

Product Launch Analytics - Accelerated Defects Identification and Rectification (ADIR)



Introduction

In today's customer driven economy, the product manufactures are striving for bringing newer products faster into the market to meet the changing customer demands. It is also necessary to ensure an extremely high quality and defect-free products to avoid higher warranty costs and subsequent brand damage. Striking a good balance between these two conflicting requirements of speed to market and first time right designs is a challenge as the products are becoming more complex and multi-disciplinary than ever. This is evident from some large recalls that we have experienced from major automotive manufactures across the Europe and Americas.

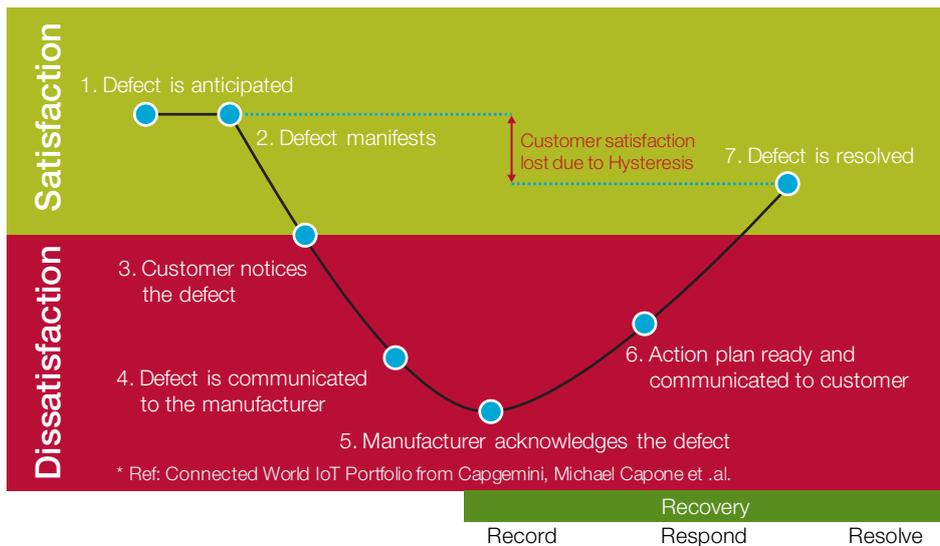
We at Capgemini believe that a systematic and innovative use of data analytics and data-driven decision making will help the industry to counter this challenge. Our ADIR framework addresses this issue by using physics-of-failures based approach along with machine learning and advance analytics on the data from various systems like product lifecycle management (PLM), Manufacturing Execution System (MES), and Dealers Management System (DMS). It tracks the defect signatures; classify the defects based on a stage-gated process and builds a self-tuning engineering and business logic to rectify the defects faster. The framework also has the ability to predict the probability of future defect occurrences based on pre-defect warning/ incidents record.

This document explains the high-level approach that ADIR follows along with its key solution elements. The approach is targeted more towards the infant mortality failures as it is a cause of concern both from warranty and brand damage perspective.

Early Failures and Customer Dissatisfaction

The engineering systems typically follow a bathtub curve for failures. The first stage of this curve has high rate of failures; called as infant mortality failures. These failures are not intended and are of a serious concern. These are typically caused as a result of design and manufacturing defects such as wrong material selection, improper assembly procedures etc. A major portion of customer dis-satisfaction can be attributed to these early-stage failures. It is observed that the drop in customer satisfactions has a hysteresis effect. Even though the concerned defect is resolved, there is a permanent partial erosion of customer satisfaction. The amount of hysteresis (permanent erosion) is inversely proportional to the time taken to rectify the defect; faster the rectification, lower is the permanent reduction in customer satisfaction. The figure below demonstrates the customer behavior in response to an un-expected defect and its rectification. The ADIR framework helps manufacturers by reducing the magnitude of satisfaction hysteresis by eliminating the defects before the customer notices it, and accelerating the recovery stage for the defects which are already noticed by the customers.

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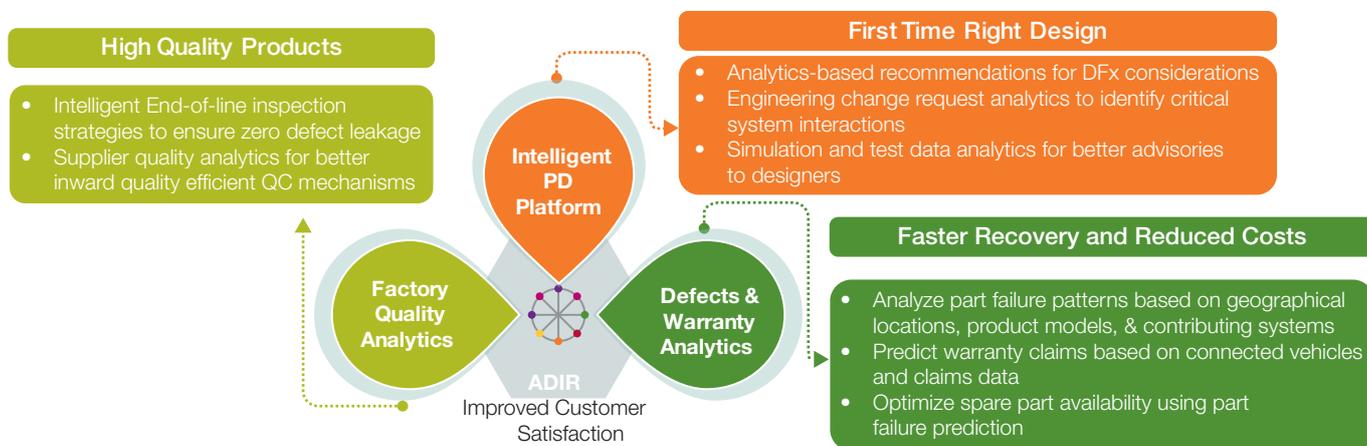
1 Ref: Michael Capone et. al. Connected World IoT Portfolio, Capgemini

