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Knowledge based Supplier Quality Management System for Automobile Industry

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Abstract – A large industrial products component manufacturer was challenged to reduce supplier quality issues in response to changing market dynamics. The manufacturer faced increased competition in their core product segments and needed to reduce their overall costs and improve product quality to stay ahead. After a detailed analysis, the manufacturer identified supplier quality as one of the three key operational improvement opportunities. Supplier quality management has emerged as one of the leading business practices in the past few years. World-class manufacturers are making significant investments in systems and processes to improve supplier quality. This paper briefly outlines some of the best practices implemented by such manufacturers in supplier quality management.

Keywords – SQM, COQ, CAPA.

I. WHY SUPPLIER QUALITY IS CRITICAL

With companies outsourcing their manufacturing to strategic partners across the globe, the supply chains have become very long. Many consumer products are manufactured in Mexico[3] or the Far East and then shipped to North American markets using multiple logistics providers via ocean, air and trucks. It can take weeks for a finished product to reach the store shelves from a supplier in the Far East. In addition, many of these manufacturers have streamlined their supply chain and implemented lean inventory techniques. As a result, any issue in supplier quality can quickly result in stock outs. Supplier quality issues like non-conformance management, product recalls and product failures are proving fatal for global organizations. More than ever, companies need to proactively address their supplier quality issues before they can damage businesses operations and cause serious supply chain risks and financial losses; especially when current business conditions are unfavorable. Most companies are already feeling the heat of the current financial meltdown, putting Chief Procurement Officers (CPOs) and their teams under intense pressure to reduce costs and improve cash flow while simultaneously managing an increasingly vulnerable supply base. As recession starts to bite, there is no place left for supply chain disruptions; any discrepancy in supplier quality can significantly reduce company's revenue, impact market share, increase production cost, threaten brand image and reputation, and lead to high Cost of Poor quality (COPQ). According to a recent AMR survey, almost 67% of the cost of poor quality can be attributed to supplier failure. In an ATS commissioned survey1, the average cost of poor quality calibration costs manufacturers $1,734,000 each year; especially for large companies with revenues of more than $1 billion, the cost inflates to an average of $4,000,000 annually. Organizations can attain systematic reductions in the cost of poor quality by implementing a Quality Management System (QMS) that provides an integrated and closed loop corrective action process.

II. SUPPLIER QUALITY SYSTEM

The manufacturer had built a network of about 25 core suppliers and sourced 90% of their components from them. In order to identify opportunities for improving supplier quality, the manufacturer started evaluating their key supplier-facing product quality and delivery quality processes. The manufacturer discovered a number of issues from the analysis, including[10]:

A. Supplier quality issues and non-conformances were tracked in multiple spreadsheets by various stakeholders. As a result, it was very difficult for the manufacturer to get an accurate view of all open and recurring issues with a supplier to assess either the scope of quality-related issues from that supplier or to determine the effectiveness of previously identified corrective actions.

B. The corrective action process was managed manually by the manufacturer. As a result, fewer Corrective Action Requests were created than warranted, resulting in recurring supplier quality issues for weeks before they were corrected.

C. Supplier performance scorecard metrics such as PPM or on-time delivery were calculated manually from multiple spreadsheets, emails and paper documents, as well as from reports generated by other systems. As a result, the analysis was error-prone, usually performed on old data and often incorporated only partial activity with the supplier. Hence the supplier scorecards did not provide the manufacturer enough leverage in working with their suppliers to address quality-related issues [5].

Fig.1. supplier Performance Score Card

D. The above Example of a Supplier Scorecard Cost recovery process was managed via spreadsheets, email and faxes. Supplier chargeback for each occurrence of non conformance were calculated manually and tracked in spreadsheets. Hence, calculations were error prone and usually included cost of supplier's components scrapped or returned. Non-material costs such as line shutdown costs, rework costs, sorting and moving costs, expedited shipping costs etc that were incurred in the manufacturing process and directly attributable to poor quality of a component from a specific supplier were not tracked and charged back to suppliers. In addition, emails and faxes were used to resolve cost recovery disputes, leading to a long resolution cycle time [4].

