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Application of Pareto Analysis for Reducing Visual Defects in Condom Manufacturing

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Abstract: ***In condom manufacturing visual defects are the major problems, which reduce profit of the firm. In manufacturing quality improves reliability and productivity. This research work investigates the major visual defects and its root causes with the help of Pareto analysis and methods to solve visual defects in the firm.This is applied on condom manufacturing , to identify and list problems and their causes. It is used to eliminate main statical errors in the industry. Pareto analysis is the better method for identifying and prioritizing the major defects .A Pareto chart, where individual values are denoted in descending order by bars. The vertical axis is the frequency of occurrence, and right vertical axis is the cumulative percentage of the total number of occurrences.***

Keywords: TER= Thickened edge roll

1. Introduction

Pareto Analysis is a technique for prioritizing problem-solving work. It's based on the Pareto Principle (also known as the 80/20 Rule), the idea that by doing 20% of the work you can generate 80% of the benefit of doing the whole job. Or in terms of quality improvement, a majority of problems (80%) are produced by key causes (20%)

Pareto Analysis is a statistical technique in decision making that is used for the selection of limited number of tasks that produce significant overall effect. There are seven quality control tools and pareto chart is one of the seven tools. The independent variables are shown on the horizontal axis and the dependent variables are described as the heights of bars. A point-to-point graph which shows the cumulative relative frequency and may be superimposed on the bar graph.

Main objectives of pareto charts are:

Separate the major problems from the many possible problems.

Arrange data according to priority andor importance.

Determine which problems are most important using data but, not perceptions.

This project is applied condom manufacturing to identify and list problems and their causes. Then score each problem and group them together according to their cause. It is used to eliminate main errors in the industry. Food and Drug Administration (FDA) and World Health Organization (WHO) regulate condoms to ensure their safety and effectiveness. So consistent high quality can be achieved through strict adherence to Good Manufacturing Practices and the persistent, conscientious efforts of all employees. Manufacturing process includescollecting the raw materials, compounding, storage, dipping, vulcanization, testing, and packaging. Every latex condom is tested for defects after its production by electronic testing. If the condom passes the test, it is rolled and packaged. In addition, a portion (sample) of each batch of condoms is subjected to number of inspections including water leak testing and air burst testing.

Rejection rate for six months are collected from the company records and analyzed. If it is found that rejected numbers of lots of condoms are high after the quality checking, and process improvement has to be done to reduce problems of condom manufacturing.

Pareto diagrams are used to: Analyze a problem from a new perspective – Pareto chart gives a simple and more structured perspective in problem solving. This is very useful and holds true in most of the scenarios and industries. Focus attention on problems in priority order – Whenever we encounter any problem or analyze defects, it is always advised to focus on problems which are vital and more critical. Pareto chart helps us in doing just that, prioritizing problems or defects to be addressed.

Compare data changes during different time periods – Pareto charts are used to compare similar data of different time periods to check if there is any change in top defects or defect reasons. At times, top reasons change or their impact changes.

Provide a basis for the construction of a cumulative line – The basic principle of Pareto chart is to show the cumulative impact of different parameters, defects etc. While individual impact may show less but when we combine and show the cumulative impact of top causes/defects, we can see the much bigger combined impact.

2. Methodology

Initial step in the pareto analysis is the data collection. Most of the time, Pareto analysis is used to determine which issues cause the most problems (or which causes lead to the greatest positive outcomes.

Step1
Identify the major defects in the firm.

Step 2
Choose a timeframe for collecting the data.

Step 3
Calculate the defect percentage.

Step 4
Now calculate cumulative frequency for each defects

Step5
List the visual defects in the decreasing order according to visual defect percentage

Step 6
Now draw pareto chart for all defects

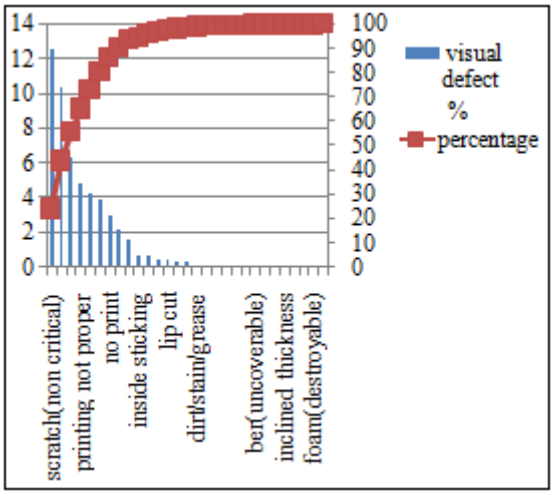
Step 7
From pareto chart 80-20 principle is applied and major visual defects are sorted

Step 8
Now cause effect diagram is drawn and identify the root causes andSuitable recommendary actions are suggested

