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Use of Root Cause Analysis in Improvement of Product Quality and Productivity in Pragoti Industries Ltd.

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Abstract

Root Cause Analysis (RCA) is an effective technique of solving especially production-related problem and used for distinguishing the root causes of problems as well as its mitigation. In this paper, root cause analysis methodology has been adopted by using various tools of quality control system such as Pareto Chart, Check sheet, Cause-effect diagram, etc. in order to eliminate the automobile assembly defects in Pragoti Industries Ltd. during the project of Mitsubishi Motors Corporation's (Japan) Pajero Sport QX model vehicle. The proposed technique has been reduced the production line defects about 63% on average results along with better product quality and productivity.

1. Introduction

In quality management system, Root Cause Analysis (RCA) grew out in such a way where the permanent solving of the root causes enhance the productivity in a more meaningful way. A factor can be viewed as the root cause if expulsion thereof from the issue flaw grouping keeps the last bothersome result from repeating. Defining and describing the problem is the initial step of the RCA. Establishing a timeline from normal situation until the final crisis is another crucial step to apply the RCA. RCA can play a role in problem prediction. RCA is regularly utilized as a receptive technique for recognizing event(s) causes, uncovering issues and fathoming them. An examination is done after an occasion has happened. Bits of knowledge in RCA make it conceivably valuable as a pre-emptive technique. In that occasion, RCA can be utilized to gauge or anticipate likely occasions even before they happen. While one pursues the other, RCA is a totally isolated procedure to occurrence the board. The quintessence of RCA underlies with the first perceive and comprehend what is causing the issue. RCA is too vital for a production engineer as root cause is the most underlying driver behind an unwanted condition or issue.

RCA was first used during the development of Toyota's manufacturing processes in 1958 [1]. Wilson et al. [2] have characterized the RCA as an expository apparatus which incorporates the recognizable proof of the root and contributory variables, assurance of hazard decrease techniques, and advancement of activity designs alongside estimation systems to assess the adequacy of the plans. Canadian Root Cause Analysis Framework [3] explains that main driver investigation is a significant segment of an exhaustive comprehension of "what occurred". In that system, "beginning comprehension" of the occasion has been checked on and unanswered inquiries and data holes have been distinguished. The process of acquiring the information includes interviews with staff, interrogating the physical environment, and observation of usual work processes. Dew and Sproull express that distinguishing and taking out main drivers of any issue is of most extreme significance. RCA is an organized methodology with different strategies in a concentration for recognizing and settling issues. Apparatuses that upgrade to recognize the main drivers of issues are known as underlying driver investigation instruments [4]. Geno et. al. [5] has presented some common RCA tools and methods and indicated some comparative differences between tool and method of a RCA. Cox and Spencer [6] have proposed an appropriate administration choice to succeed the RCA apparatuses and strategies in a specific domain. Lepore and Cohen [7], Moran et al. [8], Robson [9] and Scheinkopf [10] push forward that when change is required, at that point think underlying driver examining, recognizing and wiping out. The establishments of their examinations are spearheading one as they question an acknowledged practice for underlying driver investigation and the aftereffects of the model investigations are empowering [11]. Smith [12] has clarified that Root Cause Tools can resolve clashing techniques, arrangements, and measures. The examination on three apparatuses in particular Cause-and-Effect Diagram (CED), the Interrelationship Diagram (ID), and the Current Reality Tree (CRT) is inadequate on how these three instruments straightforwardly contrast with one another. Truth be told, there are just two investigations that looked at them and the correlations were

subjective. Fredendall et al. [12] have additionally thought about the CED and the CRT utilizing recently distributed instances of their different adequacy. While Pasquarella et al. [13] analyzed CED, ID, and CRT on Equipment/Material Problem, Procedure Problem, Personnel Error, Design Problem, Training Deficiency, Management Problem and External Phenomena utilizing a one-bunch post-test plan with subjective reactions..In a production line, equipment failure can be occurred for numerous reasons. Several progressions of actions and consequences can lead to a failure. RCA is a step-by-step method to discover the rudimentary faults or root cause. The investigation traces the cause and effect trail from the end failure back to the root cause. As soon as one can identify the root cause of a fault and related problems, actions can be taken immediately. As a result, market demand can be fulfilled with high quality at comparable price. RCA can answer the questions of what has happened, why it has happened and what can be done to rectify the likelihood of recurrence.

