Designing Quality Assurance System Using Gap Analysis Method on Automotive Spare Parts Company (Case Study of PT. TPI)

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Abstract

The Implementation of Quality Assurance System is a step for organization in improving their Quality Management System. PT. TPI is a supplier for Multinational Automotive Company, therefore PT. TPI must apply Quality Assurance System to create satisfaction and fulfill customer requirement. Quality management system at PT. TPI has already running but limited on quality control activities and has not covered the quality assurance of suppliers, quality assurance, delivery assurance, and customer acceptance guarantee. The purpose of this study to design a quality assurance system at PT. TPI that can ensure every implementation of activities and all types of work that aims to produce products to be created, received, and will be sent by PT. TPI. This research is qualitative through data collection using interview and field observation at PT. TPI. The analysis is assessed based on Gap Analysis by comparing the situation in PT. TPI with each clause in the Customer Quality Assurance System Requirements. From the result of the average value that is equal to 18.48%, it can be concluded almost all activity of Quality assurance system executed and documented almost totally fulfill the requirement, but there is negligence and inconsistent in its daily control.

Keywords (5 keywords)
Quality Assurance, Gap Analysis, Quality management system.

1. Introduction

Large scale economies emphasize global competition. Japan's emergence led to massive changes in the ease of manufacturing. As a result, manufacturers try to fulfill orders quickly without stopping for the replacement of equipment (Bendel, Boutler & Kelly, 1993; Pettigrew & Whipp, 1991). Customer satisfaction is a priority, namely quality excellence, very fast response, on-time delivery, and reasonable prices. Complete quality management efforts will not be achieved if attention is not directed to matters relating to supplier management processes (Elshennawy, 1991). Deming (1986) determined the steps to improve supplier quality as one of the quality management objectives to improve and renew various organizational requirements. Building a management structure with a win-win solution, optimizing the needs of workers, giving satisfaction to customers (internal and external), suppliers, owners, and competitors in the long term. Supplier quality gets special attention from quality experts such as Deming (1986), Crosby (1989) and Ishikawa (1985) who state that supplier development is the construction of part of the operations of the parent company or its assembly.

PT. TPI is a company which engaged in the produces of automotive parts that supply to multinational automotive companies. Therefore, this research is needed to design a quality assurance system that can be adopted by PT. TPI, with the aim of ensuring product quality has met all the requirements before reaching customers.Quality management system at PT. TPI has been running but only focused on quality control activities and has not covered the guarantee of the quality of goods received from suppliers, quality assurance processes, quality assurance of delivery, and the guarantee of acceptance of customers.

2. Literature Review

2.1. Quality Assurance

Quality assurance (QA) means to guarantee product quality so that consumers are sure to buy it and use it for long periods of time with confidence and satisfaction (satisfaction of consumer desires) (Ishikawa, 1991). Improvements in manufacturing performance through quality assurance (QA) complement two basic benefits, namely industrial services and industrial similarity. This quality assurance also complements manufacturing equipment that is well-known throughout the world and uses the development of company productivity (Travis, 1990).

2.2. Quality Assurance System for Supplier

The Quality Assurance System for Suppliers from Multinational Automotive Companies is a manual that contains guidelines for implementing a quality assurance system that is applied in all suppliers who supply parts/components or products to the Company, containing general explanations of binding rules and regulations in work contractual (Quality Assurance System for Supplier - 3rd Edition, 2015). This Quality Assurance System is reviewed by Multinational Automotive Companies at least once a year. This quality assurance system is a system-oriented to the process approach.

The requirements of the Customer Quality Assurance System (Multinational Automotive Company) consist of 7 important series, there are: Series Z, Basic Management of Quality Organizations; Series A, Image Control and Specifications; Series B, Handling Quality Material and Parts at Supplier; Series C, Product Development and Quality Approval; Series D, Quality Control and Lot Control; Series E, Configuration Changes at Supplier; and Series F, Handling Quality Problem Parts.

2.3. Gap Analysis

Gap analysis is defined by the IT Infrastructure Library (ITIL) as an activity that compares two types of data and identifies differences. Gap analysis is commonly used to compare a set of requirements. Gap analysis is generally structured on a set of areas, topics or categories, thus making a gap analysis efficient to find out which sectors or fields need to be improved. Analysis gap becomes effective because the checklist is made structured and in accordance with the topic. The checklist will cover all the requirements that exist and are made hierarchically in the assessment; this will include general questions and provide an overview of the topic or category to be assessed. Questions on the checklist are made in full, detailed, and make an assessment of each individual's requirements if needed. Each question relates to other questions to ensure traceability (Picard et al., 2016).