Accelerated Defect Identification & Rectification (ADIR) Framework

ADIR is an analytics based framework which uses two pronged approach to tackle the issue of product defects. In the first branch it embeds cognitive intelligence in the product development and manufacturing systems. This acts as an advisory and guidance to the designers and manufacturing engineers to eliminate the human errors in the design & manufacturing of the product as much as possible. The second branch concentrates more of how the field defects can be rectified faster by classifying and assigning them to appropriate groups. It also concentrates on managing warranty related costs by predicting warranty claims as per geography and time-in-service for the systems. This helps the manufacturers to react quickly to the customer grievances by managing the inventory of parts at right time and right place.

There are three key solution elements of ADIR framework which can be utilized either independently or in combination as per the business needs

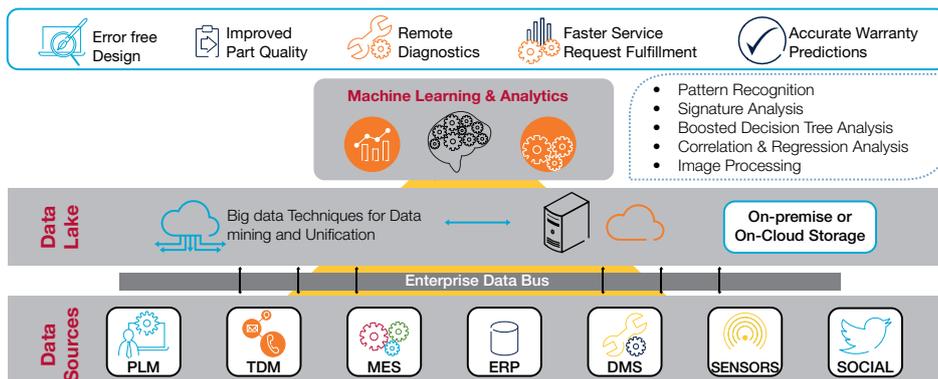
1. Intelligent Product Development Platform: It uses the data from historical product development programs, lab and field tests to embed cognitive capabilities in digital product development tools like CAD, CAE, PLM etc. This ensures that the mistakes are minimized at product design stage.
2. Factory Quality Analytics: This component uses IoT enabled smart devices and machines in the factory to ensure that the quality of product being manufactured is maintained at highest level
3. Defect Classification & Warranty Analytics Engine: This component works using vehicle sensors data along with service logs to classify the defects in order to quickly resolve those. It also uses the warranty data from history to build predictive models for spare-parts demand and warranty cost.



ADIR IT Architecture

We use our differentiated “Physics of failure” based approach to explore the data and build predictive models for various business requirements.

The solution is realized through a layered architecture. At the base are various data sources. There are silos of applications which store the data related to product development, manufacturing, and product services. Through a common enterprise data bus, the data from all these sources is relayed to a data lake. This is either a cloud-based or on-premise mechanism to store, massage, and unify the data in a common place to create single-data view. This analytics-ready dataset is then processed using analytics engine in the third layer. We use our differentiated “Physics of failure” based approach to explore the data and build predictive models for various business requirements. In the top-layer, various business applications use the results from analytics and present it in a form which can be utilized by business users for taking data-driven decisions.



Mode of Operation and Select Success Stories

We work with organizations across the entire digital transformation process - problem definition, technology selection, solution design, implementation, and change management. We typically start with a workshop to identify the probable root causes of the problem. At this stage we also check the availability and quality of the data to use the ADIR approach for problem resolution. As an outcome of this workshop, we come up with a short-list of pilots that can be executed to ascertain the feasibility of solution and the ROI. In the next stage, we execute the selected pilots in agile mode to demonstrate the business outcomes to the relevant stakeholders. Based on the feedback from stakeholders and the learning during the pilots, we design and implement the overall solution. There is an important aspect of change management which is necessary for rapid adoption of the solution by users. Capgemini's proven measures and new technologies are combined in a change approach tailored to the needs of our clients.

We have used this approach with customers from automotive, heavy machinery, rail transport and energy sectors to realize for them savings of multi-million dollars. The key success factors for ADIR are our strong capabilities in data collection, master data management, and 'physics of failures' approach to analyze data. Capgemini's industry leading product engineering, big-data, and data science expertise in a synergetic manner to deliver customer value.

Digital Transformation challenges organizations not only on a technical level but also on the people dimension by changing the way companies approach product launch.

In the US, we helped a major truck manufacturer to improve their vehicles' availability by 5% using the historical warranty claims data to predict spare-parts requirement as a function of time and geography.

ADIR for a major Oil & Gas engineering company to improve their product performance using the data generated from sensors during operation of equipment in deep oil wells. The fatigue life of one key component was improved with a potential cost benefit of over USD 15 million per year.

We are successfully using this approach with a major German automotive OEM for plant quality analytics to monitor the trend of long-term product quality and its impact on vehicle sales.



About Capgemini

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Together with its clients, Capgemini creates and delivers business, technology and digital solutions that fit their needs, enabling them to achieve innovation and competitiveness.

A deeply multicultural organization, Capgemini has developed its own way of working, the Collaborative Business Experience™, and draws on Rightshore®, its worldwide delivery model.

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