This study helps us to find out how RCA playing a significant role in order to ensure better quality and productivity during Pajero Sport QX Project which was led by Automotive giant company Mitsubishi Motors Corporation, Japan and Pragoti Industries Limited (PIL), Bangladesh Steel and Engineering Corporation (BSEC), Ministry of Industries, Bangladesh. Following articles will explain the methodology, process, result and discussion.

2. Methodology

The data have been collected from Pragoti Industry Ltd. located in Barabkunda, Sitakunda, Chattogram, Bangladesh. The main function of this company is assembling a range of vehicles and mainly provide it to the government of Bangladesh. The entire study has been completed at this organization during the assembly of Pajero Sport QX venture of Mitsubishi Motor Corporation's (MMC) from Japan. The check sheet is utilized in gathering information from all significant creation offices. The accumulated information is then examined with Pareto investigation to distinguish the principle issues which can give greatest preferences in the wake of settling. The reason impact graph is utilized to recognize the main drivers of some procedure stream. Some procedure examination is additionally accomplished for discovering main drivers. Eventually, some particular underlying drivers are recognized for development. Figure 1 depicts the flow chart of the entire methodology have been followed in this study:

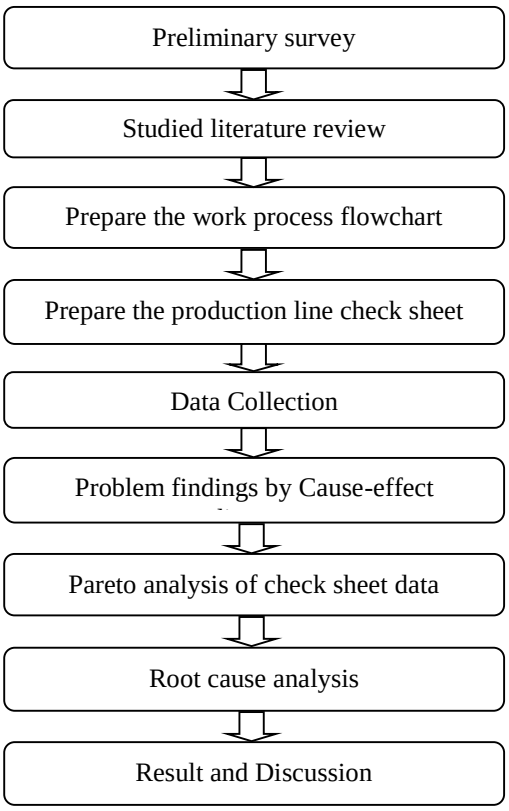

Fig. 1. Flow Chart of the methodology

3. Process Analysis

Several atages have been taken under study during running Pajero Sport QX Project and they are PJ (Joint Production) Trail, PLT (Pilot Trail) and PP (Production Preparation). To ensure the quality, benchmark was fixed by Mitsubishi Motors Corporation (MMC), Japan. To get the pass in FQCM (Final Quality Confirmation Meeting), following up the finished product after each of the stages was mandatory. Following process charts were developed as the part of routine work.

Cause Effect Diagram (CED)

To overcome any problem, study the check sheet along with the auditor reports and analyzed the CED is an essential work where the reasons behind the poor quality vehicles were illustrated. It depends on person, method, machine, materials and environment orientated issues. This study helped to find out the possible root causes behind the problems. The CED for this project is illustrated in Fig. 2.

