuals with high level, strategically oriented positions, having titles such as President, CEO, and Chairman. The data were entered into spreadsheet format and verified twice for entry accuracy. The data were then filtered for problems. Some companies were also removed from the Honda list because they were Honda subsidiaries. Given a 548 total contact names supplied, 130 were considered usable for the benchmarking study after data cleansing. The response rate for the benchmarking study was 23.7 percent. This sample allowed for suitable testing of the research hypothesis.

DEMOGRAPHICS OF RESPONDENTS

Several standard demographic measures including products/services supplied, percentage and value of sales to the manufacturer, quality certification, and number of employees were collected to obtain a general understanding of respondent attitudes. The ranked frequencies of the products and/or services provided by the suppliers are displayed in Table 3. Bearing in mind that a respondent may select more than one category, chassis and power train components were found to be the most frequently

marked categories. Most of the remaining categories were relatively evenly distributed in frequency, indicating that each of the categories was well represented in the data.

Category	Count	Per.
Chassis components	54	23.6%
Power train components	54	23.6%
Interior components	33	14.4%
Exterior components	32	14.0%
Stamping components	28	12.2%
Electrical components	27	11.8%
Other	24	10.5%
Transportation/logistics	24	10.5%
Tooling/equipment/construction	12	5.2%
Non-production services	6	2.6%

Table 3: Categories of Products/Services of Respondents

Next, the suppliers were asked to estimate the average percentage of their total sales as well as the total dollar amount of sales purchased by the manufacturer of interest (Table 4). The average percentage was 23.52%, indicating that the manufacturers accounted for a relatively large proportion of the supplier's sales. The average dollar amount of sales was found to lie between \$5 and \$50 million. The number of employees per firm averaged approximately 7,000.

Category	% Of Sales	Value Of Sales	QS9000 Certified	ISO9000 Certified	# Employees
Mean	23.52%	3.39	125 yes	112 yes	6949.11
Standard Deviation	26.28%	1.50			

Table 4: Demographics of Respondents

Finally, information about quality certification with specific regard to ISO9000 and QS9000 was collected. *ISO9000* (International Organization for Standardization) seeks to offer standardization of quality management issues. Firms attempting to register for certification must meticulously map and refine the control of processes such as inspection, purchasing, distribution, and training. One hundred twelve of the respondents report that they currently have or will soon qualify for ISO9000 certification. The steep cost of certification may prevent small suppliers from achieving such certification. Related to ISO9000, *QS9000* was developed by the Big Three U.S. manufacturers (GM, Ford, and Daimler-Chrysler) Specifically for the automotive industry.

Supplier Relations Data Collection

This section will serve to establish a benchmarking assessment of supplier relations in the U.S. automotive industry. This understanding of industry best practice will help the reader to focus upon the importance and relevance of the summary statistics to be presented later. Specifically, a segment of the survey (Appendix A) sought to establish a

comparison of supplier opinions about the different major manufacturers in the automobile industry. The statement read "In considering your relationships with the following firms, please allocate a total of 100 points among them based on their quality as a customer", Daimler-Chrysler, Ford, General Motors, Honda, and Toyota were among the e-manufacturers listed. These five manufacturers accounted for over 85% of U.S new vehicle sales in 1999.

An assessment of the relative quality of the manufacturers through the eyes of the suppliers was measured with the point allocation. If all the manufacturers supplied by the particular respondent have perceived quality as a customer, the score for each should be equal at 100 divided by the number of firms supplied. Scores differing from this average score would indicate above or below average perceived quality. This allowed suppliers to rate their customers, thus, offering an industry benchmark of the results of supplier relationship efforts. In order to gain insight into the factors affecting supplier relations benchmarking responses, respondents were also asked to select important factors influencing their rating of customer quality. They selected one or more among commitment, cooperation, trust, satisfaction, performance, and other.

