# Pareto Diagrams

What is the reason for the most rework in your organization? What about the most scrap? Which customers complain the most? What is the major reason they complain? What is the major issue with getting the books closed at the end of month? These types of questions are common in organizations. But sometimes we don't all agree on the answer. This is where a Pareto diagram comes in very handy.

A Pareto diagram is a data-based approach to determine what the major problem or cause is. All companies have lots and lots of problems on which to work. There is not enough time in our day to work on everything. The Pareto diagram gives us a way to determine which problem to work on first – where we will get the most return for our investment. And the Pareto diagram is also a great communication technique as we shall see.

## Purpose

The purpose of this module is to introduce the Pareto diagram-what it is, when to use it and how to construct a Pareto diagram. Vilfredo Pareto, an Italian economist, developed the Pareto diagram in the late 1800s. He discovered that 80% of Italy's wealth was held by 20% of the people. This has become known as the 80/20 rule or the Pareto principle. It is at the heart of the Pareto diagram. The 80/20 rule applies in many places – 20% of our customers are responsible for 80% of the customer complaints; 20% of the workforce account for 80% of employee issues. The Pareto diagram is one method of separating that 20% - the ***vital few*** – from the 80% - the ***trivial many***. This allows us to focus our time, energy, and resources where we will get the most return for our investment.

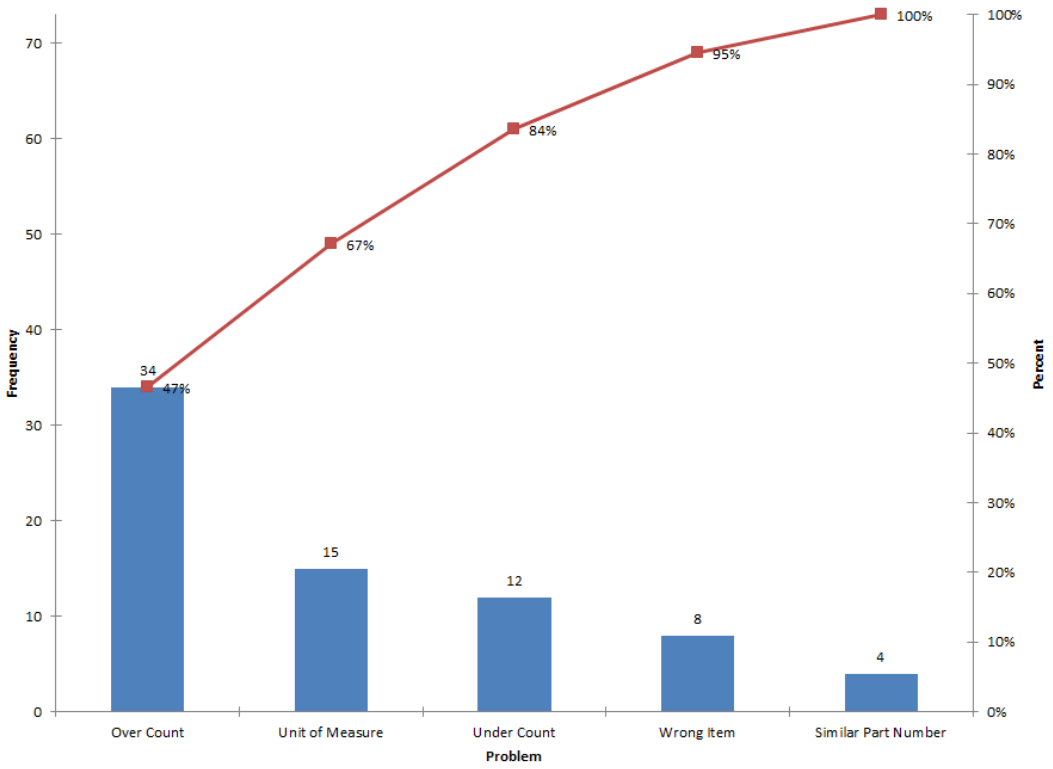
## Understanding the Pareto Diagram

A Pareto diagram is a special type of bar chart. It can be used in many situations. For example, it can be used to determine which causes of a problem occur most frequently Figure 1 below is an example of a Pareto diagram on reasons for picking errors by pickers in a warehouse. The reasons for picking errors are placed on the x (horizontal) axis. These reasons include over count (picked more items than on the order), under count (picked fewer items than on the order), unit of measure problem, similar part number, and wrong item. The frequency is plotted on the y (vertical) axis. This frequency is how often each reason for a picking error occurred. The reasons on the x-axis are listed from the one that occurred most frequently (over count) to the one that occurred least frequently (similar part number)

It is easy to see from the Pareto diagram which reason occurs most frequently – it is over count. It is difficult for anyone to disagree with this since the Pareto diagram uses data. The Pareto diagram helps get consensus on the major issue.