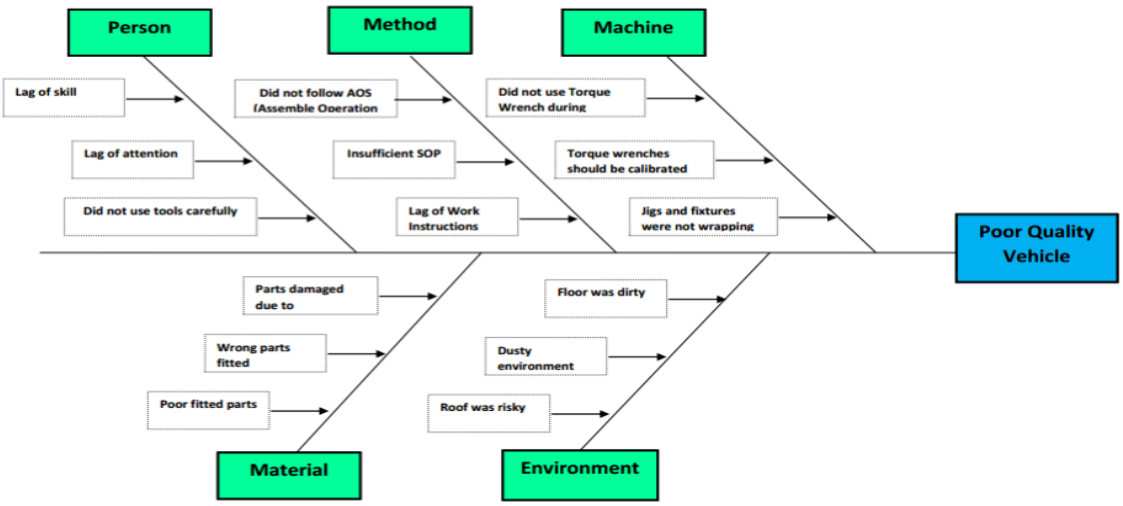

Fig. 2. Cause Effect Diagram (CED) in assembling a motor vehicle

Pareto Chart

The most common defects were identified by using Pareto Chart, is a sort of outline that contains the two bars and a line diagram, where individual qualities are spoken to in dropping request by bars, and the total absolute is spoken to by the line. The reason for the Pareto graph is to feature the most significant among a (normally huge) arrangement of variables. It helped to identified the most significant problems among the all possible defects. The Pareto Chart for Pajero Sport QX project is depicted in Fig. 3

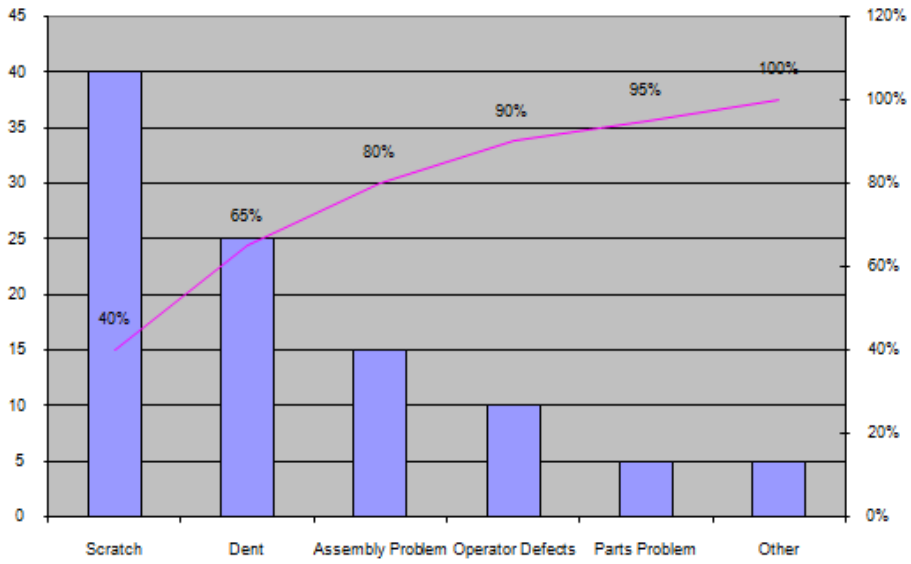

Fig. 3. Pareto Chart

Problem Follow List (Sample Check Sheet)

Once the CED and Pareto chart got ready, the next step is to find out the root causes and their possible counter measures for relevant problem in order to mitigate these. For each and every problem there was at least one root cause and relevant counter measure can mitigate this problem. In this way, for all defects RCA had been done and to do relevant responsible persons and their completion date was regularly monitored. Finally possible root causes and their counter measures were found and applied. A sample check sheet has been prepared accordingly and showed in Table 1.