IV. Results and Discussion

The scores for each response were examined. Any score sets that failed to total to 100 were removed from consideration, as were responses that indicated the respondent supplied only one of the five listed manufacturers. This left 130 usable supplier responses. The score sets for response were taken as a percentage of the expected response given the supplier considered all their manufacturer customers as equals. For instance, if a respondent supplied four manufacturers, the expected score for each would

be 25. If a manufacturer achieved its expected score of 25, its resulting indices would be 25 divided by 25 equaling 1. Thus, the benchmark indices would assume a value of one if the supplier considered the manufacturer to retain average quality as a customer. Subsequently, an indices greater than one would indicate an above average rating for customer quality while a below average score would be below one. Table 4 shows summary statistics for these customer quality indices. With an average overall rating of 1.42, Daimler-Chrysler retained the strongest reputation among the suppliers while Honda ranked second with a mean score of 1.10. The ranks of the remaining three manufacturers were found to be Toyota (mean of .96), Ford (.91), and GM (.72). 95% confidence intervals were constructed for each score and are displayed in Figure 3 to offer a visual representation of the scores. The scores were also tested for significance in difference from the average value of one. Both Daimler-Chrysler and Honda showed evidence of significant above average ratings while Ford and GM demonstrated significance in below average ratings. Toyota demonstrated no significant difference from one.

Benchmarking		Daimler- Chrysler	Ford	GM	Honda	Toyota
Scores						
All usable allocations	mean	1.42	0.91	0.72	1.10	0.96
N = 130	stdev	0.467	0.428	0.405	0.545	0.398
	t-stat	8.84	-2.14	-7.25	1.76	-0.86
	p-value	< .01	0.03	< .01	0.08	> .10
	count	97	108	113	98	69

Table 4: Benchmarking Scores for Usable (n=130) Responses

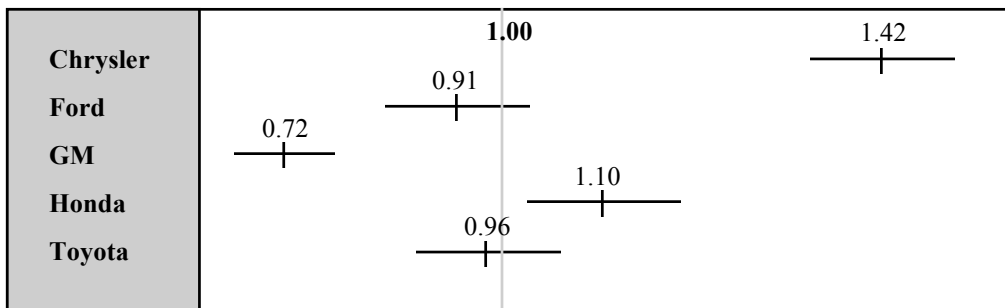


Figure 3: 95% Confidence Intervals for Benchmarking Scores (n=130)

To gain further insight regarding supplier opinions of their customers, this same analysis was conducted for the 41 respondents who indicated that they supplied all five manufacturers. These results (Table 5) were similar to the previous, finding Daimler-Chrysler with the highest average rating at 1.40. Honda followed with 1.06, then Toyota

with .95, Ford with .87, and GM with .72. Figure 4 displays 95% confidence intervals for the mean score for each firm. Also, t-tests were also run for significance in difference from the average value of one revealed that Daimler-Chrysler retained a significant above average rating while Ford and GM demonstrate significant below average ratings. Both Honda and Toyota demonstrated no significant difference from one.

