The Warranty Process Flow Within the Automotive Industry: An Investigation of Automotive Warranty Processes and Issues

Prepared for the
Program on Automotive Practices
Sponsored by
Microsoft Corporation

August 2005

Acknowledgements

The CAR-Microsoft Program on Automotive Industry Practices is a four-year research effort consisting of in-depth, focused interviews with industry participants on subjects of importance to all industry stakeholders. The Automotive Industry Program, funded by Microsoft, will investigate two topics per year, with results publicly disseminated. The first topic of investigation for 2005, presented in this report, is the flow of warranty data within the automotive industry.

The Center for Automotive Research would like to thank Microsoft Corporation for its support and proactive interest in topics of critical importance to all automotive industry stakeholders. We believe the CAR-Microsoft Program on Automotive Industry Practices is representative of Microsoft's desire to further public discussion on important automotive issues.

We would like to thank those in the automotive industry who took time to guide our work. CAR greatly appreciates the willingness of those interviewed to share their insights and ideas. Without their support such a project would not be possible. These individuals showed a strong passion for creating better warranty processes both within their companies, and throughout the industry. We hope this report reflects, in some way, the commitment these industry participants have toward their work.

Finally, this report is the result of several people contributing in many ways. The authors of this report would like to thank Karen Esper, who contributed by formatting and managing the document. Jillian Lindsay Gauthier assisted in the interview process and document review.

Brett C. Smith
Assistant Director, Manufacturing, Engineering and Technology

Raymond T. Miller
Research Assistant

The Center for Automotive Research
1000 Victors Way, Suite 200
Ann Arbor, MI 48108
Telephone: (734) 662-1287
Fax: (734) 662-5736
www.cargroup.org

TABLE OF CONTENTS

Executive Summary

The Center for Automotive Research (CAR) has undertaken the CAR-Microsoft Program on Automotive Industry Practices. The program is a four-year research effort consisting of in-depth, focused interviews with industry participants on subjects of importance to all industry stakeholders. The Automotive Industry Program will investigate two topics per year, with results publicly disseminated. [The first topic of investigation is warranty process flow in the automotive industry.] Importantly, this topic is not intended to gather confidential data such as warranty cost estimates. Instead, this report will describe the flow of warranty data gathering, including processing and application activities, and where possible, highlight selected practices and critical future operating issues.

As with many CAR projects, the identity of companies interviewed will not be made available—nor will information be presented in a way that may directly identify any participating companies. CAR researchers interviewed representatives from three automakers, four suppliers, and one dealership as part of this project. Given the relative small number of interviews, this report is not intended to be a complete description of the topic. Instead it is hoped that by selecting companies that have been identified as thought leaders in a specific topic, these reports will be then be viewed as contributing to the greater understanding of the issues and challenges.

Given the high volume of manufacture, the complexity of the product, and the often harsh operating environment in which the automobile is used, it is inevitable that there will be component failures. While there are certainly lessons to be learned from these failures, such incidents can in some ways be viewed as normal operating noise from non-assignable causes. However, the manufacturers and suppliers must be able to differentiate the expected component failure rate—the 'noise'—from those incidents that may be an indication of a systemic failure of the component. This report will focus on how the industry is addressing those warranty issues that appear to be serial in nature, and would thus present significant potential cost exposure.

Guided by the responses of those interviewed, CAR has identified two areas of the warranty process of focus for this report, and four issues that are likely to be critical challenges for the industry in the coming years. The first area of focus is the flow of data from the dealership to the manufacturer, and then from the manufacturer to the supplier. The second area of focus is the challenges brought about by the large volume of warranty data that is available.

Lastly, CAR will address four issues that were described by interviewees as pending warranty challenges within the industry: (1) the challenge of increased warranty issues surrounding greater application of on-vehicle electronics; (2) the lack of skilled mechanics; (3) the action of vehicle manufacturers moving toward warranty cost-sharing as a method to increase revenue; and finally (4) the difficulty presented when applying current warranty strategies in developing markets.

The flow of warranty data, in its most simple form, is a reporting and transfer of information regarding an in-service product failure. A failure is reported by the service representative (the dealer) to the vehicle manufacturer, and then, if deemed necessary by the vehicle manufacturer, to the component supplier. In reality, this seemingly simple path is exceptionally complex, and at times even serendipitous. The warranty data

process is highly quantitative and qualitative, sometimes scientific, and often creative. The process as identified by the participants includes:

1. Part identification/defect analysis and codification.
2. Reporting of warranty claim to the vehicle manufacturer—claim processing.
3. Investigation of claim by vehicle manufacturer warranty analysis center—claim review.
4. Notification of incident—or more accurately, increase in reported incidents—to component supplier.
5. Incident remediation (i.e. manufacturing, engineering, materials etc.) as required.
6. And, possible further action taken to assure the correction is implemented throughout the product line, including future components.

This report describes the communication formats, and touch-points for the six data flow processes.

As noted, on the surface the warranty process would appear to be rather straight forward. However, the variance with which the data is collected, communicated and analyzed creates opportunity for complexity nearly unimaginable by an outsider. Warranty data coding of failures varies from dealer to dealer—even from technician to technician—within a vehicle manufacturer dealer network, as well as between the vehicle manufacturer dealer networks. Nearly all interviewed suggested that if they were to take the same part to five different dealers, the failure would likely be identified and coded differently by each dealer. In their view, this was not an indictment of the repair shops ability to analyze the problem. Instead it was a reflection of the extent of the challenge. Often times the reason for a part failure is obvious, but just as often, the root cause of a failure is not readily apparent. The dealer repair shop must make a rapid decision regarding the failed part. Included in the decision process is allowable repair time, workload of staff, the experience of the technician, and even the history of reimbursement by the vehicle manufacturer.

From this rather inauspicious start, the data is then sent to the vehicle manufacturer where, although it is usually centrally housed, it often follows several separate paths. While each manufacturer has developed its own internal process for warranty data, the flow generally starts with a review of the dealership claim. In most aspects, this step serves as a method to monitor dealer repair work and focus on the process of repairing the vehicle. Although the claim process has become electronic in recent years, there is still a considerable amount of staff effort required to analyze and follow-up via telephone for clarification. While this review process is intended to monitor the dealership repair work, it is also considered a line of first defense in identifying potential warranty problems.

Once the warranty data is in an acceptable form, the vehicle manufacturer enters it into a database. From this point, each manufacturer has developed very established and confidential internal systems, often using both internally developed and third party software. The warranty data is controlled by either a quality or warranty function, but can be accessed by product engineering, manufacturing, materials, legal, finance, and other functions within the company.

Selected data is then made available to the suppliers. The type of data transferred from vehicle manufacturer to supplier differs greatly among the vehicle manufacturers. One respondent described three general types of data they receive: incident-based data (limited to claims and count); rate-based data (based on production/sales); and warranty data with month of production/months in service (MOP/MIS) data included. Obviously the ability to tie a defect to a date of manufacture, months in service, or some similar measure is of great value when assessing the problem and developing a response. It was widely agreed that to have an effective warranty process, the 'born on date' for a component is critical. The traceability of subsystems may become a competitive advantage for manufacturers and suppliers.

