

CHAPTER 5

PARETO ANALYSIS

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1. INTRODUCTION

Pareto analysis is a statistical technique that is used in decision making for the selection of the limited number of tasks that produce the most significant overall effect. It uses the concept based on identifying the top 20% of causes that need to be addressed in order to resolve 80% of the problems.

2. CONCEPT ORIGINS

The concept originated with Vilfredo Pareto (1848 - 1923), economist and sociologist, who made the observation that a large proportion of national wealth tended to be under the control of a relatively small number of individuals. Having made this observation it enabled him to formulate the following rule – *‘in any series of elements to be controlled, a selected small factor in terms of the number of elements almost always accounts for a large factor in terms of effort’*.

3. APPLICATION

3.1 Examples of the use of Pareto concept are as follows:

Manufacturing

The concept was first used on the factory floor by Joseph M. Juran (24th December 1904 – 28th February 2008) who said it was a methodology that could be used for separating the vital few problems from the trivial many problems and hence by the identification and the ordering according to their importance, it could show where to focus scarce manufacturing problem solving resources.

Reliability

Elsewhere it was found it could be used for the identification of areas where; the greatest reliability improvements can be employed or where the time between failures or the repair times are excessive.

Root Cause Investigation

By using a reiterative multilayered approach, the Pareto concept can assist in root cause investigations by helping to identify the principal causes of the principal failures.

Risk Analysis

In risk analysis it is used to identify the principal risks that have the most impact on a project.

Quality

The analyse and prioritisation of quality defects frequently uses the Pareto concept in situations where a few operations frequently account for the bulk of the quality defects.

Cost Analysis

Pareto Analysis in cost analysis is used for the identification of the critical warranty repairs of a product and the items they are attributable to.

Supply Chain Management

In supply chain management the top percentage of the items inventoried represents the bulk of the total cost or the majority of the usage.

Setting Work Priorities

In setting work priorities when the Pareto distribution is used to list work tasks in order of money lost (including the risk for money lost) it becomes a priority list for attacking business problems that have the greatest impact on the enterprise.

3.2 Pareto Analysis can be further enhanced by combining with other analytical tools such as Failure Mode and Effects Analysis (PtCCh33) and Fault Tree Analysis (PtCCh29), Fishbone diagrams (PtCCh53), Scatter Diagram, Run Charts and Flow Charts in order to correctly identify critical areas.

4. DRAWBACKS

Although Pareto analysis is a creative way of looking at the causes of problems; it can be limited by; the exclusion of possibly important problems which may be small initially, but which grow with time. It can also be limited by a lack of understanding of how it should be best applied to particular problems or by the choice of the wrong category of the data.

5. METHODOLOGY

5.1 The method of carrying out a Pareto Analysis is normally by the construction of a Pareto diagram. This is a diagram similar to a histogram or bar chart, except that the bars are arranged in decreasing order from left to right along the abscissa.

5.2 The steps necessary to construct a Pareto diagram are as follows:

- a) Define the purpose of using the diagram and the type of category to use.
- b) Identify the most appropriate measurement parameter.
- c) If necessary group categories into a workable amounts. A further breakdown of each category can be carried out at a later stage.
- d) List each category with its associated data count.
- e) Sort the categories in descending order placing the one with the largest count first.

- f) Label the left-hand vertical axis. Make sure the labels are spaced in equal intervals from 0 to a round number equal to or just larger than the cumulative total of all counts.
- g) Label the horizontal axis. Make the widths of all of the bars the same and label the categories from largest to smallest.
- h) Plot a bar for each category.
- i) Plot the cumulative counts.
- j) Draw a line at 80% of the cumulative value onto the x-axis. This point on the x-axis separates the important causes on the left and less important causes on the right.

6. EXAMPLE

6.1 In order to illustrate the operation of the Pareto diagram, the following example of a support officer who has to analyse and solve various product defects. In this case, the support officer considered 845 defects, which are group into the following categories.

Serial	Defect Category	Total	Cumulated Number of Defects
1	Fuel System	320	320
2	Suspension	210	530
3	Tyres	92	622
4	Driver Error	75	697
5	Engine	60	757
6	Air System	53	810
7	Software	18	828
8	Hydraulics	13	841
9	Others	4	845

Table 1 – Summary of Defects

6.2 Using a BAR chart to plot failure category against Total and Cumulative Number of Defects and mark on it the vertical line showing 80% (676 defects) of the cumulative total, the categories to the left of it indicating those categories responsible for 80% of the failures.

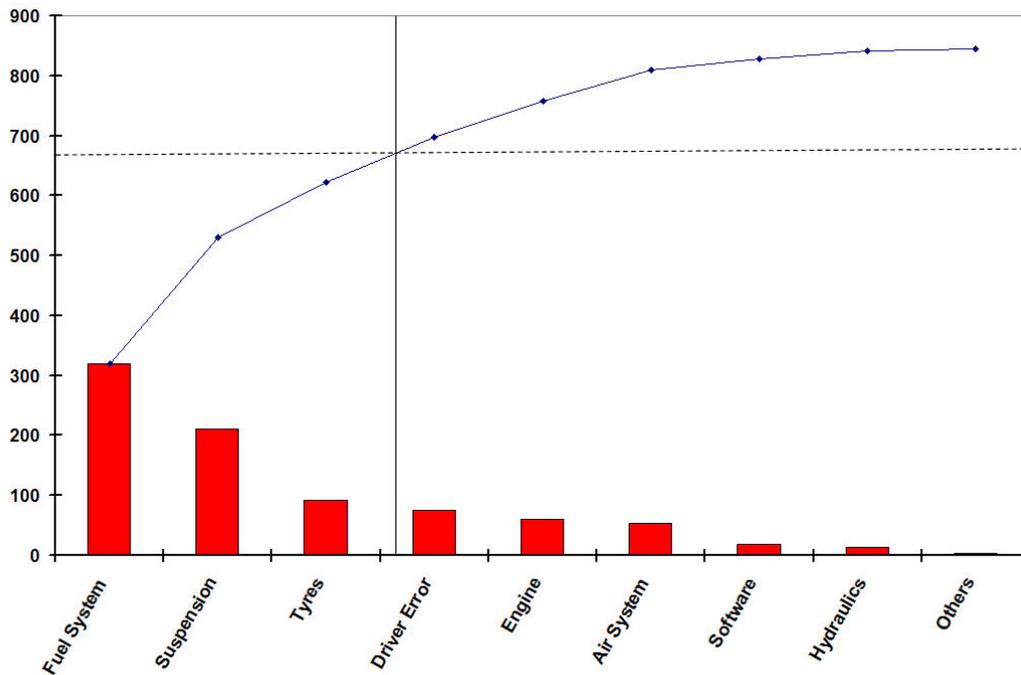


Figure 1 – Pareto Distribution

7. FURTHER CONSIDERATIONS

7.1 The numbers don't have to be 20% and 80% exactly – the purpose is to identify the categories accounting for the majority of the results, then tools like the Ishikawa diagram or Fishbone Analysis can be used to identify the root causes of the problems.

7.2 If there are any categories marked 'other' in the list of possible causes, make sure that this category does not become too large. If the 'other' category accounts for more than 25% it should be broken down.

7.3 Regular reviews of the Pareto distribution are important in order to keep account of who has solved what problems and to define what new failures have come over the horizon that require immediate attention.

