

Pareto Analysis:
When Quality-Control Demands Decisions

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What is Pareto Analysis?

Since quality is an important factor in the successfulness and longevity of any business (especially where repeat consumption is part of the business model), it would be beneficial to the business to have tools by which quality could be measured. Many of these tools already exist and are called “quality-control” tools. Pareto Analysis, which will be discussed in this paper, is one such tool. It can be described as the 80/20 rule applied to quality-control. The 80/20 rule was originally formalized by Vilfredo Pareto, after studying the distribution of wealth. He noticed that about 80% of wealth was held by about 20% of the population. Several years later, Joseph Juran applied the principle to quality-control, and Pareto Analysis was born. Pareto Analysis essentially states that 80% of quality problems in the end product or service are caused by 20% of the problems in the production or service processes. In practice, then, it is beneficial to separate “the vital few” problems from “the trivial many,” and thereby identify the individual problems that can be fixed and most drastically benefit the end product or service. Once these problems are identified, the 20% that are causing 80% of the problems can be addressed and remedied, thus efficiently obtaining quality.

Practical Pareto: How to Use It

In conducting a Pareto Analysis, the first phase is concerned with identifying possible causes of inferior quality. This can be done through brainstorming, focus groups, surveys, or any other method appropriate to the given business. The goal is to obtain actionable items that result in inferior quality. For example, if I manufacture glass windows, and some of them must be returned due to glass chips and cracks, I may identify the following four possible causes of the glass inconsistencies (inferior quality):

poor production process, mishandling at the factory, faulty packaging, and problems in transit. Each of these items can be acted upon, and in our situation, we will assume they are truly possible causes of inferior quality. Once the actionable items are identified, we can move on to phase two.

The second phase is comprised of picking an appropriate time period over which we would like to conduct our analysis and then conducting the assessment. The goal here is to obtain a statistical sampling that is representative of the time period over which we are trying to improve quality. Some quality-control measures may be intentionally applied to seasonal, biannual, or some other specified time period, depending on the business. Some businesses may care about the quality and increased investment of obtaining that quality at certain times of the year, but not at others. The objective is to make sure that the measured time period accurately represents the time period over which the quality-control measures will be enacted. Once the time period is chosen, the quality problems are tallied under the causes of inferior quality that were identified in the first phase. In our example, each time we received a return for the reason of 'faulty packaging,' we would add one to the tally for that cause. Each time we incurred an inconsistency for the reason of 'mishandling at the factory,' we would add one to the tally for that cause. This process would continue until our predefined time period had elapsed, after which we would subtotal the results and move on to the third phase.

Phase three is summarizing and graphing the results obtained in the previous phases. After subtotalling the numbers for each of the causes of inferior quality, those numbers are summed to obtain the total number of defects. Then, in order to acquire the percentage of each cause in relation to the total number of defects, each subtotaled

number is divided by the total number of defects and multiplied by 100. After these percentages are obtained, they can be graphed in a histogram, with the causes of poor quality listed on the x-axis, and the percentages of their occurrence listed on the y-axis. The causes are listed from left to right, with the most often occurring cause listed on the furthest left, the next most often occurring cause listed next to it, and so on. Finally, in order to make the histogram more easily interpretable (which will be discussed in the next paragraph), a cumulative line graph can be placed over the existing bars. This histogram is called a Pareto Chart. Now we are ready for phase four.

The fourth and final phase is concerned with interpreting and applying the graphed results. The overlaid line graph helps us in this process, as it shows the percentage of the total defects that we dispose of as we perform the actionable items, from left to right. This is where the 80/20 rule comes into play, as you will most often notice that about 80% of the defective products are caused by about 20% of the possible defect causes. When actually implementing solutions, however, it is recommended that after the leftmost quality problem is dealt with, that another Pareto Analysis is conducted before moving on to the other identified quality problems. The reason for this is that the percentages for each of the remaining quality problems may shift disproportionately as the production or service process is changed in implementing the quality-control measures on the initial quality problem. This caution may not always be necessary, but should be realized by the person conducting the analysis.

Pareto Paradigm: An Example of Using It

In order to ensure understanding of Pareto Analysis, this section will take the example already discussed, apply some fictional data, and then walk through the process.

Since we have already identified the potential causes of quality problems, we go to phase two and tally how many times each occurs. The tallies for this fictional example can be seen in Part A of Appendix 1. Phase three compares the subtotaled categories to the total number of defects and then calculates a percentage, which can also be seen in Part A of Appendix 1. The second part to phase three, which can be seen in Appendix 1, Part B, is graphing the results in a histogram. The graph included does not display the overlaid line graph, but displays the percentage totals on each of the bars, indicating the lack of necessity for such a line. So, after analysis of Appendix 1, we would choose to analyze and perfect our packaging, since doing so has the potential of eliminating 66% of our faulty product. We may also take a look at our transit method and try to find ways to perfect it. We may, however, want to conduct another Pareto Analysis after resolving the packaging problem, to make sure that the causes of faulty product are distributed the same way that they were when we conducted this analysis

Perfected Pareto: Where to Discover More About It

This paper gives a short, practical, and applied approach to Pareto Analysis. Pareto Analysis can be used on a more complex scale, including the incorporation of defect weights based on time, cost, and difficulty of implementation. It also makes some assumptions that may not be in line with highly volatile companies. In order to find out more information concerning these and other issues, check out the bibliography to this paper, Joseph Juran's book, entitled, Juran's Quality Handbook, McGraw-Hill Professional, 1998, and Managing Quality: An Integrative Approach by S. Thomas Foster, Prentice Hall, 2000.

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Appendix 1

Part A

<u>Potential Cause</u>	<u># Defects</u>	<u>Percent</u>
Poor Production Process	7	6%
Factory Mishandling	12	10%
Faulty Packaging	80	66%
Problems in Transit	22	18%
	121	100%

Part B

