Product and Quality

Seminar: Quality Instruments and tools
Pareto analysis

What is a Pareto Chart?

A Pareto Chart is "a series of bars whose heights reflect the frequency or impact of problems. The bars are arranged in descending order of height from left to right. This means the categories represented by the tall bars on the left are relatively more significant than those on the right". The chart gets its name from the Pareto Principle, which postulates that 80 percent of the trouble comes from 20 percent of the problems.

- Bar chart arranged in descending order of height from left to right
- Bars on left relatively more important than those on right
- Separates the "vital few" from the "trivial many" (Pareto Principle)

Why should teams use Pareto Charts?

You can think of the benefits of using Pareto Charts in economic terms. "A Pareto Chart breaks a big problem into smaller pieces (and) identifies the biggest contributors. It can help us get the most improvement with the resources available by showing where to focus efforts in order to maximize achievements. The Pareto Principle states that a small number of causes accounts for most of the problems. Focusing efforts on the 'vital few' causes is usually a better use of valuable resources". Summarizing the Benefits Pareto analysis:

- Breaks big problem into smaller pieces
- Identifies most significant factors
- Shows where to focus efforts
- Allows better use of limited resources

When should we use a Pareto Chart?

A Pareto Chart is a good tool to use when the process you are investigating produces data that are broken down into categories and you can count the number of times each category occurs.

No matter where you are in your process improvement efforts, Pareto Charts can be helpful, ". . . early on to identify which problem should be studied, later to narrow down which causes of the problem to address first. Since they draw everyone's attention to the 'vital few' important factors where the payback is likely to be greatest, (they) can be used to build consensus. In general, teams should focus their attention first on the biggest problems—those with the highest bars".

Making *problem-solving* decisions isn't the only use of the Pareto Principle. Since Pareto Charts convey information in a way that enables you to see clearly the choices that should be made, they can be used to *set priorities* for many practical applications in your command. Some examples are:

- Process improvement efforts for increased unit readiness
- Skills you want your division to have
- Customer needs
- Suppliers
- Investment opportunities

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How is a Pareto Chart constructed?

To construct a Pareto Chart, you need to start with *meaningful* data which you have collected and categorized. You may want to turn to the Data Collection module at this point to review the process of collecting and categorizing data that you can chart.

- **Step 1 Record the raw data.** List each category and its associated data count.
- **Step 2 Order the data.** Prepare an analysis sheet, putting the categories in order and placing the one with the largest count first.
- **Step 3 - 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 total of all counts. Provide a caption to describe the unit of measurement being used.
- **Step 4 Label the horizontal axis.** Make the widths of all of the bars the same and label the categories from largest to smallest. An "other" category can be used last to capture several smaller sets of data. Provide a caption to describe them. If the contributor names are long, label the axis A, B, C and provide a key.
- **Step 5 - Plot a bar for each category.** The height of each bar should equal the count for that category. The widths of the bars should be identical.
- **Step 6 - Find the cumulative counts.** Each category's cumulative count is the count for that category added to the counts for all larger categories.
- **Step 7 - Add a cumulative line.** This is optional. Label the right axis from 0 to 100%, and line up the 100% with the grand total on the left axis. For each category, put a dot as high as the cumulative total and in line with the right edge of that category's bar. Connect all the dots with straight lines.
- **Step 8 - Add title, legend, and date.**
- **Step 9 - Analyze the diagram.** Look for the **break point** on the cumulative percent graph. It can be identified by a marked change in the slope of the graph. This separates the significant few from the trivial many.

NOTE: The *significant "few-trivial many"* principle does not always hold. No matter how many data are categorized, they can be ranked and made into a Pareto diagram. But sometimes no single bar is dramatically different from the others, and the Pareto Chart looks flat or gently sloping. To attack the tall bar in that situation is no help. You need to look for another way to categorize the data.

