

Leveraging Warranty Analytics to Drive Product Safety and Reliability

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Manufacturers across industries are increasingly leveraging data analytics to inform important business decisions and improve product quality. This trend is driven by two major factors: 1) technological innovations that continue to fuel product complexity and 2) society's growing expectations for product quality, reliability, and safety. Analytics based on quality and warranty data can provide valuable insight to manufacturers throughout the business cycle. This article focuses on warranty analytics, an important tool that helps manufacturers identify and resolve safety and reliability issues that occur after a product enters the marketplace. To learn more about identifying and addressing product failures that occur before market launch, click [\[here\]](#) to read my colleague Nathan Soderborg's article on quality analytics.

Warranty analytics can help manufacturers mitigate safety and reliability issues for products currently in the marketplace. While the initial period post product release is critical, manufacturers should continue to monitor performance throughout the entire product life cycle to ensure that latent issues with product performance or unforeseen use that may not have been discovered during the design, development, or quality analytics phases are identified and resolved. In our experience, most manufacturers have a mature warranty data collection process. Manufacturers consistently gather information on product models and serial numbers, the type of problems consumers have encountered, the types of technician services rendered, and whether entire products or certain components have been replaced. However, more may be done to further improve product reliability beyond simply collecting warranty data. Manufacturers may find it more helpful to know whether there is a pattern of failure over time; whether a product line is failing for a single reason or for multiple reasons; and how they can adequately address the failure in an effective and cost-effective manner. Manufacturers can answer these questions by 1) incorporating robust failure analysis and hazard testing into their warranty analytics, 2) augmenting

warranty data with publicly available information, and 3) supplementing warranty surveillance and machine-learning algorithms with subject matter expertise.

Conducting failure analysis on returned products can help manufacturers identify patterns of failure and the root causes behind them. Our team at Exponent has determined the root cause of failure for electronics and a variety of component materials, alongside evaluations of thermal behavior and thermal properties of products that pose a safety risk. These analyses have informed response planning and have enabled manufacturers to feed critical insights into their quality and safety metrics. Careful failure analysis can isolate different failure modes and offer a clear picture of the most important components or use scenarios driving warranty claims. Hazard testing can be used to gauge the severity and range of effects of a failure mode that has been observed in the field.

Augmenting warranty data with publicly available information can help manufacturers gain a fuller perspective of the issues that consumers are experiencing and provide preliminary warnings of issues that are beginning to arise. For instance, the U.S.

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Consumer Product Safety Commission encourages consumers to upload descriptions of product problems, model numbers, and photographs into their online database.¹ Consumer reviews posted on social media or online retail sites can also offer important feedback. Although this information is not directly issued to the manufacturer and may have a degree of uncertainty in its accuracy, it can be used to supplement warranty data to help manufacturers identify early warning signs of potential reliability and safety issues.

Finally, engaging subject matter experts can help manufacturers build effective surveillance algorithms to analyze warranty data and ask the right questions about manufacturing processes, components, suppliers, and failure modes to determine how best to respond to a product issue. For example, imagine a microwave oven model experiences issues in the field. A preliminary warranty analysis can determine the rate of occurrence, if the rate is trending up, and whether a particular component is most frequently affected. A subject matter expert can take the process several steps further by asking the right questions of the data. Are multiple suppliers involved in manufacturing the component? What are the potential risks of injury to the user associated with failures of this component, and what tests can be done to evaluate this? In this particular example, machine-learning algorithms that may be used to identify patterns in warranty data are complemented by insights from the subject matter expert. The former are used to uncover patterns in warranty data and detect anomalies that could indicate emerging product issues. The latter helps manufacturers understand why the failure could be occurring, what are the associated hazards, and, importantly, how to respond.

Exponent has helped dozens of clients leverage failure analysis, publicly available data, and subject area expertise to derive actionable learning from their warranty analytics programs. One example involves a washing machine that faced a dispute alleging a defective printed circuit board design in thousands of machines. We performed a warranty analysis, conducted a number of tests on functional circuit boards, and analyzed a number of failed circuit boards returned from the field. Our experts first isolated the issue by examining the rate of warranty claims for the family of washing machines in which the printed circuit board was replaced. By further analyzing the manufacturing date of the circuit boards involved in the warranty claims for this particular circuit board, we quickly found that the rate of replacement was unusually high for circuit boards manufactured during a brief window of time. We determined that during this period alone, a specific overseas supplier had been carrying out improper mechanical procedures that stressed the circuit board beyond its specifications. Our internal lab tests verified that this type of improper procedure would indeed cause printed circuit boards to fail in a manner identical to that of the circuit boards we examined that had failed in the field. By leveraging our knowledge of manufacturing, materials, mechanics, electronics, and circuit board failure, our team proved that it was a brief manufacturing problem, rather than a defective design, that was responsible for the failed circuit boards. This finding proved significantly valuable to our client.

Exponent's multidisciplinary team of mechanical, electrical, and thermal experts are backed by over fifty years in failure analysis experience and can help identify, isolate, and resolve product safety and reliability issues across a wide variety of industries.

¹ U.S. Consumer Product Safety Commission <https://www.saferproducts.gov/Default.aspx>



Patrick F. Murphy, Ph.D., P.E., CFEI Electrical Engineering & Computer Science
Senior Managing Engineer
New York
(212) 895-8115 | pmurphy@exponent.com



Shukri J. Sourì, Ph.D.
Electrical Engineering & Computer Science
Corporate Vice President & Practice Director
New York
(212) 895-8126 | ssouri@exponent.com