III. Requirement of the Quality Management System

All-in-all, the manufacturer did not have appropriate systems to manage and improve supplier quality in a repeatable and predictable manner. Hence, their overall profits suffered due to two key issues - higher scrap costs and lower manufacturing throughput - both attributed to poor supplier quality. The manufacturer decided to implement an automated supplier quality management system to address the above mentioned issues. After an initial analysis, the manufacturer identified the following requirements for their quality management system[4]:

E. Provide capability to track quality issues across all sites with all suppliers and implement closed loop corrective action programs

F. Provide a scoreboard mechanism to measure and communicate quality metrics with suppliers and use it as a basis to drive continuous improvement in supplier quality

G. Enable suppliers to easily access the system and integrate it into their operations for this customer. The suppliers should only be able to see the data about their own operations in the system.

H. Allow the organization to implement an end-to-end cost recovery process that includes:

1. Identifying supplier quality issues that need cost recovery
2. Ensuring material and non-material costs and supporting documents are included in the cost recovery records and
3. Providing a basis for chargeback communication and dispute resolution with suppliers.

I. Allow the manufacturer to configure the system easily for each site so that different quality processes can be deployed simultaneously at different sites to accommodate variance in process maturity levels

J. Ensure that the system can scale to multiple sites and dozens of key suppliers with a centralized data repository.

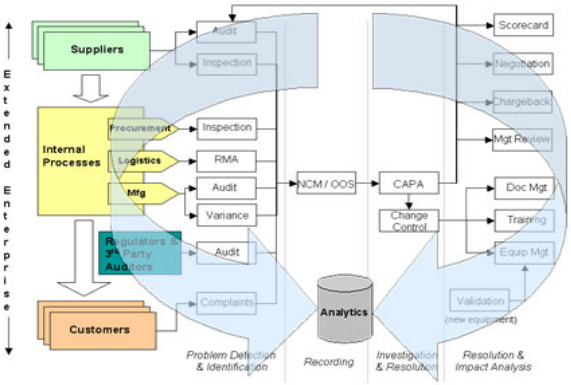


Fig.2. web based closed loop quality management

The manufacturer selected and implemented a web-based closed-loop quality management system that met the above requirements. The solution provided integrated inspection/audit, non-conformance tracking, corrective action, change control, document management, user certification and analytics/dashboard capabilities, with scalable extra rise architecture, so the manufacturer could implement an end-to-end solution to manage quality processes for its supply-base.

IV. Benefits of Knowledge Quality Management System

The manufacturer saw the following benefits within a quarter after the system went live[1].

K. The system provides a common repository across all plants to track issues, manage corrective actions and calculate metrics. The supplier scorecard with key metrics and detailed drilldown is now available to relevant stakeholders from the manufacturer and the suppliers and forms the basis for a close cooperation for improving quality.

L. The manufacturer has seen more issues go through the corrective action process due to an automated CAPA system, while keeping the same headcount. As a result, supplier quality issues have been addressed at a faster rate, resulting in accelerated improvement in the PPM metrics, increase in percentage of cost-of-poor-quality (COPQ) recovery from suppliers, decrease in warranty reserves needed, reduction in MRB inventory, a drop in rework-hours from supplier component quality issues and reduction in #RMA processes per month. In addition, the

collaborative capabilities in the automated system have increased employee productivity, leading to a reduced issue resolution time.

M. Non-conformance tracking process is now automated and all issues across all plants are tracked in the same system. As a result, one can quickly assess product quality issues from a supplier across all plants and product lines, as well as, their history over time and proactively drive appropriate actions.

N. The supplier quality system is integrated with other systems within the company. Hence, supplier product non-conformance can automatically trigger material containment, cost recovery and RMA process, making the entire process streamlined.