2.4. Geometric Mean

Gap Analysis Checklist that involves more than one respondent will produce different assessments. The results of the gap value of each respondent will be combined into one value that represents all the results of the assessment. The merger is done by finding the average value. According to Thomas L. Saaty (1994), the leveling method used is the Geometric Mean method. Geomean is the average obtained by multiplying all data in one group of samples, then rooted by the number of samples. Each gap percentage value of each respondent is multiplied and the multiplication results are measured according to the number of respondents is the geometric mean. Mathematically the geometric mean formulation is written as follows (Saaty, 1994):

$$(GM) = \sqrt[2]{x_1.x_2.x_3 \dots x_n}$$

(GM) : Geometric Mean
N : Number of Respondents
XN : n Gaps Value

3. Methods

Based on the requirements of ISO 9001: 2005, the Gap Analysis Checklist consists of two interrelated stages. Stage 1 started with Identifying the gaps in the PT. TPI system using the Gap Analysis Checklist. The checklist contains seven requirements that form a standard quality assurance system that has been set by the customer (Multinational Automotive Company). Next, in stage 2, after identifying all gaps and knowing the parts that must be improved or developed, the next step is to fill that gap. To simplify this step can be done with the Plan, Do, Check and Act steps.

Assessments in gap analysis are conducted by discussion with several respondents from the company who have sufficient competence. There are three person in the company that are respondents in filling in the standard Gap Analysis Customer Quality Assurance System (Multinational Automotive Company).

The results of the gap value calculation: The next step is to do a gap assessment. Gap assessment aims to see how big the gap is in the company. The percentage value of the gap is obtained by summing the value per variable and dividing it by the maximum value on that variable.

4. Results

Assessment of Gap Analysis involving more than one respondent will produce different assessments. The results of the gap value of each respondent will be combined into one value that represents all the results of the assessment. The merger is done by finding the average value. The geometric mean is found with each percentage value of the gap per respondent multiplied and the multiplication results are measured according to the number of respondents.

The overall value of the overall gap is 18.48% (Table 1), and the results of the average gap value of each series are then identified based on the company's readiness range in implementing the customer's Quality Assurance System Requirements.

Table 1. Geometric Mean Results

Series	Description	R1	R2	R3	*GM*
Z	Basic Management of Quality Organizations	17.14%	20%	14.29%	16.98%
A	Image Control and Specifications	36%	40%	32%	35.85%
B	Handling Quality of Materials and Products at Suppliers	28%	32%	12%	22.07%
C	Product Development and Quality Approval (Stage: Pre-Production)	33.3%	36.67%	35%	34.97%
D	Quality Control and Lot Control (Stage: Mass Production)	12.9%	20%	14.3%	15.43%
E	Confection of Changes in Suppliers (Stages: Mass Production)	15%	25%	10%	15.54%
F	Handling Quality Problems (Abnormal Quality)	5.71%	17.14%	2.86%	6.54%
Average		18.09%	26.01%	13.42%	18.48%

5. Discussion

Based on the assessment of the gap analysis that has been carried out, the activities of the Quality Assurance System that have not been implemented at PT. TPI will be given a draft improvement step. So by giving steps for improvements, activities and documentation that previously did not exist or have not been implemented at PT. TPI is done. The checklist that gets a value of 3-5 is an activity that has not been carried out at PT. TPI (Table 2).

Table 2. Checklist Gap Recapitulation

Series	Clause	Description	Value
A	3.B.7	Have the quality department personnel been provided with safety-part knowledge?	4.3
A	3.A.2	Does the data collection and storage of the image comply with the applicable rules/customer requirements?	3.3
A	3.A.1.1	Is the image control in accordance with the applicable rules/customer requirements?	3.3
B	3.6.1	Have the quality audit results (if any) been followed up to 'OK' status?	3.0
C	3.1.3	Has the Manufacturing Control Plan (MCP) been made and updated?	4.7
C	3.2.1	Has the Quality Assurance Matrix been available and refers to the technical information on previous quality problems?	5.0
C	3.12	Has the supplier carried out the transition stage (pre-mass production to mass production) and poured it into the document 'Declaration of Mass Production'?	4.7
D	3.A.1	Has verification of process capability been carried out in the initial stages of mass production and its follow-up according to customer requirements?	5.0

5.1. Designing Gap Improvements in Series A (Image Control and Specifications)

Personnel Training

PT. TPI as a company that manufactures safety type products (Helmets, Rear Bumper Ornament, etc.), this company is required to follow the provisions of safety products for which all terms and conditions have been set, one of which is Personnel Training. This training covers knowledge about Safety Product material.

Maintenance and Control of Images and Technical Documents

As a supplier of Multinational Automotive companies, of course, PT. TPI received various pictures and technical documents from the company. Therefore PT. TPI must be able to manage and maintain all forms of images and technical documents related to the design and specifications received from customers.

