TRIGO
Global Quality Solutions

THE 5 KEY RECOMMENDATIONS TO BUILD A SUCCESSFULL PREDICTIVE QUALITY MANAGEMENT MODEL

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In today's constantly changing business landscape, the demands placed on Quality Management are evolving. Products, such as cars and aircraft, are increasingly more complex, and customers' expectations as well as regulatory requirements are more demanding. In this context, quality's role is not anymore to inspect parts and components only, but more and more to help production teams anticipate the issues that will happen somehow in the global supply chain.

To meet these expectations, organizations are embedding predictive practices into Quality Management, which represents a shift towards proactive problem prediction powered by data analytics and machine learning.

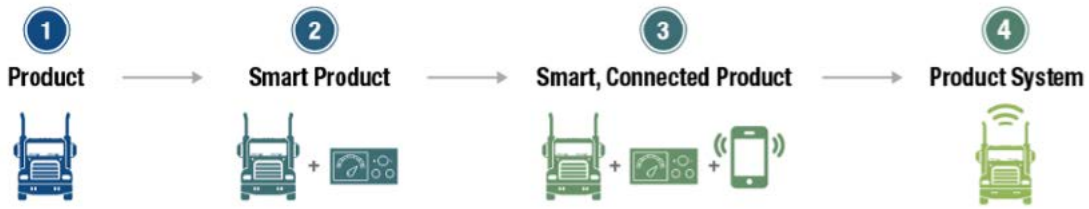
However, today's approach to predictive quality management are falling short. A lot of complexity is created but effective results are hard to see. And this is the key issue of data in the production/quality world today. **How can data improve the quality of manufacturing production in the supply chain in the very short term?** And, **how to improve efficiency of this manufacturing production thanks to good usage of data and effective predictive models?**

This article highlights the need for a data-driven approach and provides recommendations for organizations looking to embark on this transformative journey. Follow a real-world case study that demonstrates the power of machine learning in forecasting underperforming suppliers. Through this use case, discover the tangible benefits of predictive quality practices, for increased operational efficiency and more informed decision-making.

A. QUALITY MANAGEMENT EVOLUTION: SHIFTING FROM REACTIVE TO PREVENTIVE LEVERAGING PREDICTIVE STRATEGIES

The principal mission of Quality Management has always been to ensure that products, services, and processes not only align with, but exceed customer expectations. Presently, the primary emphasis of Quality teams lies in their capacity to resolve problems and mitigate known customer issues while proactively addressing the root causes before any quality issues arise. This purpose of the Quality function is still relevant, but there is nevertheless a need to shift towards a predictive approach.

Expectations of the various stakeholders of the supply chain regarding Quality departments have also evolved in the past years. As an example, when a product is recalled, customers, regulators, and distributors now expect companies to effectively identify defective batches, take swift corrective actions, and maintain transparent communication. Coupled with rising product complexities and the integration of more and more technologies, identifying root causes to prevent recurrence has become more challenging than ever for any leader in the production world.

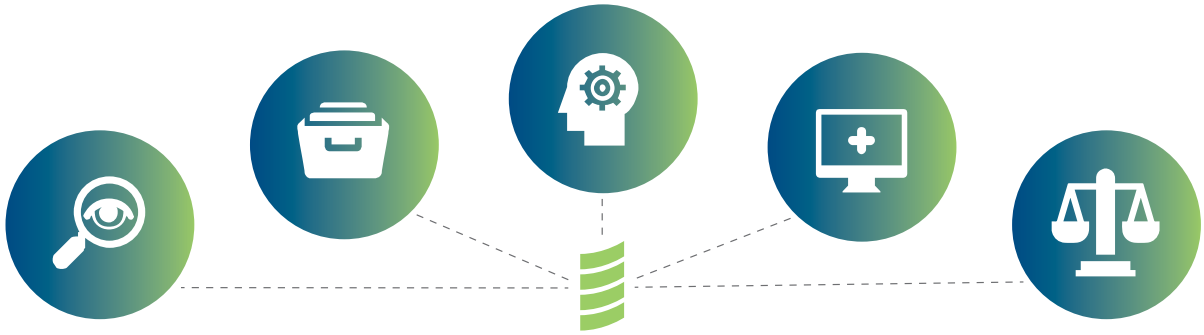


Organization expectations towards Quality Management are transcending accountability on conventional quality metrics as well. New expectations now encompass a diverse array of objectives, including the transformation of the organization's approach from reactive problem solving to a proactive one relying on data analytics.