O. The cost recovery process itself is streamlined with an automated workflow for dispute resolution with the supplier. The system captures all relevant information for cost recovery at various levels of detail including total material and processing costs to be recovered, as well as detailed inspection data and documents that triggered the non-conformance. As a result, the cycle time for dispute resolution and for cost recovery collection has dramatically improved and a higher percentage of costs are recovered from the suppliers.

P. The quality system has enabled the manufacturer to standardize its quality processes and operating procedures with all suppliers across all sites. It provides the manufacturer with a platform for continuous improvement across their supplier-facing operations. It also enables the manufacturer to train new employees quickly.

V. Operational Metrics Improved from Supplier Quality System

1. PPM of Supplier Components
2. % of Actual COPQ Recovered from Suppliers
3. MRB Inventory Levels
4. Rework Hours due to Supplier Components
5. RMAs Processed per month
6. Issue Resolution Time
7. Customer Complaints on Product Quality
8. Warranty Reserves

VI. How to Give a Quality Score to Supplier

A supplier scorecard contains categories or main groupings of metrics by which suppliers are measured. These categories include quality, delivery, cost, and responsiveness. Aggregated score for each category is calculated first, providing a company visibility into quality score, delivery score etc. Each category has assigned weighting, which is then rolled into the overall supplier score within the scorecard. The score of the quality category (quality score) typically carry 40% to 60% of the overall supplier score weighting factor in most organizations. Hence, quality management systems (QMS) drive the overall supplier scorecard in such organizations. This paper first describes how some of the leading manufacturers calculate their quality score and then gives a checklist to ensure that your quality management system (QMS) can drive an accurate and quick calculation of the quality score. The following chart identifies key metrics in each of the categories.

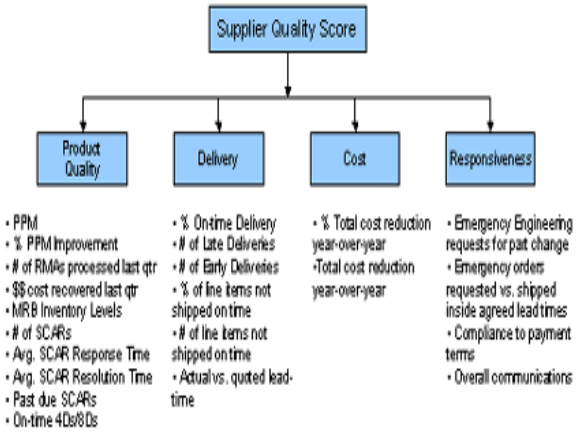
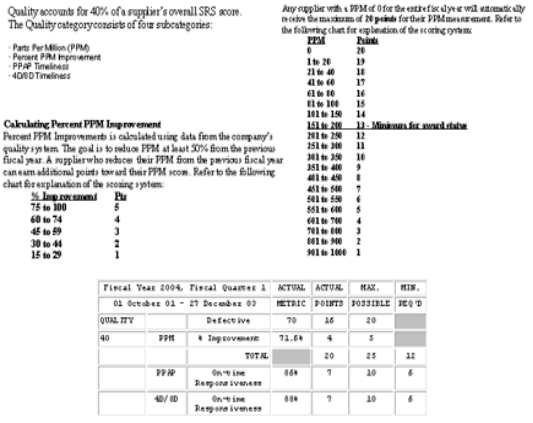


Fig.3. Various Metrics in Supplier Scorecard

VII. Supplier Quality Score

The Supplier Quality Score is an aggregate rating of the various quality-related performance metrics for the supplier. Scores for various quality metrics are multiplied by their weighting and the summation provides the overall quality score for the supplier. The following examples show how two leading manufacturers calculate the overall quality score for their suppliers[7].