Provisions stipulated in the control and maintenance of images and documents include: 1) Rules for approval of material to be published, 2) Rules for reviewing or reviewing the suitability of documents, 3) Procedure if there is a document revision and how to purchase the identification, 4) Procedures for distributing documents must be ensured that the relevant and up-to-date documents must be in the person concerned, 5) Documents must be easy to read and easy to take when needed, 6) Storage procedures and control of the distribution of external documents, 7) Procedure for enforcing expired documents, 8) Images received must be recorded in a systematic management list so that they are traceable and must be checked at any time, 9) Storage facilities must be adequate, 10) Handling of images and technical documents (Soft-Copy and Hard-Copy) must be recorded in the list of controls so that they are traceable.

5.2. Design Gap Improvements in Series B (Handling of Quality Materials and Products at Suppliers)

Supplier Quality Audit

PT. TPI, as a supplier of Multinational Automotive Companies, will carry out routine audits from customers. The audit will be carried out by the customer at least once every two years or in accordance with the policies of the customer by taking into account the status of the supplier in terms of quality.

The Audit Scope covers the aspects of the quality system as follows: 1) Policy and Quality Organization, 2) Quality System, 3) Supervision of Design and Specifications, 4) Document and Note Supervision, 4) Supplier Supervision,

6) Supervision of Product Components, 7) Manufacturing Process Supervision, 8) Manufacturing Facility Supervision, 9) Final Inspection and Reliability Test, 10) Monitoring of Monitoring Equipment and Measuring Instruments, 11) Product Supervision Not Appropriate, 12) Internal Quality Audit, 13) Quality Training, 14) Compliance with the Supplier Quality Guidelines Requirements: reviewed from the assessment in areas 1-13 above

5.3. Designing Gap Improvements in Series C (Product Development and Quality Approval)

Quality Planning and Manufacturing Process

In the Quality Assurance System for Supplier module - 3rd Edition, 2015 from customers, suppliers are required to make a Work Activity Planning document using the control sheet that has been determined by the customer: Manufacturing Control Plan (MCP). Based on Quality Assurance System for Supplier - 3rd Edition, 2015, MCP is a form that contains a plan for manufacturing activities for a product, from the receipt of images / designs to the status of 'Ready for Mass Production', which is used in developing a component as well as controlling actual achievement against the planned set.

Quality Inspection Planning and Inspection Facilities

In order to achieve maximum quality assurance, the Supplier must review technical information in the form of a record of product handling experience to support the planning of the process to be made. In the Quality Assurance System for Supplier module - 3rd Edition 2015, it requires the Supplier to make a record of events on the product through the Quality Assurance Matrix sheet. At PT. Terang Parts Indonesia itself has no such sheet. The Quality Assurance Matrix itself is a form used to record quality case events that have occurred in previous manufacturing processes. This listing aims to guarantee that the product can meet the quality characteristics to fit the requirements in the drawings, specifications, and technical requirements that have been set.

Transition Stages (Pre-Production to Mass Production)

Before heading to mass production, suppliers are required to verify completion of the Pre-Production stage. PT. Terang Parts Indonesia has fulfilled the Requirement List of Approval and has found Quality Approval Notification from customers, but there has not been any actual production of the Declaration on Mass Production required under the provisions. In the Quality Assurance System for Supplier - 3rd Edition, 2015 module from customers, Suppliers are required to make a 'Mass Production Declaration' document if they have completed the Pre-Production stage. The document 'Declaration of Mass Production' contains a statement of the Supplier's ability to carry out mass production by fulfilling all the requirements specified by the customer.

5.4. Designing Gap Improvements in Series D (Quality Control and Production Lot)

Process Capability Verification

Based on the Quality Assurance System Requirements set by the customer, PT. TPI is required to verify process capability during the initial stages of mass production. PT. TPI is also required to submit verification records/documentation if requested by the customer. Verification of process capability is carried out by the Process Capability Analysis method where the results of the analysis must meet the requirements below:

1. Cpk $\geq$ 1.33 or P <0.11 the observed range.
2. If 1.0 <Cpk <1.33 or 0.01 <P <0.3, 100% inspection or sampling inspection is combined in the process and the results show no incompatibility.
3. If Cpk <1.0 or 0.3 <P, 100% of the inspection is carried out.
4. Investigate and determine whether an inadequate process will change the median or distribution and take action.

6. Conclusion

Calculation of the value of the gap analysis shows that the design of the Quality Assurance System at PT. TPI is quite good because almost all quality assurance activities are based on the requirements of the Customer Quality Assurance System that have been implemented and documented, but there are only a few activities that have not been implemented and documented.

The results of the percentage gap value of each series have an average value of 18.48% so that it can be concluded that the Quality Assurance System at PT. TPI has been implemented almost in its entirety but there has been little negligence in its implementation so that it requires repairs to some activities and documentation but not too comprehensive only in series A which must be considered more because it has the largest gap value and for some C documentation activities need to be made and implemented, as well as series B where the results of the company quality audit must be considered in making repairs while the Z, D, E, and F series have been implemented and meet the requirements of the Customer Quality Assurance System.

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