Quality leaders within organizations have made persistent efforts to fulfill these new expectations. However, traditional approaches seem to fall short. While regular Quality methods have been successful in facilitating continuous improvement and some issue prevention in the past, their efficiency has diminished significantly within the currently transformed environment. It's not just the costs associated with further improving through traditional methods, but also the speed and complexity of modern business operations that challenge their relevance.

Hence, arises a necessity for a novel approach that encompasses the systematic collection, experimentation, and analysis of data from diverse sources, enabling the identification and prevention of previously unrecognized issues. This fresh approach involves moving beyond general prevention and instead emphasizes targeted prevention, harnessing the potential of big data and advanced analytics to extract actionable insights, add customer value, and meet both customers and internal stakeholders' expectations.

B. 5 KEY RECOMMENDATIONS TO START YOUR PREDICTIVE QUALITY JOURNEY



Our experience of data innovation in Quality management for leading OEMs and suppliers has led us to isolate 5 key guidelines, with one major rule: adopt a pragmatic approach.

#1: Perfection is enemy of progress.

Often, individuals strive for an ideal level of data and skill readiness before embarking on their predictive journey. However, aiming for perfection in use cases, data accessibility, and expertise may prove to be an unattainable objective.

Instead, it is advisable to maintain a realistic approach and commence at a more basic stage by selecting a problem that is already a concern for the business or one that the business aims to address. This approach can bolster your business case as it ensures support right from the outset.

#2: Start from already existing data in your organization.

Begin with the data currently available to you, even if it is not perfect or comprehensive. Waiting for flawless data is unnecessary, so search within your organization for excellence areas where data is already present and use that as a starting point. This approach allows you to expedite your progress.

#3: Conduct experiments within your areas of business expertise to showcase the benefits.

Experiment with what's existing, test them, and learn from the results alongside your business experts. Adjust your approach as you gather insights. By demonstrating the advantages of predictive Quality through the delivery of improved efficiency, the demand for further enhancements from the business side will significantly increase.

#4: Technology costs are deflationist.

The declining cost of technology, the emergence of low code/no code solutions, and the gradual creation of data lakes with relevant data all contribute to increased readiness for the next steps in predictive Quality management. It is important to acknowledge that organizations may be better prepared than we may think, as off-the-shelf solutions are increasingly available, reducing the skill barriers to leverage such technology.

#5: Strike a balance between critical business use cases and data readiness.

As organizational readiness improves and a strategy for future investments is developed, it is crucial to exercise caution. Do not solely focus on use cases that exhibit high readiness but are not critical to the business. This approach would result in the wastage of valuable resources such as capacity, technology, and investments on projects that yield little impact.

C. THE SUCCESSFUL USE OF DATA IN PREDICTIVE APPROACHES: FORECASTING UNDERPERFORMING SUPPLIERS WITH POWERED MACHINE LEARNING IN THE DEFENSE INDUSTRY (USE CASE)

At TRIGO, we recently showcased our capabilities to one of our customers in the Defense industry, demonstrating how collected data can effectively anticipate and provide an early warning on the next suspected degrading suppliers. This customer was facing lots of non-forecasted supplier delivery delays, that were leading to poor industrial performance. Specifically, addressing this issue, we decided to focus our powered AI analysis on a panel of over 100 suppliers. This latter allowed us to define specific recommendations and consequently to improve on time delivery of our client.

In the analysis, the suppliers encompassed a broad spectrum of characteristics that made the analysis robust and comprehensive. These suppliers ranged in size from small-scale entities to large conglomerates while spanning diverse geographies. Furthermore, the manufacturing technologies employed by these suppliers varied significantly, allowing for an integrated view of the industry's technical landscape. Some of these suppliers operated on a "design-and-build" basis, working with a supplier providing both design and manufacturing services, while others functioned on a "contract-to-build" model, concentrating solely on the manufacturing and assembly of products based on provided designs. Other variables considered were the purchase order size, which gave insights into the volume of business each supplier can handle, and the batch size, providing both a perspective on their production capacities and scalability. This diverse mix ensured that the machine learning model was trained on a wide variety of data, increasing its accuracy and generalizability across multiple supplier profiles.