Benchmarking		Daimler- Chrysler	Ford	GM	Honda	Toyota
Scores						
Supply all 5	Mean	1.40	0.87	0.72	1.06	0.95
N = 41	stdev	0.561	0.427	0.445	0.565	0.392
	t-stat	4.51	-2.01	-3.98	0.72	-0.78
	p-value	< .01	0.04	< .01	> .10	> .10
	count	41	41	41	41	41

Table 5: Benchmarking Scores for Suppliers of all Five Manufacturers

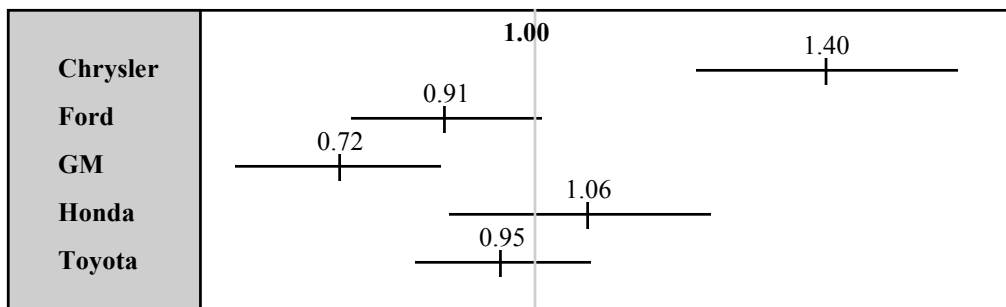


Figure 4: 95% Confidence Intervals for Benchmarking Scores for all five suppliers

The above for the benchmarking assessment verifies this best practice, indicating that these two firms set the industry best practice for fostering relationships with their suppliers.

Important Factors in Customer Assessment

These results were tallied for the 130 suppliers providing response to the benchmarking assessment (Table 6). Of these factors, commitment (98 out of 130 responses, 75.4%), cooperation (107, 82.3%), and trust (93, 71.5%) were checked most frequently. Both satisfaction (33, 25.4%) and performance (56, 43.1%) were chosen less by less than half of the respondents, and no consensus replies were provided for the "other" category. These proportions were examined for significance in difference from .50 (50% of respondents). Commitment, trust, and cooperation were significantly greater than .50. Furthermore, satisfaction was found to be significantly less than .50, while performance demonstrated no significant difference.

Basis for Scoring		Commit-	Cooper-	Trust	Satis-	Perfor-
		ment	ation		faction	mance
All usable	count	98	107	93	33	56
allocations						
n=130	freq	0.754	0.823	0.715	0.254	0.431
	z stat	5.79	7.37	4.91	-5.61	-1.58
	p-value	< .01	< .01	< .01	< .01	> .10

Table 6: Basis for Allocation of Points in Benchmarking Assessment

The respondents were also asked to indicate the relationship factors that were most important in evaluating the quality of the automotive manufacturers as customers. The most important relationship factors, cooperation (107, 0.823), commitment(98, 0.754) and trust (93, 0.715) were selected more frequently. Both performance (56, 0.431) and satisfaction (33,0.254) were chosen by less than half of the respondents. There were no consensus replies chosen for the “other” category. These proportions were examined for significance in difference from .5(50% of the respondents), and cooperation, commitment and trust retained significance grater than .50. There is less than.50 significance for performance and satisfaction. An explanation for this finding is the comfort level the respondents had with defining some of the concepts. Cooperation, commitment and trust can be perceived to be more easily defined. On the other hand, the performance and satisfaction definitions are less clear. The performance and satisfaction may be confounded with financial and relational elements. Perhaps in future studies performance and satisfaction can be more clearly defined.

Another explanation for the lack of significance of performance and satisfaction as indicators of customer assessment may be derived from supplier expectations. Because the primary performance measures in the industry are associated with the manufacturer, the suppliers may accept their own performance measures through the manufacturer. Thus, these suppliers seek to maintain their relationships with the best practice manufacturers as they figure their own success will be inevitable because of their alignment with these manufacturers. This would be especially true over the last few years, as the manufacturers have enjoyed great profitability.

These results show that in judging the quality of the manufacturers as customers, the suppliers are more focused on relational elements such as commitment, cooperation, and trust. Satisfaction and performance seem to carry less weight in such an assessment. This is not to say that the suppliers are not concerned about performance and satisfaction. It merely indicates that the suppliers seem to be more relationally oriented and value those customers that seek to foster sincere and mutual business partnerships.