3. Calculations

S.No	Visual Defects	Visual Defect %	Cumulative %	Percentage
1	Scratch(Non Critical)	12.598	12.598	23.97
2	Ter	10.43	23.028	43.82
3	Ber (Coverable)	6.33	29.358	55.86
4	Printing Not Proper	4.83	34.188	65.05
5	Visible Hole (Destroyable)	4.263	38.451	73.17
6	Folding	3.94	42.391	80.66
7	No Print	2.965	45.356	86.31
8	Broken	2.23	47.586	90.55
9	Wrinkle	1.573	49.1653	93.55
10	Inside Sticking	0.63	49.7953	94.75
11	Foam Salvageable	0.63	50.4253	95.95
12	Oil	0.4765	50.9018	96.86
13	Lip Cut	0.43	51.3318	97.68
14	Discolourisation	0.311	51.6428	98.27
15	Dter	0.272	51.9148	98.79
16	Dirt/Stain/Grease	0.1064	52.0212	98.99
17	Non Uniform Edge Roll	0.1027	52.1239	99.189
18	Latex Deposit	0.0767	52.2006	99.33
19	Vulcanization Not Proper	0.073	52.2736	99.17
20	Scratch (Destroyable)	0.063	52.3366	99.59
21	Dust	0.0618	52.3984	99.71
22	Ber(Uncoverable)	0.047	52.4454	99.8
23	Nipple Weak	0.044	52.4894	99.88
24	Ink Spread	0.0259	52.5153	99.93
25	Inclined Thickeness	0.00742	52.52272	99.94
26	Nipple Cream	0.00742	52.53014	99.96
27	Bump	0.00618	52.53632	99.973
28	Foam (Destroyable)	0.00247	52.53879	99.978
29	Water Dripping	0.00247	52.55	100

4. Pareto analysis for Visual Defects



After pareto analysis, We can observe

- Scratch is the most common visual defect with 12.59%.
- Thickened edge roll is the most common second defect with10.43%
- Six top defect positions are the initial few where 80% of total defect occurs.

5. Findings and Recommendation

While conducting third dipping process some problems are faced due to lack of space, an effective way of sudden heating and cooling system in order to dry the latex is not available. Overheating causes hanging of latex drops at the tip of condoms and heated mould may damage latex. Latex consumption increases with dipping process. Non-hygienic environment makes more uncontrollable visual defects and fumes of ammonia can damage the drying system. Infrared heaters can be selected for space heating.. Centrifugal blowers can be used to remove moisture from the product.

In the plant uses simple ovens so defects produced are high so by using infrared heaters defects can be reduced.Weight checking of condoms must be done in every two hours to avoid further problems with packing and testing departments. Protective cabin must be made to avoid direct contact with the air. Controlled heating can be done after the installation of infrared heaters in limited area.Ease of maintenance and less energy consumption can save loss of money and time. Infrared heater helps to eliminate visual defects efficiently and thereby decreases the rate of rejection. Infrared heater is selected because heat must be concentrated at the tip of the condoms and heating time must be matched with the mould speed, i.e. faster heating. Two different types of IR heaters can be used for these applications, i.e., medium-wave gas-fired IR heaters and short-wave electric IR heaters. An infrared heater is a device which transfers energy to a body with a lower temperature through electromagnetic radiation. According to Wien‟s displacement law [µm=C/T], the equation will calculate the most energetic or peak operating wavelength of the radiant source when operated at a specific temperature. According to Stefan-Boltzmann law [W=Eσ (Ts4-Tt4)], the equation shows how small changes in source temperature relate to much larger increase in energy transferred. The application of this law reveals that a practical limit is quickly reached with respect to industrial heating applications.

Infrared heat source provides uniform heat over a large area. Operating life over 5,000 hours minimizes machine downtime .Resistant to thermal shock, heaters are not damaged if it is hit by water spray.

6. Conclusion

This project is applied on condom manufacturing, to identify and list problems and their causes. Then find each problem and group them according to their cause. It is used to eliminate main statically errors in the industry. If the condom passes the test, it is rolled and packaged. In addition, a portion (sample) of each batch of condoms is subjected to number of inspections including water leak testing and air burst testing. This project is conducted on HLL one of the leading contraceptive manufacturing industry in the world. Rejection rate for one six months are collected from the company records and analyzed. If It is found that rejected numbers of lot are high after the quality checking, and process improvement has to be done to reduce problems of contraceptives.Pareto chart in previous chapter reveals 80% of problems are caused by 20% of visual defects. They are Scratch (Non critical), TER, BER (Coverable), Printing not proper, Visible hole (Destroyable), Folding, No print, Broken, Wrinkle.30% visual defects are main obstruction for achieving desired profit level. By reducing these defects; we can reduce the rejection rate of condoms in ETD. By using the above recommendations we can eliminate a limit of 80% of problems caused by 20% visual defects.Root cause analysis was conducted for the major defects showing critical nature. Root causes of visual defects were identified using cause effect diagram.Use of infrared heaters are suggested to reduce visual defects and rejection rates are reduced.

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