While the warranty data is vital to identifying systemic failures, an analysis of the component is often required to establish root cause of the failure. Due largely to logistics and transportation, it is also a costly proposition. Thus it is important to better understand the fate of the failed component. Often the component is disposed of at the dealership, thus ending any opportunity to establish root cause of the failure. Manufacturers also may randomly select dealers to send a limited number of components for inspection, allowing a sample for study. These are then sent to the supplier for review. Finally, if the supplier has an indication there may be issues related to a component, the supplier may request the vehicle manufacturer obtain a small number of components for analysis from the dealers. Importantly, the vehicle manufacturers differ greatly in how they deliver the parts. Some send them through a vehicle manufacturer parts center, while others have a more formal warranty processing location, and still others send the parts directly to the supplier. The inherent conflict of the warranty system is that it was originally developed to monitor and pay claims, not necessarily to capture the data.

The vehicle manufacturers (and some of the suppliers) interviewed indicated that one of the most pressing challenges of warranty investigation is the vast amounts of data processed, and the wide range of groups within the company that have use for the data. During the creation and implementation of the TREAD (Transportation Recall Enhancement, Accountability and Documentation) act, much was made of the enormous amount of data already collected by the industry. Based on numerous published reports, CAR estimates the automotive industry handles well over 100 million warranty claims per year. Each claim includes numerous fields, and often several lines of text. Realistically, the industry handles billions of warranty data fields annually.

Not only are companies challenged to develop methods of effectively capturing and storing warranty data, but they also must have the ability to access the information in a timely—and perhaps most importantly—cost effective way. As noted, each manufacturer has developed such information technology systems, but there continues to be concern that these systems are not yet fully capable of delivering consistent data to the suppliers. One supplier suggested they don't need more data, instead they need increased responsiveness (of the manufacturers to data requests); while another suggested that there was not consistent data available. A strong theme from all discussions was that a successful warranty program relied on a strong relationship between the interested parties.

Several companies were either currently investigating or had recently investigated text data mining as a method of increasing their ability to better analyze warranty data. From a vehicle manufacturer's viewpoint, text data mining presents opportunity to further

investigate and understand the vast text reports received from dealer repair shops. The ability to accurately analyze text entered by technicians may offer insight into, and potential early warning of, likely in-service product failures. One supplier indicated that it had spent several months investigating text data mining, but concluded that the cost of off-the-shelf systems could not be justified by the expected savings.

During the interviews, respondents identified several issues that will likely challenge the automotive industry in the near future. While CAR does not attempt to offer solutions to these issues, each of them is worthy of discussion and provides fertile ground for further research. Those areas are:

1. Warranty cost sharing
2. The lack of skilled mechanics
3. Electronics as a warranty burden
4. Adapting warranty systems to developing markets

This report presents a description of the flow of warranty data within the automotive industry, and highlights pending challenges faced by dealers, vehicle manufacturers and suppliers. CAR's investigation has highlighted several areas that offer opportunity for improvement. It is apparent that the industry continues to struggle with the warranty data flow, particularly in the areas of data management and process interfaces. In conclusion, CAR believes the warranty process will continue to be an area of great challenge, interest and opportunity for the industry.

Introduction

The Center for Automotive Research (CAR) has undertaken the CAR-Microsoft Program on Automotive Industry Practices. This program is a four-year research effort consisting of in-depth, focused interviews with industry participants on subjects of importance to all industry stakeholders. The Automotive Industry Program will investigate two topics per year; the results will be publicly disseminated. Warranty in the automotive industry is the first topic for consideration. It is important to note that it is not the study's purpose to gather confidential data, such as warranty cost estimates. Instead, this report will describe the flow of warranty data gathering and, where possible, highlight selected practices and critical future operating challenges. The identity of companies interviewed will not be made available—nor will information be presented in a way that could directly identify any participating company.

As a part of this project, CAR researchers interviewed representatives from three vehicle manufacturers (VM), four automotive suppliers, and one automobile dealer. By design, this program's studies are not intended to be a complete description of the topic. Instead it is hoped that by focusing on companies identified as leaders in a specific topic, these reports will then be viewed as contributing to the greater understanding of the issues and challenges.

Given the high volume of manufacture, the complexity of the product, and the often harsh environment in which the automobile operates, it is inevitable that there will be component failures. While there are certainly lessons to be learned from these failures, such incidents can in some ways be viewed as normal operating noise. However, the vehicle manufacturers and suppliers must be able to differentiate the expected component failure rate—the 'noise'—from those incidents that may indicate a systemic failure of the component. This report will focus on how the industry is addressing those warranty issues that appear to be systemic in nature, and would thus present significant potential cost exposure.

Theoretically, vehicle manufacturers can address warranty costs via two approaches. First, they can proactively attempt, through engineering, to reduce expected warranty costs toward zero. While this approach will likely lead to robustly engineered products, and concomitantly higher usage of engineering resources, it also often requires a willingness to accept a higher initial price for a component. Alternatively, the manufacturers can attempt to monitor the warranty data and react to in–service incidents. This approach is closely associated with those companies that have a strong cost-focused purchasing bias in their sourcing decision process. Realistically, each vehicle manufacturer uses a combination of the strategies, with some companies biased more toward the proactive engineering approach, while others tend to place more emphasis on reacting to reported data.

The automotive industry tends to focus on warranty in terms of direct costs—manufacturing, logistics and labor for replacement. Granted, these are significant costs; however, it is also important to understand other 'soft' costs associated with warranty. While any in-service product failure is likely to dissatisfy a customer to some extent, the quick, accurate repair of a warranty issue is likely to lessen the customer's overall dissatisfaction. Any discussion of warranty processes should not overlook the

importance of developing warranty strategies that deliver the greatest customer satisfaction—or more appropriately—least dissatisfaction in the most cost effective manner.

The Path from Repair Bay to the Supplier

The flow of warranty data, in its most simple form, is a reporting and transferring of information regarding an in-service product failure. A failure is reported by the service representative (the dealer) to the vehicle manufacturer, and then, if deemed necessary by the vehicle manufacturer, to the component supplier[1]. In reality, this seemingly simple path is exceptionally complex, and at times even serendipitous. The warranty data process is highly quantitative and qualitative, sometimes scientific, and often creative.

The process, as identified by the participants, includes:

1. Part identification/defect analysis and codification. This may be the most critical element of the process, and yet it is certainly the most variable. The process of capturing the customer's description of an in-service product failure, diagnosing the problem and correcting it remains a difficult and unscientific process.

2. Reporting of warranty claims to the vehicle manufacturer. The movement of data from the dealer repair shop to the vehicle manufacturer has become electronic in recent years, which has allowed for a much faster reporting system.

3. Investigation of claim by vehicle manufacturer warranty analysis center. Even though warranty claim filing has become increasingly electronic, it still requires effort to verify and clarify the data. Each manufacturer has a group review the data and enter it into some form of warranty database. This database is then accessed by product engineering, product development, manufacturing engineering, and the manufacturing plant, among others.

4. Notification of incident—or more frequently, increase in reported incidents—to component supplier. The type and amount of data transferred to supplier differs among the vehicle manufacturers.

5. Incident remediation (i.e. manufacturing, engineering, materials etc.) as required. If the in-service product failure is found to be caused by a supplier component, the supplier will then use the available data and parts to identify the problem, and determine actions to elicit a remedy.

[1] CAR acknowledges the failure of a product may enter through other sources (e.g. police reports, fleet reports, insurance claims and customer service calls). For this study, the focus is on the warranty process though the most common entry-point, from the dealer's repair shop.

6. Proactive suppliers and the vehicle manufacturers will take action to assure the correction is implemented throughout the product line, including incorporating the knowledge into future component development.

