Improving the Productivity of Lever Combination Switch using Continuous Improvement Process

Anil Kumar, Sanjay Kumar Bagri

Abstract—Most of the companies always report poor quality of particular product during its operation which results in increasing cost, and customer complaints. The purpose of this study is to help Company Mindarika to improve the product quality and to increase productivity by using Continuous Process Improvement and the Quality Control Techniques. Methods and procedures of this study include a review of literature relevant to Continuous Improvement, Quality Control Techniques, Root cause Analysis. After the causes of defects are identified, solutions and procedures are recommended to the Company to eliminate defects in the assembly process of Lever Combination Switch so that the productivity can be improved.

Keywords — Lever Combination Switch; Continuous Process Improvement; Quality Control Tools; Noise in Switch; Greasing of ratchet.

I. INTRODUCTION

1.1 Background
Quality is now involved in every kind of business: manufacturing, hospital, school, food industry, public utility, etc. This is not focused only in production areas but in service areas also. It has turned out to be a core competency for many companies to improve their competitive advantage. Why is quality important? High quality products or services are leading to business success, improved competitiveness, higher customer loyalty, and lower costs. Continuous process improvement and Quality Control Techniques are the strategies that can help organizations to satisfy customer needs and help organizations to have greater performance.

1.2 Project/Concerned Place Introduction
Mindarika Pvt. Limited, with Rs.1.30 billion (USD 32.12 million) in revenue, is India’s largest 4 wheeler automotive switch manufacturer. Mindarika Pvt. Limited has consciously evolved into a complete design and development centre for four wheeler automotive switches.

It offers customized solutions to the automotive industry in the realm of product improvisation and new product development. The core strengths at Mindarika are skilled manpower, adherence to the highest quality standards and providing cost effective solutions.

II. LITERATURE REVIEW

This chapter will discuss concepts of quality including continuous improvement, lean techniques. Moreover, this chapter is devoted to the review of literature which includes the concept of automotive parts manufacturing and processing.

2.1) Continuous Improvement
Companies are always keen to search ideas through which productivity and ultimately the benefits can be improved. The organization's ability to survive in a highly competitive business world depends on how the organization manages and adapts to demands of a changing environment.

Customer always needs new products and their needs are always changing. Therefore, many companies have had to improve in terms of products or services to satisfy customers' needs. Continuous improvement is an ongoing effort to improve products, services, or processes. It is more focused on customer service, process improvement, higher product quality and long-term strategies.

Table 1 shows additional differences between companies that apply continuous improvement theory and traditional companies.

<table>
<thead>
<tr>
<th>Continuous Improvement versus Traditional Orientation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Company Oriented Toward</strong></td>
</tr>
<tr>
<td>Continuous Improvement</td>
</tr>
<tr>
<td>Customer Focus</td>
</tr>
<tr>
<td>Focus on “What” &amp; “How”</td>
</tr>
<tr>
<td>Long-Term Focus</td>
</tr>
<tr>
<td>Process Improvement Focus</td>
</tr>
<tr>
<td>Incremental Improvements</td>
</tr>
<tr>
<td>Problem Solving</td>
</tr>
</tbody>
</table>

2.2) Seven Tools of Quality

Kaoru Ishikawa developed seven basic visual tools of quality so that the average person could analyze and interpret data.

The seven tools of quality are used for improving processes, identifying problems, seeking root causes of problems, and solving problems. These are—Histograms, Pareto Charts, Cause and Effect Diagrams, Run Charts, Scatter Diagrams, Flow Charts, Control Charts.

2.3) View of Product under consideration (LEVER COMBINATION SWITCH)

Figure 1 - Schematic of a LEVER COMBINATION SWITCH
III. OBJECTIVE
To improve the productivity of Lever Combination Switch.

IV. PURPOSE OF THE STUDY
The need of this study is to help Mindarika Private Limited –
1. To minimize the rejection of a specific product,
2. To improve the product quality and

V. SCOPE OF THE STUDY
This study will help the various automotive/process industries-
1. In minimizing the rejection of a specific product,
2. In improving the product quality and

VI. RESEARCH METHODOLOGY
6.1) Introduction
The purpose of this study is to help Mindarika Private Limited to improve productivity of Lever Combination Switch, then provide feedback to the company for the future improvement.

6.2) Define
We than define the main problem which provides the limitation in increasing the productivity.

6.3) Data Collection
Data related to production will be collected. It will include the total produced quantities, rejected quantities and type of defects in the specific product.

6.4) Data Analysis
The various Quality tools will be used to analyze data, identify problems, seek root causes of problems, and solve problems.