The line on the Pareto diagram is called the cumulative percentage line. It gives the cumulative percent for the reasons starting with the first reason and going through all the reasons. For example, over count was responsible for 47% of the total picking errors. Over count and unit of measure, the next most frequent reason, accounted for 67% of the picking errors. Of course, the last entry on the cumulative percentage line is 100%.

**Figure 1: Picking Errors**




The cumulative line gives you an idea of how much improvement there could be if a reason was eliminated, e.g., 47% of the picking errors could be eliminated if we could figure out how to eliminate over counts.

Pareto diagrams can also be used to show improvements. If we worked on reducing picking errors due to over counts, what would happen to the over count "bar" on the Pareto diagram in Figure 1? It should be lower and move to the right. Figure 2 shows the Pareto diagram after working on reducing picking errors due to over counts. You can see that the over count "bar" has moved to the right. It is the second smallest bar instead of the largest. So, a Pareto diagram can be used to show the gains made through process improvements.

The vertical axis metric is usually frequency – how often a reason occurs. But it does not have to be. There are other options to consider and sometimes it depends on what the Pareto diagram is being used for. For example, consider Figure 3 below. This is a Pareto diagram on injuries in a manufacturing plant. The vertical axis is frequency – how often an injury occurred to a part of the body. Are there other ways to look at these data? The greatest frequency occurred with injuries to the hands and arms. This is not surprising in a manufacturing plant – cuts or bruises to the arms and hands are not that uncommon – particularly in the maintenance department. But they are not too serious most of the time. On the other hand, injuries to the head, eyes or chest can be very serious. You may want to examine the data in terms of seriousness of injury – working on injuries to arms and hands may not be as important as injuries to the head, eyes or chest even those occur less frequently. You may consider examining the data in terms of lost time or medical costs. The point is that you do not have to use "frequency" all the time as the vertical axis metric. There are times where it is appropriate to use other metrics, such as cost. Management often likes to see data in terms of cost.

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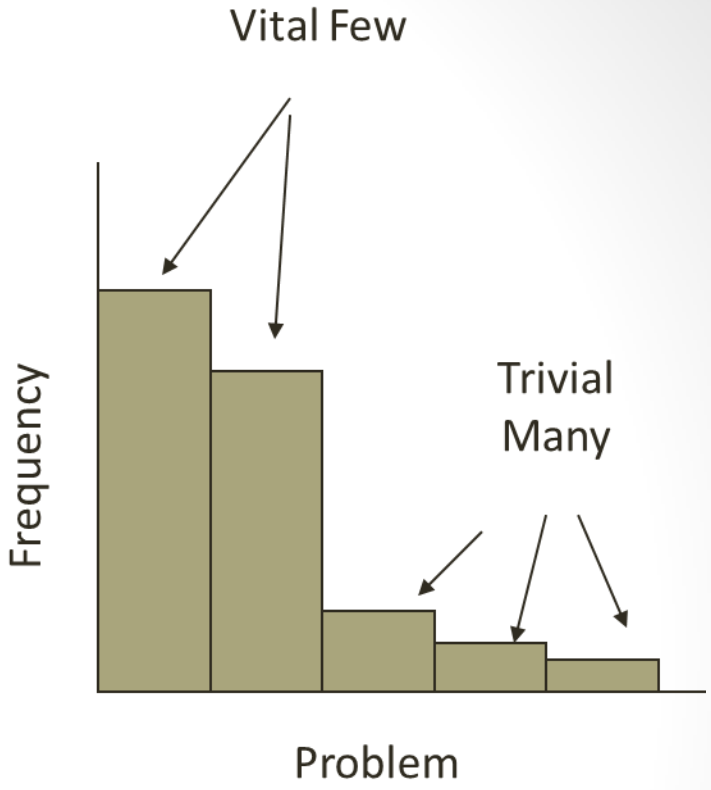


A rule should suit the purpose.

-Dr. W. Edwards Deming

# Introduction

- Reasons for problems?
- Causes of a problem?
- How to agree?
- Pareto diagram
  - Data-based
  - What to work on first
  - Most return
  - Great communication technique

Rework?

Scrap?

Complaints?

Days to close?