From the Dealer to the Vehicle Manufacturer

On the surface the warranty process appears to be rather straightforward. However, the variance with which the data is collected, communicated, and analyzed results in complexity nearly unimaginable by someone unfamiliar with the process. Warranty data reporting varies from dealer to dealer within vehicle manufacturer dealer networks, and even mechanic to mechanic within dealerships. Vehicle manufacturers also differ in the reporting methods they require of their dealers. Such a varied starting point for warranty data creates potential for great difficulty downstream.

Nearly all study participants suggested that if they were to take the same part to five different dealers, the failure would likely be identified and coded differently by each dealer. In their views, this was not an indictment of the repair shops' ability to analyze the problem. Instead, it was a reflection of the extent of the challenge. Often times, the reason for a part failure is obvious, but just as often, the root cause of a failure is not readily apparent. The dealer repair shop must make a rapid decision regarding the failed part. Included in the decision process is allowable repair time, workload of staff, the experience of the technician or mechanic, and even the history of reimbursement by the vehicle manufacturer.

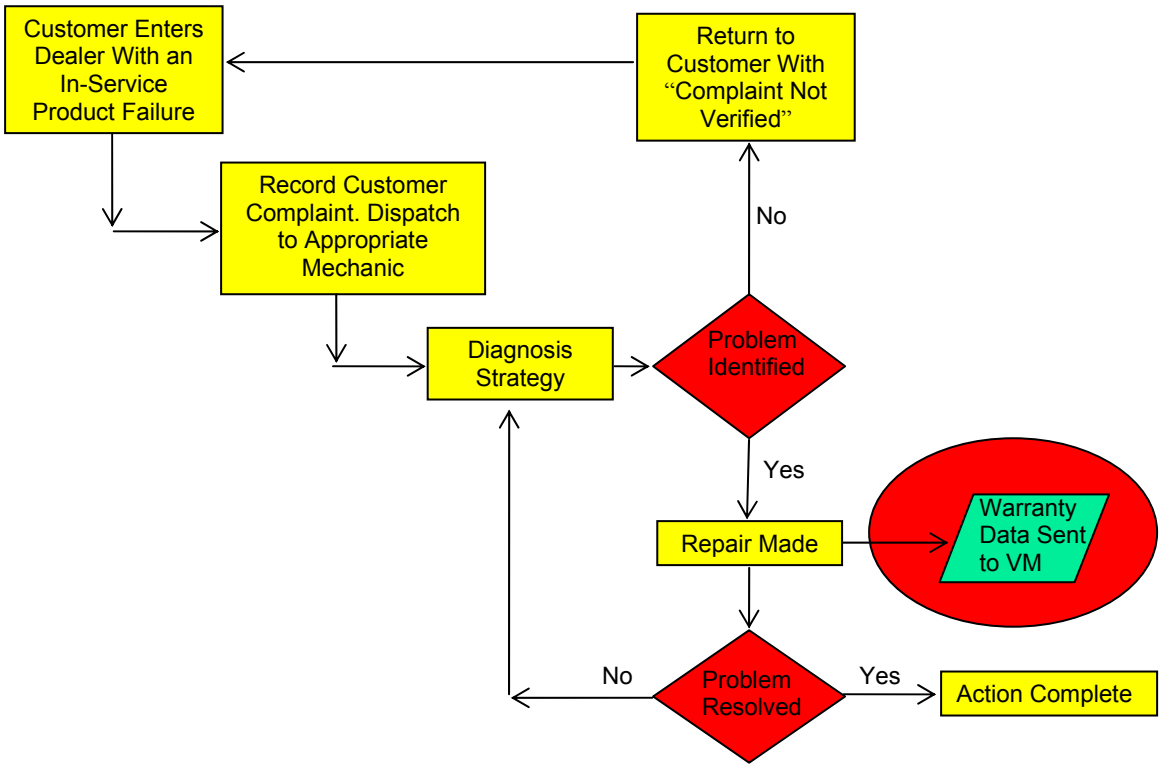
Because the point of entry for an in-service product failure is so critical, it is valuable to investigate this stage of the process more closely (Diagram 1). The first step in the process is to record the customer's complaint. Again, while this is a seemingly simple task, there is great opportunity for miscommunication as the customer tries to explain the problem to the service manager. Importantly, this input—often a short written documentation of the issue—can be a vital part of the warranty tracking process. Key words or phrases entered at this point can potentially offer insights as vehicle manufacturers and suppliers undertake root cause analysis weeks, months or even years later. An investigation of the warranty process in the automotive industry quickly highlights the fact that the dealer repair shop service manager is, in many ways, the cornerstone of a successful process. Once the shop manager identifies a likely cause of the problem, the vehicle is assigned to the appropriate mechanic.[2]

Each vehicle manufacturer continues to develop strategies that remove the responsibility from the repair shop floor. One vehicle manufacturer respondent suggested the biggest improvement of the information received from the repair shop to the vehicle manufacturer would be the implementation of a new, more structured warranty reporting software; however, the respondent also suggested that the replacement cost was currently prohibitive. While it is important to develop systems that make the identification of an in-service failure more efficient and effective, it is also important to realize that the ability of the mechanic or technician will be a key part of any diagnosis strategy for the

[2] Repair shops may use a technician to identify the problem, then, in turn assign a mechanic who will do the actual repair work.

foreseeable future. As such, it behooves the industry to work to develop a skilled technical base at the dealership level.

Diagram 1: In-Service Problem Identification



The mechanic, using visual inspection, technical manuals, service bulletins, and technical support from the vehicle manufacturer, must then begin the process of identifying the part that has failed. Upon determining the failure, the mechanic must then match it to a warranty repair code. The coding process illustrates two important variables. First, there are often ulterior motives for the mechanic to select a code for the in-service failure. For example, some codes may tend to offer more repair time, or may be less likely to be questioned by the manufacturer[3]. Second, the true cause of the failure may not be completely understood, thus the mechanic may make an educated guess as to why the failure occurred, and code it accordingly. Given the time constraints, working environment and differing experience level among mechanics, it is understandable that the mechanics often aren't able to fully identify the product failure. However, once the repair is performed, a warranty claim is then sent to the manufacturers.

Most respondents expressed concern that there is potential for dealers to consider the repair shop as a profit center by affecting *unnecessary* repair work. Although there was no data presented to support this concern, those that mentioned the problem indicated that if new vehicle sales were down, some dealers were more likely to push warranty

[3] CAR does not wish to suggest that these are necessarily fraudulent acts, instead they may be honest attempts by the mechanic to better capture the time needed to complete an adequate repair, and better satisfy the customer, while remaining within the standards set forth.

claims to fill the profit 'valleys.' While such actions have wide ranging implications, of interest to this report is the potential for a decrease in the accuracy of the reported warranty data. A warranty claim that is not accurate—whether intentionally or unintentionally entered as such—will have consequences throughout the entire warranty process.

Finally, it is at the dealer repair shop where warranty data and the part are separated. Most parts are scrapped, while others are shipped to the manufacturer—or directly to the supplier for review. In order to understand and analyze the warranty process more completely, it is important to note the data and the component take markedly different paths.