VII. RESULTS
The purpose of this study is to help Mindarika Private Limited to improve product quality and improve the productivity by continuous improvement plan.

7.1) Identifying and analyzing problems in Mindarika-
Company Mindarika Private Limited has faced unsteady quality of automotive products, which results in increasing cost and customer complaints. One of the reasons for this is that the company’s business has increased dramatically within the past couple years. As a result, the variety of automotive products has been escalating. Another reason for quality issues at Company Mindarika private limited relates to new employees hired to support the growing business who lack quality knowledge of material/ product characteristics. During the last quarter in 2012, Company Mindarika private limited has noted a countable rejection in various products manufactured by it. The details of these rejections are given below in the histogram chart in figure-

As we have chosen the product S11120 (Combination Lever Switch) so it is marked with red dots around it. Now as per our need we will identify the problems associated S11120, which leads to the rejection of this product.

Table 2 Problems related with S11120

<table>
<thead>
<tr>
<th>S.N.</th>
<th>PROBLEMS RELATED TO S11120</th>
<th>AREA</th>
<th>CATEGORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PART SHORTAGE ON LINE</td>
<td>SS</td>
<td>B</td>
</tr>
<tr>
<td>2</td>
<td>OVERTIME ON LINE</td>
<td></td>
<td>B</td>
</tr>
<tr>
<td>3</td>
<td>PART FEEDING ON LINE</td>
<td>SS</td>
<td>A</td>
</tr>
<tr>
<td>4</td>
<td>SHORTAGE OF BIN</td>
<td>SS</td>
<td>B</td>
</tr>
<tr>
<td>5</td>
<td>MORE NO. OF DOCUMENT ON LINE</td>
<td>SS</td>
<td>A</td>
</tr>
<tr>
<td>6</td>
<td>MORE ABSENTEESISM ON LINE</td>
<td>PRODUCTIVITY</td>
<td>A</td>
</tr>
<tr>
<td>7</td>
<td>NO PROPER LOCATION OF SMALL PARTS ON LINE</td>
<td>QUALITY</td>
<td>B</td>
</tr>
<tr>
<td>8</td>
<td>MORE LOSSES DUE TO MACHINE BREAK-DOWN</td>
<td>PRODUCTIVITY</td>
<td>B</td>
</tr>
<tr>
<td>9</td>
<td>ERRATIC CONTINUITY</td>
<td>QUALITY</td>
<td>B</td>
</tr>
<tr>
<td>10</td>
<td>LOCKING NG</td>
<td>QUALITY</td>
<td>B</td>
</tr>
<tr>
<td>11</td>
<td>CAPACITY CONSTRAINT</td>
<td>PRODUCTIVITY</td>
<td>A</td>
</tr>
<tr>
<td>12</td>
<td>NOISE IN THE SWITCH</td>
<td>QUALITY</td>
<td>B</td>
</tr>
<tr>
<td>13</td>
<td>SCREW MISS</td>
<td>QUALITY</td>
<td>B</td>
</tr>
<tr>
<td>14</td>
<td>BATCH CODE MISS</td>
<td>QUALITY</td>
<td>B</td>
</tr>
<tr>
<td>15</td>
<td>DELIVERY FAILURE</td>
<td>DISPATCH</td>
<td>B</td>
</tr>
<tr>
<td>16</td>
<td>MARKING OF COMPONENTS</td>
<td>QUALITY</td>
<td>B</td>
</tr>
<tr>
<td>17</td>
<td>FLASH ON COMPONENTS</td>
<td>QUALITY</td>
<td>B</td>
</tr>
<tr>
<td>18</td>
<td>SCRATCH ON COMPONENTS</td>
<td>QUALITY</td>
<td>B</td>
</tr>
</tbody>
</table>

From the table Shown above we found that there are Total 18 (Internal) Problems associated with S11120.

Also on the basis of above sources we have divided these problems into following 3 categories-

A- problems can be solved by the assembly department
B- involvement of other departments is a necessity
C- management sanction may be needed

QUALITY PROBLEMS RELATED WITH S11120 =9
Among the 9 problems 8 of the problems are solved with the help of the Lean or Kaizen Techniques. Now only 1 Quality related problem is remaining.

Table 3-Total Quality Problems

<table>
<thead>
<tr>
<th>S.N.</th>
<th>PROBLEM</th>
<th>TOTAL</th>
<th>SOLVED (KAIZEN)</th>
<th>REMAINING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>'A' - TYPE</td>
<td>01</td>
<td>01</td>
<td>00</td>
</tr>
<tr>
<td>2</td>
<td>'B' - TYPE</td>
<td>08</td>
<td>07</td>
<td>01</td>
</tr>
<tr>
<td>3</td>
<td>'C' - TYPE</td>
<td>00</td>
<td>00</td>
<td>00</td>
</tr>
</tbody>
</table>

Now the single problem which remained unsolved is-
“Extra noise observed in switch while turn is on”.