Example : A Fortune 500 Automotive Supplier:



Quality accounts for 40% of a supplier's overall SRS score. The Quality category consists of four subcategories:

- Parts Per Million (PPM)
- Percent PPM Improvement
- PPAP Timeliness
- 4D/8D Timeliness

Calculating Percent PPM Improvement

Percent PPM Improvements is calculated using data from the company's quality system. The goal is to reduce PPM at least 30% from the previous fiscal year. A supplier who reduces their PPM from the previous fiscal year can earn additional points toward their PPM score. Refer to the following chart for explanation of the scoring system:

% Improvement	Pts
75 to 100	5
60 to 74	4
45 to 59	3
30 to 44	2
15 to 29	1

Any supplier with a PPM of 0 for the entire fiscal year will automatically receive the maximum of **20 points** for their PPM measurement. Refer to the following chart for explanation of the scoring system:

PPM	Points
0	20
1 to 20	19
21 to 40	18
41 to 60	17
61 to 80	16
81 to 100	15
101 to 150	14
151 to 200	13 - Minimum for award status
201 to 250	12
251 to 300	11
301 to 350	10
351 to 400	9
401 to 450	8
451 to 500	7
501 to 550	6
551 to 600	5
601 to 700	4
701 to 800	3
801 to 900	2
901 to 1000	1

Fiscal Year 2004, Fiscal Quarter 1			ACTUAL	ACTUAL	MAX.	MIN.
01 October 01 - 27 December 03			METRIC	POINTS	POSSIBLE	REQ'D
QUALITY		Defective	70	15	20	
40	PPM	% Improvement	71.6%	4	5	
		TOTAL		20	25	12
	PPAP	On-time Responsiveness	86%	7	10	6
	4D/8D	On-time Responsiveness	88%	7	10	6

VIII. Key Capabilities of QMS

Quality Management System (QMS) enables a manufacturer to deploy supplier quality scores and use it as a basis to categorize their suppliers, as a part of their overall supplier strategy. While evaluating a QMS, you should look for the following four key capabilities within the system:

Q. Ability to configure the quality scorecard: The manufacturer should be able to easily configure the scorecard capability within the QMS to add their own metrics with their own calculations and apply their own threshold criteria for each metric (to show green/yellow/red status for each metric) without having to modify their QMS system.

R. Ability to see charts and details: The manufacturer should be able to configure the supplier scorecard capability within the QMS to easily see trend charts for a metric, as well as, be able to drill down into the details to better diagnose the issue without having to modify their QMS system.

S. Ability to easily import information from other systems: The manufacturer should be able to easily import relevant information from various homegrown systems with no hardcode programming into the QMS scorecard module. This enables the manufacturer to quickly create scorecards and easily update them when the source systems change, at a very low cost of ownership.

T. Ability to calculate quality score: The manufacturer must be able to apply their own model to calculate their overall quality score without having to write custom software code within the QMS system. This is very important, since the calculations and weightings evolve over time and the manufacturer need not have to bear the cost of developing, testing and validating such changes to the QMS software on an
ongoing basis. Supplier quality scores, when implemented correctly, provide a very compelling tool to a manufacturer to automatically and continuously measure the performance of their supply-base and to proactively work with them to improve their capabilities. Without the right QMS product, these scores are created manually on spreadsheets in many corporate quality organizations – a very manually intensive and error-prone process

IX. Supplier Quality Management Measures: Preventing Supply Chain Disruptions

According to AMR, supplier quality plays a critical role attributing to almost 52% of the overall manufacturing performance. In such a scenario, the need to implement streamlined supplier quality management measures can never be over emphasized. Some of the measures employed by leading global manufacturers include [11]:

1. Supplier Site Inspections: Ensuring that all supplier components and materials are sampled, examined, tested, and authenticated before being shipped. It includes tracking supplier nonconformance issues in real-time by establishing consistent procedures for components and lots that do not conform to specifications.
2. *Streamlined Corrective Actions*: Implementing a proactive approach to supplier corrective action requests (SCARs) or corrective/preventive action requests (CAPAs) across the supply-base by following a common methodology for performing root cause analysis, assigning follow up actions while effectively tracking and routing cases from initiation to closure.
3. *Supplier Charge-backs:* Charging cost of poor quality back to the supplier for the costs incurred by a manufacturer due to nonconforming components, materials, and late deliveries in order to introduce business discipline and accountability into the supply chain.
4. *Supplier Scorecards*: Monitoring supplier performance on scorecards to proactively identify and implement timely corrective actions to improve supplier performance. Scorecards measure key performance indicators (KPI) in real-time and track improvements over time supporting sound decision-making based on data.
5. *Supplier Audits*: Conducting supplier audits to ensure that suppliers meet the established product and process quality requirements and the audit process drives continuous improvement.