The Pathway Within the Vehicle Manufacturer

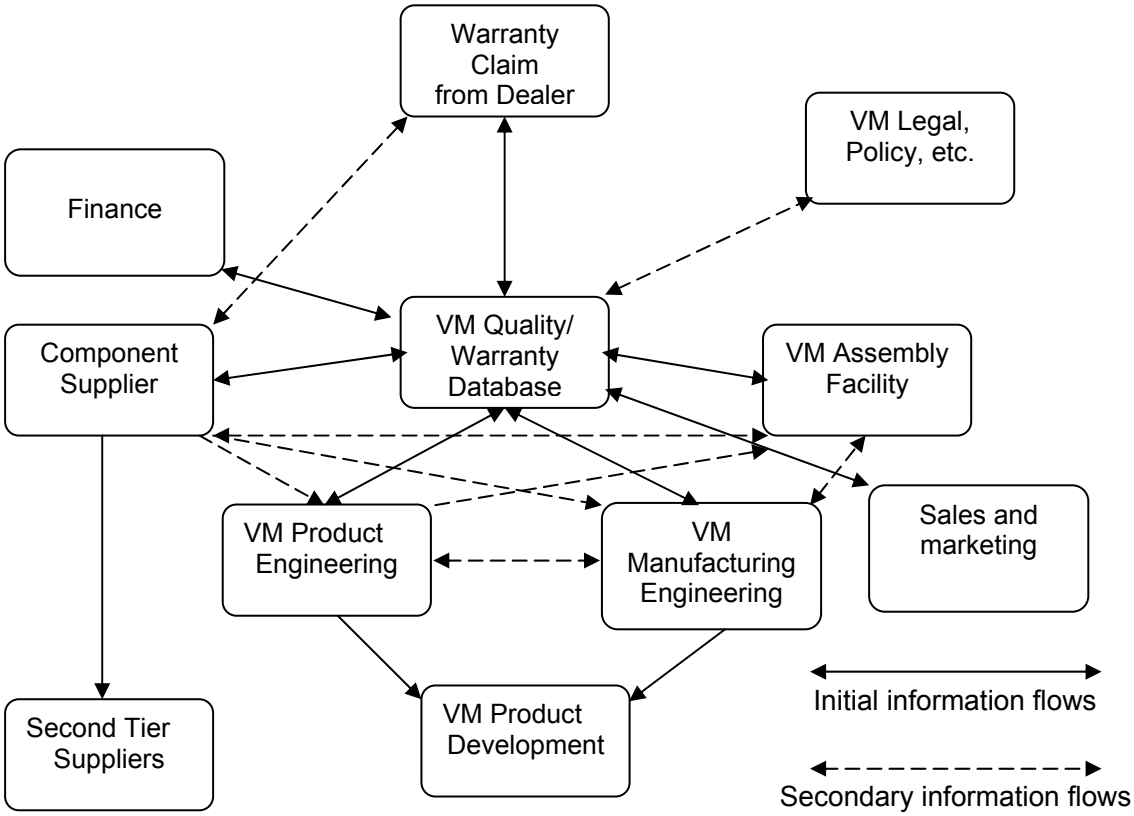
From this rather inauspicious start, the data is then sent to the vehicle manufacturer where it often follows several separate paths, although it is usually centrally housed. While each manufacturer has developed its own internal process for warranty data, the flow generally starts with a review of the dealership claim. Such a review is intended to monitor the work done at the dealership. In most aspects, this step serves as a method to monitor dealer repair work and focus on the process of repairing the vehicle. Special attention is given at this step to assuring the warranty claim meets the standards set by the manufacturer. Commonly, the review includes an evaluation of the claim to assure completeness and correctness, an analysis of the type of repair, the time taken to make the repair (especially if different from the standard), the frequency of repair at that dealership vis-à-vis other dealerships and other such concerns. Although the entry of the claim process has become electronic in recent years (most are now on-line, and completed overnight), there is still a considerable amount of staff effort required to analyze and follow-up via telephone for clarification. While this review process is intended to monitor the dealership repair work, it is also considered a line of first defense in identifying potential warranty problems as trends become evident.

The reduction in time for the claim filing process has important implications for root cause analysis. Critical to understanding any in-service part failure is the interaction with the mechanic. The ability for the vehicle manufacturer—or even the supplier—to contact the mechanic within a few days of when the repair is affected increases the chance the mechanic will be able to more clearly remember the repair in question, and thus more accurately describe the problem identified, and the process of repair.

Once the warranty data is in an acceptable form, the vehicle manufacture enters it into a database. From this point, each manufacturer has developed comprehensive and confidential internal systems, often using both internally developed and third party software. The warranty data is controlled by either a quality or warranty function, but is available to be accessed by product engineering (product and manufacturing), manufacturing (assembly plant), legal and other functions within the company. Diagram 2 illustrates the complex flow of warranty data within the vehicle manufacturer. It is important to note warranty data is only one form of information used to identify in-service product issues. Other forms (technical call centers, insurance claims, police reports, etc.) are often captured by other internal functions, and are likely to be stored in entirely different data warehouses.

Warranty data is accessed by many different functions within a vehicle manufacturer. The manufacturers interviewed indicated that because the warranty data was accessed by so many functions internally, some uncertainty exists among the different functions as to who else in the organization might be accessing the same data and what their needs might be. There was also uncertainty expressed as to how the data might be of value to others in the company. It is a valuable area of further study to more closely examine the pathways within the vehicle manufacturers. However, two caveats are offered. First, the flow of data, or more appropriately the description of users, within these large companies is complex. Second, each manufacturer views the warranty process as a competitive advantage, and is not necessarily interested in discussing detailed descriptions of the process.

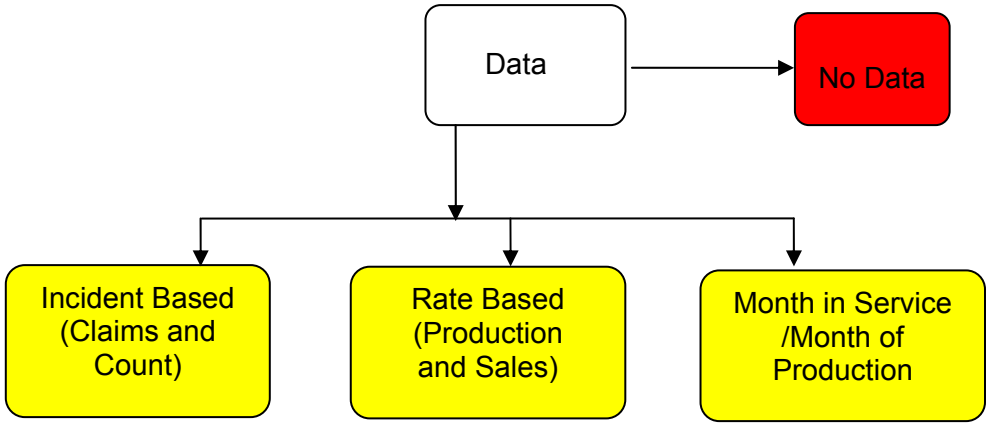
Diagram 2: Flow of Data within the Vehicle Manufacturer (VM)



The type and amount of data that flows to suppliers from a vehicle manufacturer differs greatly among vehicle manufacturers. Generally, the supplier must query the vehicle manufacturer database (increasingly via web-based applications) to access warranty information. One respondent described three general types of data his company receives (Diagram 3): incident-based data (limited to claims and count); rate-based data (based on production/sales); and data that included months in service, and month of production. While the suppliers interviewed had developed strong internal warranty tracking processes, the respondents made it clear the quality of data passed along by

the vehicle manufacturers affected the speed and accuracy of any early warning system. The ability to tie a defect to a date of manufacture, months in service, or other similar measures is of great value when assessing the problem and developing a response. Certainly there has been much discussion surrounding the traceability of parts in the manufacturing process. However, the traceability of some key components in service presents an opportunity for those wishing to gain a competitive advantage in the automotive warranty business. Vehicle manufacturers that develop effective reporting systems—a means of getting concise, accurate warranty data to their suppliers in a timely fashion—will take a large step toward developing a proactive early warning system.