Capitalizing on the data at our disposal, we, TRIGO's Innovation department, crafted a forward-thinking predictive model powered by state-of-the-art Machine Learning technology. The primary goal of this model was to proactively forecast which suppliers will fall into the rank of FLOP-15 underperformers in terms of on-time deliveries.

After several fine-tuning iterations, the module we defined achieved a precision rate of 90%. This means that on a consistent monthly basis, for 18 months, our teams have been able to reliably predict and pinpoint at least 13 out of the 15 suppliers that would end up on delivery hiccups. This top risky suppliers list revealed to be different from the one our client was monitoring with a traditional approach. Thanks to the accuracy of our analysis, our customer has opted to collect the output of the developed AI model on a monthly basis to prioritize his focus on suppliers at risk.

Previously, the analysis and generation of insights from amounts of data were not feasible. However, with the utilization of machine learning solutions available in the current market, it's become possible. This is not only clear proof on how well predictive approaches can work but underscores how much it can help in transforming supply chain oversight and management.

This project meets all the criteria for a strong business case to embark on the predictive Quality journey, as outlined previously:

- It utilizes the organization's pre-existing data. Instead of initiating extensive new data collection efforts, our strategy prioritized maximizing the potential of the data we had already accumulated over 2.5 years from our own systems on this program. This data encompassed orders and deliveries spanning this duration. While there were inevitable discrepancies within the data, we viewed them as opportunities rather than setbacks. The detected anomalies served as a catalyst to refine, rectify, and enhance data quality by implementing requisite checks, restrictions, and alerts.
- It taps into the readily available, off-the-shelf AI solutions that integrate AutoML capabilities (automated Machine Learning). What AutoML offers is a systematic assessment of existing ML algorithms, subsequently recommending the most accurate one. To continuously enhance this accuracy, we constructed new models each month over a half-year period. Importantly, exploring into such an initiative doesn't necessarily demand an upfront investment. Many solution providers grant trial access to their platforms during the exploratory phase, allowing teams to witness firsthand tangible benefits before making a financial commitment.

- It demonstrates the potential benefits of implementing predictive quality practices, leading to increased operational efficiency. For our team of 20 delivery assurance specialists assigned to the customer program, this shift can be transformative. They now have access to a dynamic, analytically backed supplier priority list, providing clarity on the rationale behind each prioritization. Given the constraints of skilled staff, such a data-driven approach ensures that attention is channeled towards the most critical suppliers, optimizing the outcomes for on-time delivery KPIs.
- It fosters a deeper interest within the business to explore further possibilities, by generating diverse use cases, where we can unlock richer insights. One such thought-provoking proposition is the analysis of actual delivery lead times in contrast to the requested lead times, particularly focusing on the most underperforming. Furthermore, bridging our findings with root-cause analysis data presents another exciting dimension, promising a more integrated and comprehensive perspective on the challenges at hand.

As our offerings revolve around data analysis for decision support, the latter achievement holds significant implications for routine business decisions, and in particular these 2 areas:

1. **Resource prioritization for supplier monitoring is now augmented by machine learning, elevating decision-making beyond human expertise within the organization.**
2. **Anomalies and patterns observed in the collected data enable the system to raise alerts for the entire supplier panel, preemptively identifying potential problems.**

Today, this predictive Quality Management approach by TRIGO is 100% effective and in use in several OEMs and suppliers of the defense industry.

Considering the challenges that manufacturing companies face in managing their Quality performance and extracting actionable insights from data, identifying key challenges and making it a priority to address these challenges is crucial. Its impact on improving Quality, preventing issues, and driving supplier development are already paying off and will continue to flourish in the future.

If you want to know more about how to build a successful predictive data driven approach, please contact Augustin Brochot, Vice President Innovation and Strategic ventures, TRIGO Group. If you want to more about the use case, please contact Emmanuel Marquis, Executive Vice President Aerospace Defense Rail, TRIGO Group.

Ricard Lou currently holds the position of Group Data Solutions Director at TRIGO Group. Joining TRIGO in 2011, he has been instrumental in the company's development, serving as the Director of Operations in Spain & Portugal, and subsequently as Group Project Management Officer. Having completed a graduate in industrial engineering degree from institutions in Spain (Universitat Politècnica de Catalunya), France (CentraleSupelec), and Germany (Universität Stuttgart) and holding a master degree in project management (EAE Business School), he has over 15 years of experience in the automotive industry. He joined the Group's Innovation & Strategic Ventures team in 2022 focusing on advancing TRIGO's proficiency in data applications.