EXAMPLE: *You recently inherited $10,000 and would like to apply it to some of your outstanding bills. Here is what you owe:*

- Home improvement loan balance $1,956
- Visa $2,007
- Mastercard $1,983
- Church building fund (monthly installments of $83.33) $2,000
- School tuition (monthly $169.17 for one year) $2,030
- Balance car loans $2,971

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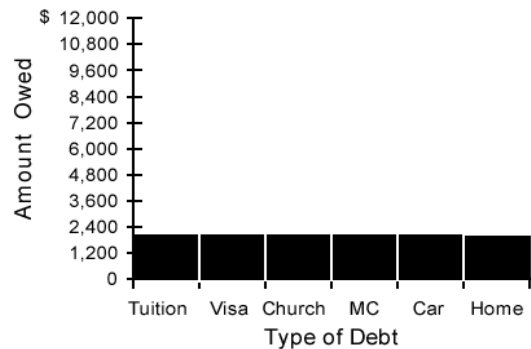
Analysis Sheet Example
Outstanding Debts

Category	Amount ($)
School tuition (monthly installments)	2,030
Visa	2,007
Church pledge (monthly installments)	2,000
Mastercard	1,983
Balance of car loan	1,971
Home improvement loan balance	1,956
Total	11,947

Pareto Chart Example
Outstanding Debts

LEGEND: AMOUNT OWED ON OUTSTANDING DEBTS AS OF 12 FEB 95.

You noticed that no single bar is dramatically different from the others. Looking at your outstanding debts in this way isn't much help. Is there a different way the data could be categorized to make it more meaningful? What if you were to consider the interest rates on your outstanding debts?
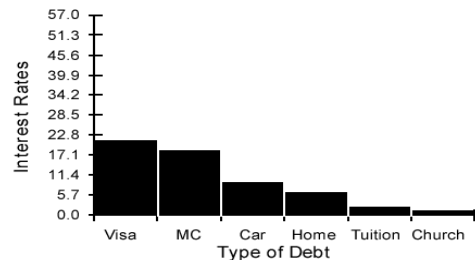
Analysis Sheet Example
Interest Rates on Outstanding Debts

Category	Int. Rate (%)
Visa	21
Mastercard	18
Balance of car loan	9
Home improvement loan balance	6
School tuition (monthly installments)	2
Church pledge (monthly installments)	1

Pareto Chart Example
Interest Rates on Outstanding Debts

LEGEND: INTEREST RATES CHARGED ON OUTSTANDING DEBTS AS OF 12 FEB 95.

How do we interpret a Pareto Chart?

When you look at a Pareto Chart, you can see **break points** in the heights of the bars which indicate the most important categories. This information is useful when you are establishing priorities.

As you can see in the example we've just looked at, you can detect two big breaks in the heights of the bars when you categorize the data in a different way:

- The first break point is between the second and third bars. The difference between these two bars is much more noticeable than the other differences. This shows the relative importance of the first two bars in relation to the others.

The other break point occurs after the fourth bar. Addressing the third and fourth bars will give a higher payoff than addressing the last two bars. You will have an opportunity to develop your interpretation skills when you do the practice exercises that follow.

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EXERCISE 1: You are part of a team responsible for the quality in a hotel. You want to improve the service you provide but are not sure where to begin or where to concentrate your efforts. You decide to keep track of the complaints received over a three-month period. Viewgraph records this data in numbers of complaints, hours spend for solution of this complaint and costs caused by complaint.

Rank order your data in an analysis sheet and draw a Pareto Chart. Now answer the following questions:

1. Does the Pareto Principle apply?

2. Where should you concentrate your efforts if you want save 80% of costs caused by complaints?

2. In addition to previous question how much time will you save if you eliminate complaints caused 80% of costs?

4. Which complaints are important if you want decrease loss from complaints by 80%?

4. Do your proposed efforts pass a sanity check? In other words, do the top problems really stand out as most important to you and your customers?

Complaint	Number of complaints	Hours of elimination (avg.)	Avg. costs elimination per 1com.
Loud stereo noise after 2300	97	0,2	3
Insufficient hot water	54	0,3	85
Towels too small and/or thin	32	1	12
Inadequate lighting	350	0,5	35
Poor quality TV reception	83	2	8
Worn-out furniture	15	0,3	135
Insufficient storage space	127	0,1	25
Cockroaches	962	2,5	10
Rooms too warm or too cold	505	0,4	28