Diagram 3: The Reporting of Data from Vehicle Manufacturer to Supplier

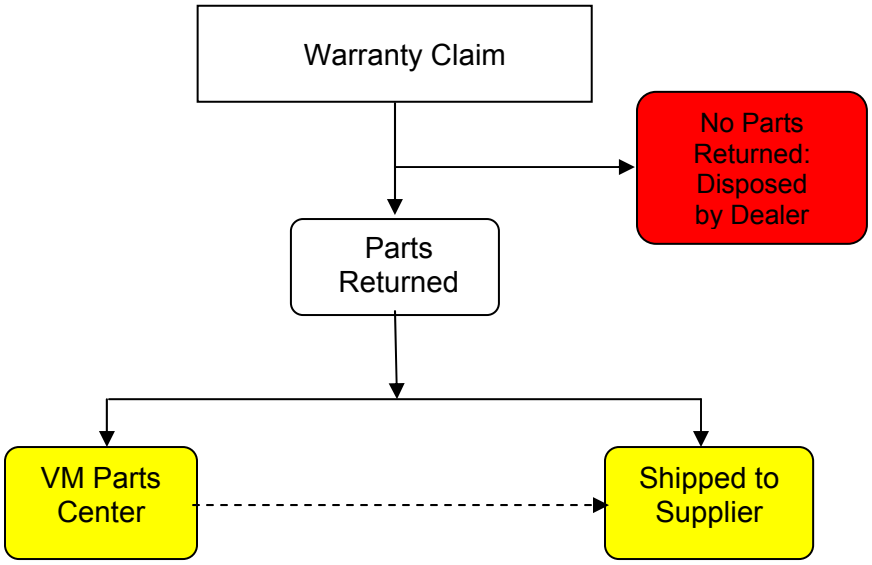


Because of the variance in the warranty reporting processes among vehicle manufacturers, each supplier interviewed had set up its warranty efforts by customer. Such redundancy was difficult for the suppliers to justify financially. Although several people interviewed indicated it would be valuable for the vehicle manufacturers to work to make their systems more common, there was little hope that it would occur. It is worth noting the Automotive Industry Acton Group (AIAG) has begun to investigate warranty process flow, with the intention of developing a set of industry best practices for use as a guideline. As such, this guideline could potentially serve to offer a first step toward industry standardization within some elements of the automotive warranty reporting system.

While the warranty data is important for identifying systemic failures, an analysis of the component is often required to establish the root cause of the failure. It is a costly proposition, due largely to logistics and transportation. Thus, it is important to better understand the fate of the failed component. Diagram 4 shows the possible outcomes for an in-service failure under warranty. The vast majority of components are disposed of at the dealership, thus eliminating any opportunity to establish the root cause of the

failure.[4] Manufacturers may randomly select dealers and require that the dealers send a limited number of components for inspection, creating a sample for study. Depending on the vehicle manufacturer, these components are then sent either to their component assessment center, or directly to the supplier for review.

Diagram 4: The Returning of Parts from Vehicle Manufacturer Repair Shop to Supplier



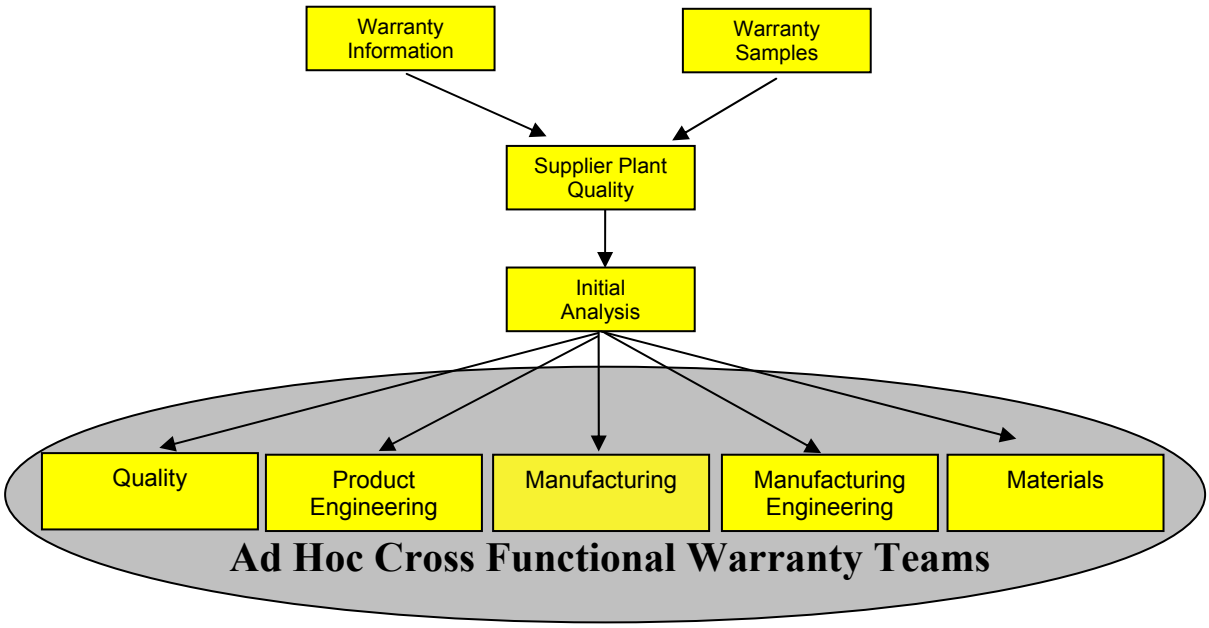
If the supplier has an indication there may be issues related to a component, the supplier may request the vehicle manufacturer obtain a small number of components for analysis from the dealers. As was illustrated during the course of the interviews for this project, the automotive warranty process is often driven by relationships. Each of the suppliers interviewed had established relationships that enabled them to side-step the bureaucratic red tape, and resolve issues rapidly. This was especially evident in the area of component procurement. Such relationships are difficult to represent in a flow chart, but are vital to successfully solving warranty issues. One final method of parts dispersal, according to one supplier: one vehicle manufacturer sends the supplier a 'box of parts' with no information nor explanation of failure.

Each supplier interviewed had developed similar, albeit slightly different processes, for analyzing the warranty data. Diagram 5 shows the general flow of warranty data and parts as described by a smaller supplier. The data (and component) is directed from the vehicle manufacturer to the supplier's manufacturing plant, where it is received by the plant's quality department. After review of the data, a cross-functional team is assembled to begin the process of identifying the problem. It is important to note that the smaller supplier felt warranty issues were in essence a 'plant issue,' thus they used

[4] Vehicle manufacturers have often struggled with quality on newly launched vehicles, and therefore have become much more aggressive in addressing launch quality. Several companies have leveraged the existing warranty system to assure that launch products have a 100 percent part return program. By capturing all parts that fail during the launch phase and using the warranty infrastructure to analyze the data, companies hope to quickly respond to potential product issues.

the manufacturing plant as the central processing point for the in-service product failures.