Overall, the assessment reveals the importance of manufacturer strategy toward supplier management. The suppliers value those manufacturers that foster relational exchanges. This indicates that those manufacturers that are focused upon building strong supplier partnerships should place emphasis on enhancing the relationship itself. This yields direct implications for supply chain strategy in practice and further inflates the value of the research insights.

V. SUMMARY AND CONCLUSIONS

The mean results were compared to the 1.0 expected index. The t-statistics indicate that Daimler-Chrysler and Honda were significantly different from the expected index of 1.0. Thus, in general, the respondents believe that Daimler-Chrysler and Honda are higher quality customers than the other three manufacturers. The respondents ranked the automotive manufacturers from the highest quality to the lowest as Daimler-Chrysler, Honda, Toyota Ford and General Motors.

The respondents were also asked to indicate the relationship factors that were most important in evaluating the quality of the automotive manufacturers as customers. The most important relationship factors, cooperation, commitment and trust were selected

more frequently. Both performance and satisfaction were chosen by less than half of the respondents, and no consensus replies were chosen for the “other” category. These proportions were examined for significance in difference from .5 (50% of the respondents), and cooperation, commitment and trust retained significance greater than .50. There is less than 50% significance for performance and satisfaction. An explanation for this finding is the clarity in which cooperation, commitment and trust. On the other hand, the performance and satisfaction factors are less clear.

These results show that in judging the quality of the manufacturers as customers, the suppliers are more focused on relational elements such as commitment, cooperation, and trust. Satisfaction and performance seem to carry less weight in such an assessment. This is not to say that the suppliers are not concerned about performance and satisfaction. It merely indicates that the suppliers seem to be more relationally oriented and value those customers that seek to foster sincere and mutual business partnerships.

Notes

1. Chappell, Lindsay, "GM Gets Tender with Suppliers," *Automotive News*, July 23, 2001, 1+.
2. Chappell, Lindsay and Gail Kachadourian, "DCX Drags Suppliers Down Rocky Road: Bernhard Declares End to Era of Good Feeling," *Automotive News*, August 13, 2001, 1+.
3. Kamath, Rajan R. and Jeffrey K. Liker, "A Second Look at Japanese Product Development," *Harvard Business Review*, November-December, 1994, pp. 154-170.
+
4. Maloni, Michael J. and W.C. Benton, "Power Influences in the Supply Chain," *Journal of Business Logistics* 21(1), 2000, 49-74.
5. Maloni, Michael J. and W.C. Benton, "Supply Chain Partnerships: Opportunities for Operations Research," forthcoming *European Journal of Operational Research*, Vol. 101, No 3, 1997, pp. 419-429.

Appendix A

Relationship Assessment Survey

VII. Estimate the percentage of your sales accounted for by Automotive Industry

Please check the approximate category of the overall **value of your sales** to Chrysler.

< \$2 mil ___ \$2-5 mil ___ \$5-20 mil ___ \$20-50 mil ___
\$50-100 mil ___ \$100-500 mil ___ > \$500 mil ___

Is your firm QS9000 registered? _____

Is your firm ISO9000 registered? _____

Approximate the number of employees in your firm _____

VIII. In considering your relationships with the following firms, please allocate **a total of 100 points** among them based on their quality as a customer. If you do not sell to a company, indicate "n/a" (for not applicable).

Chrysler _____

Ford _____

GM _____

Honda _____

Toyota _____

TOTAL 100

In the above ratings, which (more than one may be chosen) are important factors for the basis of your point allocation?

Commitment ___ Cooperation ___ Trust ___ Satisfaction ___ Performance ___

Others _____

THANK YOU AGAIN FOR YOUR TIME AND COOPERATION IN RESPONDING.