However, the best way to control quality is to prevent non-conformity at the source. Following this adage, most organizations today are spending a little more time upfront to identify the discrepancies, non-conformances in manufacturing and quality process at the supplier's site itself.

X. Key Benefits of Site Inspections: Benchmarking Supply Quality Standards

From management perspective, site inspections accrue a quantifiable return on investment - fast and just-in-time quality production and reduction of both order cycle times and inventory levels. Few of the tangible rewards are listed below[2]:

U. Reduced Costs: On-site inspections help companies take proactive remedial actions to reduce their costs of poor quality (COPQ). Timely identification of non-conforming and poor quality components help save shipment costs and costs of late delivery.

V. Monitored Supplier Performance: Site inspections provide real time visibility into supplier's performance - evaluating manufacturing techniques, assembly procedures or quality issues, and ensuring that the production is as per requirement. Monitoring product quality via performance metrics and scorecards ensures quality adherence and customer satisfaction along with helping in identification and qualification of new vendors.

W. Enhanced Product Quality: Procurement of faulty or low quality raw materials can cause serious quality defects in the final product. For example, Ford Motor Co. incurred huge losses due to procurement of faulty tires, losing about $3 billion. On-site inspections can avert such losses by ensuring shipment of high, acceptable and standard quality raw materials.

X. Accelerated Issue Resolution: Site inspections can help in proactive identification, tracking and resolution of quality issues before they become major events.

XI. TECHNOLOGY DRIVEN SOLUTIONS: GETTING THE BEST OUT OF SITE INSPECTIONS

Inspections provide insight and visibility to potential supplier problems so that they can be rectified on time. This helps in ensuring quality procurement, compliance adherence, and costs reduction. Below are the ways by which you can leverage technology to ensure that your site inspections become beneficial in enhancing supplier quality:

Y. Deploying a web based system and granting access to suppliers helps in easing the tasks related with quality management. By instituting a web-based system, supplier's can enter inspections data enabling the manufactures' supplier quality team to gain a real-time visibility into the inspections data, without indulging in manual process of data collection and reporting.

Z. Integrating real-time inspections data into a common enterprise wide database helps in eliminating inconsistencies and errors. This holistic approach for heterogeneous environments can help in standardizing the methodology to analyze, resolve and prevent quality issues.

AA. Recording of inspections data and activities helps in creating an appropriate track of all inspection activities. The inspections data can then be used for trend analysis and business intelligence.

BB. Streamlining the entire onsite inspection process helps in timely implementation of corrective actions if a quality issue arises during the inspection process.

CC. Implementing an automated quality management process resulting in significantly lower cost of poor quality.

XII. CONCLUSION

Quality issues not discovered and addressed prior to shipment can hurt the bottom line of any organization. World-class manufacturers are realizing the need to maintain a consistent and systematic quality process to gain real time inspections data with analytics of trend analysis. AMR2 reports in 2007 survey that 46% of companies planned to implement supply chain risk management technology in the next 12 to 24 months. Leading organizations are replacing their manual and paper-based systems with technology-driven solutions, to achieve complete automation of supplier quality management. By improving operational efficiencies in quality systems, automated solutions enables companies to create a transparent environment for proactively identifying, tracking and resolving quality issues. Moreover, the embedded best practices for supporting key processes and requirements for standards and regulations such as ISO 9000 and FDA GMPs lower the cost of regulatory compliance and risk of noncompliance.

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