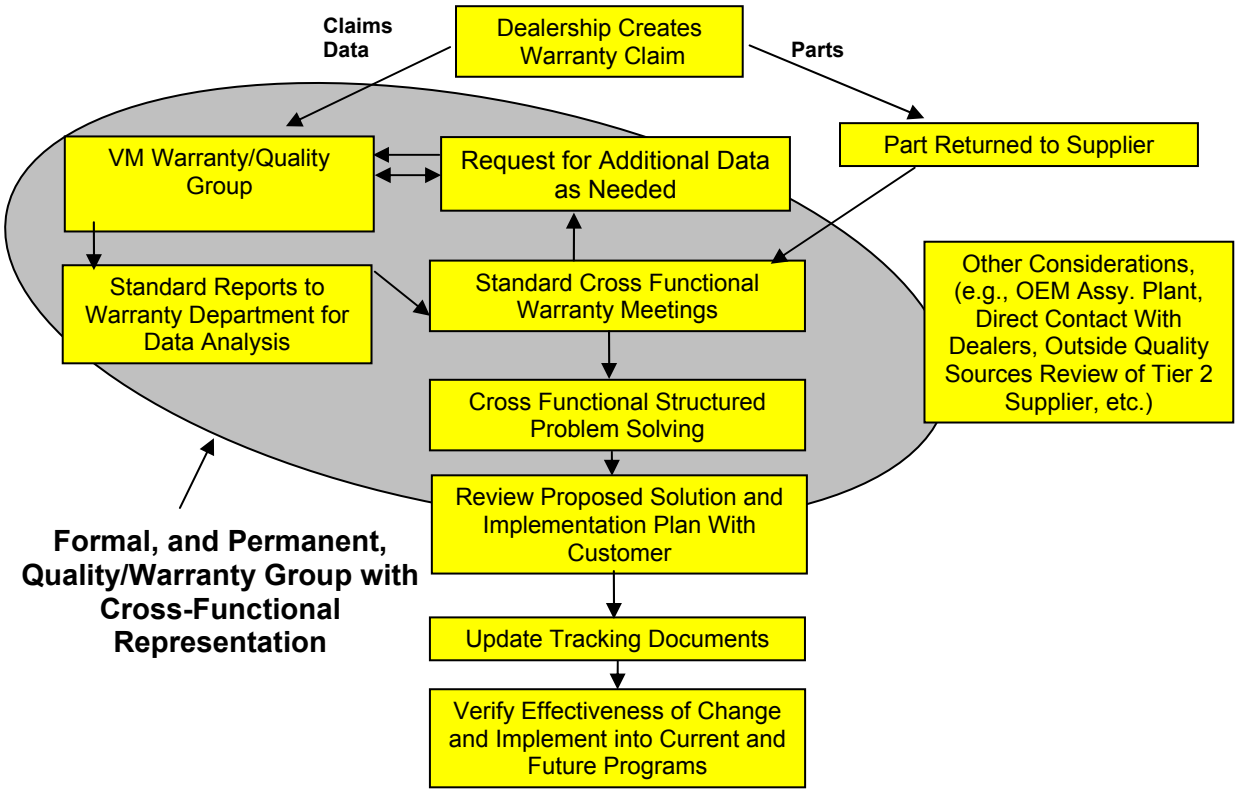
Diagram 5: Stylized Flow of Warranty Data and Parts—Tier 2 (Small Supplier)



CAR researchers also had discussions with a larger supplier who admitted that ownership of the problem—and thus solution—was often found at the manufacturing plant. However, this supplier had a more comprehensive program than the others (Diagram 6). This maybe due, in part, to a progressive warranty strategy as well as availability of greater resources. According to this supplier, the warranty data was received from the vehicle manufacturer by a central quality contact for this supplier. This supplier requested a structured monthly data report from its customer. The data was then reviewed by the customer-focused quality team. Any issues were discussed at a cross-functional meeting. The warranty data was tracked using structured problem solving strategies. If it was determined that more information was needed, they would make a special request to the vehicle manufacturer for more specific data or components. The supplier also worked with the vehicle manufacturers' assembly facility, engineers and others as needed.

The supplier requested that generic parts (i.e. those components that were used for several different vehicle lines and customers) be sent to a central location. This was done because these products tended to be manufactured using similar processes in multiple plants. Components that were product specific (i.e. those components that were unique to a vehicle) were passed on to their specific manufacturing plant.

Diagram 6: Stylized Flow of Warranty Data and Parts—Tier 1 (Large Supplier)



The availability of resources was an important determinant of the supplier's warranty process. The larger companies are more likely to have dedicated quality departments, focusing on ongoing warranty tracking. Conversely, smaller companies are more likely to have a small quality staff, with much of the product failure analysis done by an ad hoc cross-functional team at the manufacturing facility. In such cases, the tracking of warranty information is then done by a small staff at the product engineering center.

Several respondents interviewed used basic spreadsheet software found on most computers to handle all data. A few respondents indicated they needed more complex information technologies to be used for specific and more technical actions—or as one respondent suggested the "backroom work." However, most of the respondents interviewed strongly indicated their current spreadsheet software was more than adequate for many of their manipulation and data management needs. The challenge was making the "back room" operations available in a format conducive to corporate wide use through common user-friendly interfaces.

Data Overload

The manufacturers (and some of the suppliers) interviewed indicated one of the most pressing challenges of warranty investigation is the vast amount of data processed. Further, they indicated the wide range of groups within the company that have use for

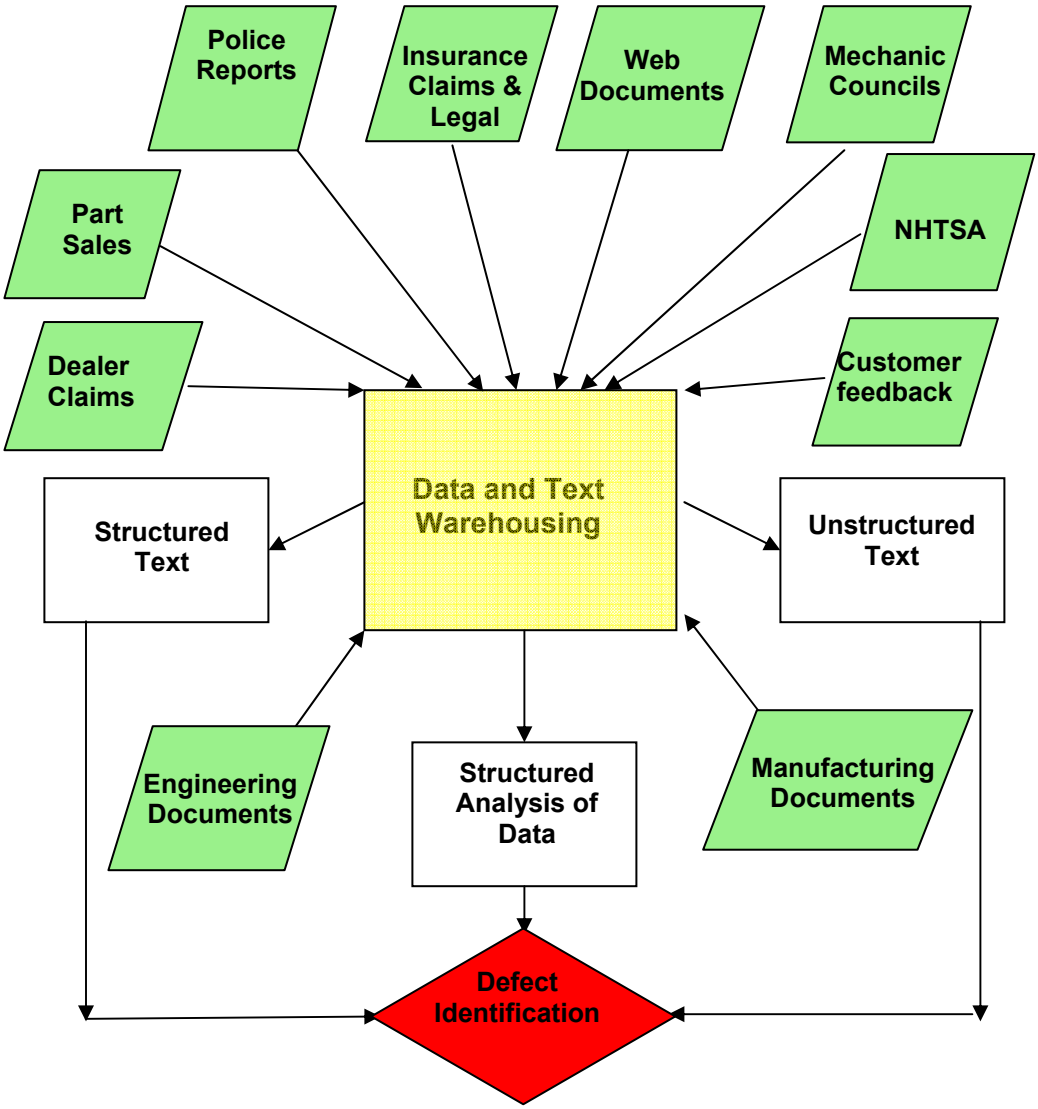
the data adds even greater complexity. During the creation and implementation of the TREAD (Transportation Recall Enhancement, Accountability and Documentation) Act (2000), much was made of the enormous amount of data already collected by the industry. Based on numerous published estimates, and discussions with industry sources, CAR researchers estimate the automotive industry handles well over 100 million warranty claims per year. Each claim includes numerous fields, and often several lines of text. Realistically, the industry handles billions of warranty data fields annually. The challenge for vehicle manufacturers is not to get enough data, but instead to better understand which of the data is important.