Table 1. Sample check sheet for RCA

Sl. No.	Line	Problem	Root cause	Counter measure	Date of writing	Target Date	Recurence
1	Trim	Contamination cover for each brake tube	End of brake tube is not covered	Need to cover the break tube	17-Oct-16	17-Oct-16	N/A
2	Final	Rack of FR & RR bumper are not wraping correctly	Lack of wraping	Need to wrap the rack	18-Oct-16	25-Oct-16	2 vehicle
3	Trim	Touch	Dam hood side	After the fender garnish sequence change	19-Oct-16	19-Oct-16	N/A
4	Trim	Scratch	Lack of consciusness of worker	Procure softest groove	20-Oct-16	By PP to purchase	N/A
5	Chasis	FRS/ABS FR Upper spring scartch	Interfere with wrench	Change process, brake pipe E-clip 1st, S/ABS 2nd	24-Oct-16	27-Oct-16	5 vehicle

4. Result and Discussion

By using CED, Pareto Chart, and Check Sheet, the PIL management considered few reasons for most of the defects happened. Application of the counter measures reduced the flaw day by day. Specially, awareness of the operator and working environment put the impact immediately on the product quality and its productivity. Therefore, PIL able to achieved its target point. Figure 4 shows the graphical presentation of PIL's gradual improvements. In the PP, the products' demerits points dramatically reduced about 63% (from 53.3 to 33.7) on an average basis. Consequently, the productivity is improved significantly for this project. After having started the mass production, proper documentation played a vital role in continuous monitoring of the production line. Whenever, any problem was found, PIL management have been informed and took necessary action(s) accordingly. In case of the unavailability services from the PIL, MMC representative took the responsibility. Monthly quality progress report has been checked regularly as a part of the continual improvement.

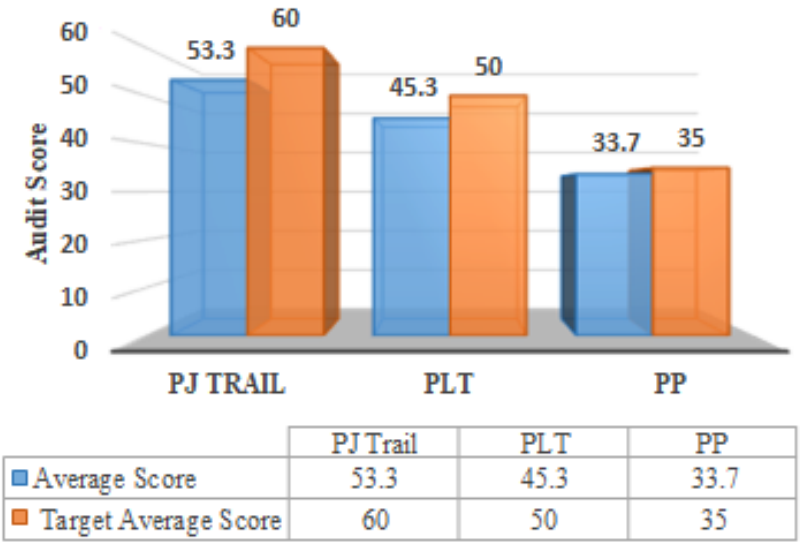

Fig. 4. Continual Quality Improvement scenario of Pajero Sport QX Project

5. Conclusion

This paper has discussed the RCA during the assembly of Pajero Sport QX model vehicle in Pragoti Industries Ltd., Bangladesh. RCA is a simple process but it makes a considerable difference at the output of any system. For an effective RCA, several process tools are required. In this study, cause effect diagram, pareto chart, and sample check sheet have been used as the RCA tools. Person, Method, Machine, Materials, and Environment, these key factors are chosen to develop the CED. Pareto chart was used to find out the root causes. Counter measures have been taken accordingly. Application of the counter measures put an impact to achieve 88.8% at PJ Trail, 90.6% at PLT, and 96.28% at PP of the target score. It is observed that regular monitoring of the improvement increased the productivity of the motor vehicle production line significantly.

6. References

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