7.1.1) Definition of Problem (Noise in the Switch)?
Noise in switch may be defined as the “The unpleasant sound from the Combination Lever Switch while the turn is On”.

7.1.2) Analysis & Finding out causes of High Significance
For finding out the causes of Noise in switch let us draw the process flow chart where the problem actually happened and how it bypassed the existing checking parameters.
1. Fog Contact assembly
2. Fog contact assembly with lever
3. Soldering of wire with base cap
4. Wire insertion in lever
5. Manual assembly of ratchet with case assembly after greasing
6. Holder assembly
7. Lower case assembly
8. Wire terminal assembly
9. Coupler fitting
10. Wire terminal mouth checking
11. Sound test and final inspection
12. Dispatch to HSCI

We will now draw a Cause and Effect Diagram to find out the causes of Noise in switch-

From the cause and effect diagram we have found that the problem of Noise in Switch is due to the following reason-
1. Ratchet was rubbing during the movement
2. Grease not done in the moving slot of ratchet
3. Operator did the greasing on wrong position
4. Process sequence was difficult to adhere for operator hence possibility of grease missing or miss positioning of greasing.

7.2) Developing solution for problem –
From the cause and effect diagram we found that the problem mainly arises due to the following reasons-
1. Ratchet was rubbing during the movement
2. Grease not done in the moving slot of ratchet
3. Operator did the greasing on wrong position
4. Process sequence was difficult to adhere for operator hence possibility of grease missing or miss positioning of greasing.

7.2.1) Developing solution of the problem
To remove the problem of Noise in switch we have to find the solutions of the above reasons.
After thorough analysis we developed the two solutions for removing these problems. These are –
1. Improvement in the greasing process.(Refer App. 1)
2. OGS (Operator Guidance Sheet) and PQCS (Process quality control Sheet) updated for the changed process. (Refer App. 2,3,4).
3. Check points have to be added at 200% inspection stage to check the ratchet sound.

7.3) Making recommendations for the removing the problem of Noise in the Switch –
From our research we found that the following problem is associated with combination lever switch-
“Noise in the switch when indicator On”.

Recommendations for removing Noise problem from Switch -
By using the CI techniques we recommend the following solutions for this problem-
1. Improvement is required in greasing process.
2. (Appendix 1)
3. OGS and PQCS must have to be updated for the changed process.(Appendix 2,3,4)
4. Check points have to be added at 200% inspection stage to check the ratchet sound.

VIII. CONCLUSION
The causes of these problems has been determined-
1. Ratchet was rubbing during the movement
2. Grease not done in the moving slot of ratchet
3. Operator did the greasing on wrong position
4. Process sequence was difficult to adhere for operator hence possibility of grease missing or miss positioning of greasing.

Recommendations Related to this Study
1. Improvement is required in the greasing process.
2. OGS and PQCS must have to be updated for the changed process.
3. Check points have to be added at 200% inspection stage to check the ratchet sound.
By using the Above Recommendations we can definitely improve the productivity of the Lever Combination Switch upto a certain degree which is the required target of our research work.

Recommendations for Further Study
This study provided the procedures and solutions based on CI to solve only single problem. In addition, this study can be applied to other assembly lines, which are facing similar kind of problems, for minimizing the rejection of some particular product.

REFERENCES
3. www.mindagroup.com/mindarika.htm

Dr. Anil Kumar is presently pursuing his PhD from CMJ University, Shillong. He has just submitted his PhD and simultaneously Working as HOD Mechanical Engineering in One of the most reputed organization of North India. He has published more than 3 International Research papers.

Mr. Sanjay Kumar Bagri is presently pursuing his M.Tech in Manufacturing Technology & Automation from MDU, Rohtak, Haryana. He also has a vast experience in the field of teaching.

Appendix 1
Improvement in greasing process

Appendix 2
OPERATOR GUIDENCE SHEET
Before Implementation of Solution

Appendix 3
OPERATOR GUIDENCE SHEET
After Implementation of Solution
Appendix 4
PROCESS QUALITY CONTROL TABLE

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Value</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Step 1</td>
<td>Ref.1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Step 2</td>
<td>Ref.2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Step 3</td>
<td>Ref.3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Step 4</td>
<td>Ref.4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Step 5</td>
<td>Ref.5</td>
<td></td>
</tr>
</tbody>
</table>

Diagram: [Diagram Image]