While the TREAD act is not of central concern to this report, it is important to briefly address some key points of the regulation. Probably the most visible element of TREAD is the development of an early warning database to help identify critical safety defects. Like many aspects of the warranty/defect discussion, this database (containing information on 24 vehicle systems) presents a challenge far greater than merely reporting those key systems. Although the act requires vehicle manufacturers to report quarterly on 24 different systems, in reality each of those systems is made up of numerous components, which are manufactured by a wide range of suppliers. Interestingly, the interviewees had varying levels of familiarity with TREAD. The vehicle manufacturers have proactively approached the act by developing internal systems. Each manufacturer has developed a TREAD response system that it believes offers a significant advantage over its competitors. However, the vehicle manufacturer representatives were not willing to discuss the specifics of those programs. This highlights an interesting challenge with regard to investigating warranty processes. Each manufacturer believes warranty to present opportunity for strong competitive advantage. Thus, there is little willingness to share strategies, and even less understanding of the opportunities presented by collaborative efforts. The suppliers interviewed seemed to better grasp the opportunity—and even need—to develop collaborative solutions. This is likely due to the fact the suppliers have to deal with numerous warranty systems. The suppliers may be better able to identify which vehicle manufacturer systems truly provide a competitive advantage.

Although the usefulness of the TREAD act was initially questioned by many within the automotive industry, several respondents did credit the act for leading manufacturers to be more proactive in establishing early warning reporting systems. It has encouraged—even required—the companies to re-examine their existing systems, to better understand the data, and to assess how the warranty process might be improved.

Diagram 7 shows the various inputs that comprise a vehicle manufacturer warranty data warehouse. It is important to note although the diagram suggests a single data storage warehouse, there are often numerous data warehouses within each manufacturer. While this report has focused on the dealer warranty repair shop as the entry point, it is valuable to briefly consider the other input sources. National Highway Transportation Safety Administration (NHTSA) reports, police reports and insurance claims are usually presented in some form of coded response and unstructured text. Customer feedback (via call centers and other forums) is often the first line of notification for a developing problem. Critical data can also be gathered from mechanic councils and tracking repair part sales. There is also valuable information available from monitoring both internal and supplier engineering documents. Many of these inputs present rich information. However, they are often in the form of unstructured text.

Diagram 7: In-Service Product Failure Reporting Channels



Not only are companies challenged to develop methods of effectively capturing and storing warranty data, but they also have the ability to access the information in a timely—and perhaps most importantly—cost-effective way. As noted, each manufacturer has developed numerous internal information technology storage and retrieval systems. These legacy systems are occasionally redundant, and often narrowly focused. One individual stated that data overload was an important challenge. According to this respondent, it was critical for each function within a vehicle manufacturer to learn what data were the best indicators for their needs. They should then use that type of data as the guidepost. The other types of data should then be used to confirm trends identified by the lead data.

A supplier indicated that it doesn't need more data. Instead, it needed increased responsiveness from the manufacturers to data requests. Another supplier also

suggested that consistent data was not available. All discussions asserted a successful warranty program relied on a strong relationship between the interested parties, in part to make up for the lack of robust data (and component retrieval) processes.

Both manufacturers and suppliers highlighted the richness and importance of warranty claim text. Each of the respondents described the complexity and repetitiveness of reviewing the unstructured text. Each of the suppliers was either currently investigating, or had recently considered unstructured text data mining as a method of increasing their ability to better analyze warranty data. From a vehicle manufacturer perspective, text data mining presents an opportunity to further investigate and understand the vast text reports received from dealer repair shops. The text entries may offer insight into, and potentially an early warning of, in-service product failures. Such analysis also adds depth to the often vague or inconclusive repair codes entered at the repair shop.

One supplier indicated that his company had spent several months investigating text mining, but concluded that the cost of off-the-shelf systems could not be justified by the expected savings. The respondent believed the vast coding differences and terminology between vehicle manufacturers presented complexity issues that made text mining strategies difficult (and cost prohibitive) at the supplier level. This respondent believed the standard reports were sufficient in tracking potential problems. However, another supplier had worked with a software provider to develop a text mining application that effectively searched data text from several manufacturers. This supplier believed that its ability to mine text was a significant advantage. Further, they indicated several other suppliers had contacted him to inquire about their application of the software.

Strategic Warranty Considerations

During the interviews, respondents identified several issues that will likely challenge the automotive industry in the near future. This section will address those concerns. While solutions to these issues are not presented here, each of the issues is worth discussing and provides fertile ground for further research.

A. Warranty Cost Recovery

The issue of most concern to supplier respondents was that of vehicle manufacturers moving toward a cost recovery warranty strategy as a revenue stream. As an increasing amount of the vehicle is built by suppliers, it is logical to believe components produced by suppliers are a major portion of the total warranty cost. One vehicle manufacturer estimated that 80 to 85 percent of all recalls were traceable to supplier components. Therefore, according to the vehicle manufacturers, it is logical that the suppliers take a larger portion of the financial responsibility for the failures. The vehicle manufacturer representatives indicated it was a logical step to pursue some form of cost sharing. They also expected it would happen.

Currently, it is common practice for the component supplier to be responsible for the manufacturing cost of the failed part covered under warranty plus some portion of the logistics and labor cost. However, the vehicle manufacturer must cover the remaining costs, including transportation, part replacement labor, and

information processing. Warranty cost recovery has shifted an increased portion of those non-manufacturing costs to the supplier.

Suppliers felt that if the vehicle manufacturers continue to pursue cost recovery, it will have a negative impact on product quality. It was suggested that suppliers will be forced to put increased resources into defending against accusations, and less time resolving issues, resulting in more cost for all. Another aspect is the lack of ability to build some cost for warranty into the piece price of the component. Suppliers suggested that the car companies 'bake-in' warranty cost into the price of a vehicle. (Assuming they are able to get the 'price.') Suppliers have no leverage/leeway to include a 'warranty cost' into the price of the component. A part is sold at production cost, with no allowance for future warranty costs. Thus, if the suppliers are increasingly charged for total warranty costs, the respondents believe it could have serious implications.

Importantly, the suppliers interviewed indicated they had made recommendations—even warnings—to vehicle manufacturers regarding product decisions. According to these suppliers, the warnings usually went unheeded and occasionally predicted warranty actions accurately during production. There was great concern among the suppliers that with warranty cost recovery, the suppliers would likely be paying for future product failures that could have been prevented with better upfront engineering.

Suppliers (and the dealership manager) also expressed concern regarding vehicle manufacturers including a strong purchasing bias in their component sourcing decision process. One supplier recounted an example where it had clearly demonstrated that its component, although a few pennies more expensive than that of its competitor's, had a significantly lower expected warranty cost—and a thus a lower overall cost. According to the supplier, the vehicle manufacturer, driven by its purchasing bias, chose the component with the lower upfront cost. According to this supplier, within several months of launch the cheaper component was already causing significant warranty expense and likely customer dissatisfaction. Suppliers indicated such a strategy creates a very difficult operating environment.

Suppliers also expressed concern regarding initial analysis of the component at the dealership, and the integration of that component into the vehicle. Because of the vagaries of component identification, defect analysis and codification processes (at the dealership repair shop) suppliers suggested there is opportunity, even likelihood, that their part may be improperly identified as at fault. Further, if the in-service failure is the fault of their part, they may be held liable for the costs of disassembling the vehicle to conduct a repair. Such cost (as measured in mechanic labor hours) could be substantial, and is driven, not by the component, but instead by vehicle design decisions made by the vehicle manufacturer.

B. Lack of Skilled Mechanics

As described in this report, the first step in the warranty process is the identification of the in-service product failure by the mechanic at the dealer repair shop. If a problem is not properly identified, or it takes several attempts to

correctly pinpoint the problem, the process is less efficient. The service manager interviewed indicated his concern regarding the availability of highly competent mechanics. According to the service manager, a strong understanding of how a vehicle works is essential to quickly and accurately assessing in-service product failures. Based on his experience, he believes there are too few mechanics who truly understand the automobile. He left little doubt that a good mechanic can be one of the most effective early warning points in the process.

While mechanics are critical to the warranty process, they can also be viewed as the touch point for the customer. An accurate, fair and fast assessment of a warranty issue by the mechanic can greatly enhance customer satisfaction. Thus, a first step for vehicle manufacturers looking to more effectively address warranty costs while increasing customer satisfaction is to address the shortage of highly trained mechanics with a strong diagnostic skill.

C. Electronics as a Warranty Burden

Numerous articles in the popular press have illustrated the growing dissatisfaction (as measured in quality ratings) among consumers—and concern among vehicle manufacturers—regarding the reliability of in-vehicle electronics. Warranty repair for electrical systems has always presented unique challenges. Traditionally a wire that was 'pinched' during installation in the vehicle could cause a short in the electrical system. This type of electrical open circuit has been a part of the failure identification challenge since the alternator became a standard option on the vehicle. However, it is no longer as simple as finding a bare wire or a poorly performing electrical motor. Now many of the product failures are caused by software or other electronic glitches. The non-technical term for such challenges offered by one respondent was 'chasing electronic gremlins.'

These electronic gremlins present significant challenges for the repair shop attempting to properly identify and correct the problem. A dealer repair shop manager interviewed for this project estimated that 90 percent of the electronic problems reported by consumers were intermittent, and were not able to be validated by the dealership on the first attempt. Since the warranty process cannot start without a validated problem, they will return the vehicle to the consumer and expect it back within a short period. After two failed attempts to verify using vehicle manufacturer guidelines, the manager then advises the mechanic to attempt to identify the problem by using a process of elimination. Often times such a strategy proves to be very time-consuming and difficult to code into warranty claim forms. However, the manager felt it was his responsibility to his customers to go beyond what the system allowed, and do anything in his power to resolve their problems. Once the electronic gremlin was identified, the dealership was able to correct about 90 percent of the problems. The area of in-service electronic product failure resolution—and prevention of such incidences—presents a strong opportunity for further investigation.

D. The International Challenge

The final area of concern addressed in this report is the international challenge—or more accurately the *two* international challenges. The first challenge is that of

vehicle manufacturers operating different warranty strategies and processes in the United States, Japan and Europe. Suppliers indicated some manufacturers have different warranty processes and targets for each of these regions. The elimination of such differences could bring significant efficiency gains. The second challenge is that of bringing the current warranty methodology to developing markets.

The warranty process is, in many ways, driven by the dealer repair service shops. As noted earlier, the dealer repair service is the point of entry for any in-service product failure. The United States, Japanese and European dealer systems are characterized by strong technical expertise, significant experience, and ample resources. As such, they have demonstrated an ability to analyze and identify in-service product failures. They also benefit from strong logistical networks within the borders of their country of operation. Although the dealerships in these different regions are similar in some ways, they have developed within the constraints of the local customs, laws and consumer requirements. Suppliers indicated their customers had different systems in place in the each of the developed markets. From their point of view, there is significant opportunity to standardize international warranty operations.

As manufacturers move into developing markets, they often ask their suppliers to apply their warranty data control systems to operations in these new markets. This request presents challenges on many levels. It was strongly suggested that operations in markets with relatively undeveloped dealer networks—and no local suppliers—cannot meet the same warranty standards as those in more experienced markets. It is important for vehicle manufacturers to work with suppliers and dealers in these developing markets to leverage the systems already in place elsewhere, but also to be prepared for lapses in the system.

Conclusions

This study, the first in the CAR-Microsoft Program on Automotive Industry Practices, is intended to identify the flow of warranty data through the automotive value chain. As such, CAR researchers have captured the drivers and pertinent issues regarding this important automotive data process flow. However, to view the path warranty data travels as merely a data flow process would be a mistake. As this project progressed, it became apparent that although the flow of warranty data was increasingly becoming more formalized, successful actions were still often behavioral and relationship driven. From the dealership through to the supplier, each of the interviewees had examples of how they went beyond the process ‘structure’ to obtain a better result.

It is valuable to present a few examples of this creative behavior for illustrative purposes. One supplier, with a critical new engine component, developed an early warning system by enlisting the help of local dealerships. This supplier contacted several local dealers and asked them to inform the supplier if the dealer were to perform repairs on engines that used this particular technology. The supplier had an engineer assigned to the dealerships to observe the repair, and analyze specifics of the failure. While such an action is not statistically reliable, it gives the supplier immediate feedback on early problem detection.

Another supplier spoke of how his personal relationship with his vehicle manufacturer warranty contact allowed him to 'go around' the process to get a more immediate response to questions and concerns. If this supplier needed better access to a part, or wanted further data, he would contact the vehicle manufacturer representative. And certainly, the service manager interviewed had developed numerous action plans that better enabled him to reach a satisfactory—and equitable—resolution for the vehicle owner. CAR researchers believe any analysis of the warranty process must consider these behavioral characteristics as an important and effective part of the system.

Similarly, there were individuals within the vehicle manufacturers that had clearly driven a process or project to resolve challenges. These individuals had to use creativity to overcome the challenge of the legacy systems, scope, and cost to develop solutions that achieved the desired results while still staying within the bounds of their corporate culture.

These relationships, while successful, are indicative of the complexity of an effective warranty process. As vehicle manufacturers and IT providers attempt to formalize the warranty process, it is likely that behavioral aspects will continue to be a vital part of rapid warranty resolution.