Excel 2022 Pro

100+ PivotTables, Charts & Reports

Excel's charts, graphs, and reports are beneficial, so it's time to use them to your advantage. Learn how to execute the most innovative analysis on your preferred data using PivotTables, PivotCharts, What-if-Analysis, descriptive statistics, correlations, histograms, sparklines, animated charts, dashboards, trendlines, and more than 100 other charts and graphs.

The book includes the following:

- *Try and practice new Excel 2022 Charts and Reports in your Excel 2019, Excel 2021 and Office 365 editions.*
- *Learn with easy-to-read, step-by-step instructions and screenshots.*
- *Learn to illustrate your data in a way that is readily digestible at a glance.*
- *Figure out how to make beautiful infographics that reflect your company's personality or culture.*
- *Learn the ins and outs of making and editing expert PivotTables and PivotCharts.*
- *Master PivotTables and PivotCharts to construct dynamic dashboards.*
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- *Create Sensitivity-Analysis tables to check the quality of your decision-making tools.*
- *Create summaries, cross-tabs, filtering, and other visualizations.*
- *Conduct in-depth statistical analysis in Excel with minimal effort.*

This book's thorough instructions on Excel charts will improve readers' skills in making the most innovative and visually appealing reports. You will be able to make dynamic, eye-catching dashboards once you complete reading this book.

WHO THIS BOOK IS FOR

No matter what your professional or academic status is, if you often engage in data analysis, summary creation, and report writing, this book is for you. You'll be able to generate relatively strong reports and infographics from your data, thereby allowing you to make more well-informed decisions. There is no need for you to be an Excel expert to use this book.

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Excel 2022 Pro
100 + PivotTables, Charts & Reports
Dr. Isaac Gottlieb

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Explore Excel 2022 with Graphs, Animations, Sparklines, Goal Seek, Histograms, Correlations, Dashboards

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Dedicated to

My Grandchildren:

Jonah**, **Ruby**, and **Lev

whose curious minds constantly inspire me.

About the Author

For over 25 years, **Dr. Isaac Gottlieb** has taught Excel workshops for MBA students in several universities, including Columbia, NYU, Rutgers, and others in the US and other countries. In addition, he taught courses in Management Science and Statistics for Managers (always) using Excel. Over 100,000 students have attended his workshops and courses over the past 25 years.

He received the Microsoft Most Valuable Professional (MVP)– award for 2014-16. "A Microsoft Most Valuable Professional (MVP) is an award for individuals who have exhibited exceptional technical expertise and a talent for sharing knowledge within their technical community." (From Microsoft's site.)

Isaac Gottlieb has taught how to use Excel—and how to apply it effectively to various business disciplines—to thousands of corporate professionals from leading multinational companies and small private business corporations. Johnson & Johnson, Merck, Pfizer, Procter & Gamble, Caterpillar, Vornado, El-Al Airlines, Microsoft, Intel, Boeing, NCR, Chrysler, Sealed Air, JPMorgan, Morgan Stanley, 3M, H-P, and the New York City Economic Development Corporation.

He authors an Excel-Tip-Of-The-Month newsletter distributed to over 35,000 recipients. For an archive see **isaacgottlieb.com/excel-tips**

Dr. Gottlieb has earned his Ph.D. and two Masters' Degrees from Columbia University Department of Industrial Engineering and Operations Research. He has over 20 years of business and industry experience as a manufacturing company CEO and a senior consultant.

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He obtained several international certificates as a Microsoft Excel expert (MO201), Microsoft data analyst associate (DA100), and Microsoft certified trainer (MCT), which has had a substantial impact on his career path.

Acknowledgement

Special thanks to my friend Art Sagy for his continuous encouragement and support while I was writing this book. He acted as a sounding board while reading every chapter's draft and provided feedback as I wrote. Art's professional background and experience contributed to many of the topics in this book.

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Preface

Whether you work in a corporation or a government agency, if you are a student or an instructor – you probably use Microsoft Excel. Your job or classes could involve analyzing, summarizing data, and reporting your results. This book, Excel 100+ PivotTables, Charts & Reports, will help you transform and enrich your data into better reports and charts to enable you to make superior intelligent decisions.

The purpose of this book is to provide guidance and a helping hand in extracting insights from Excel sheets, running various analytical excel tools, creating beautiful Charts, and presenting the results to your team, employer, and clients in the form of a unique report. It will thoroughly cover PivotTables and Dashboards. Additionally, the book provides you with a set of Analytic Techniques for Intelligent Decision Making.

The book has **three** parts:

Part one, **Chapters 1-4**, covers Excel Charts comprehensively. When you complete this part, you will possess the knowledge and hands-on tools to create Excel charts to present data in a meaningful fashion. These chapters instruct you on preparing data for the charts, working around the axis, and personalizing the charts, among other things. You will be able to create all the Excel charts, modify them and express the chart in the best way to characterize you or your company.

The second part, **Chapters 5-13**, is about PivotTables and PivotCharts. Once you become proficient with these two topics, you will be able to demonstrate how several passing datasets via a single PivotTable, constructing charts based on PivotTables, and other techniques will help you learn how to manage your Excel sheet for advanced analysis. This part guides you through creating Dashboards and reports, using convincing charts, maps, graphs, and pivot tables into a meaningful storytelling report.

The last part of the book, **Chapters 14-15**, is about decision-making tools. The Data Analysis ToolPak of Excel is a statistical Excel Add-in which will quickly and easily analyze data - without using any Excel functions. The second tool, the What-if-analysis, is a set of decision-making tools. These tools enable the user to investigate the impact of input changes on outputs resulting in intelligent decisions.

Part I

Chapter 1 is about charts, the graphic presentation of numerical data visualization. Using a chart to represent data through visual representation frequently leads to a better understanding of the data and the information you want to convey to your audience. This chapter will familiarize the reader with most of the Excel charts' galleries. It introduces the charts used in Excel in industry, government, and research. The idea is for the reader to understand where, when, and how to use these Excel charts. Using your creativity and the know-how of the chart you will design is also an art.

Chapter 2 introduces Chart Terminology, Elements, and Styles. These concepts are used to modify charts after they were created or when you want to change the chart to meet your needs or audience expectations. You will be able to work, add, subtract, and position each Element using this Elements menu. You will also understand how the data feeds your chart should be structured. This familiarity is essential for creating an appropriate chart. When you complete this chapter - you will be comfortable creating and manipulating any of the Excel charts.

Chapter 3 enables you to take any chart and make it appear as "your" chart – the chart you are proud to present. This chapter demonstrates how to modify the charts in a variety of ways. You can swap the Rows with the Columns. You can delete or add data to existing charts. The chapter will cover different filtering, layouts, and formatting techniques. You will learn to add specific features to a chart, such as logos or pictures or presenting your company's identity. Once you create a chart that you would like to use again – you will be able to save the chart - as a Template for future use.

Chapter 4 covers unconventional charts and advanced charting techniques topics. The chapter commences with techniques used to animate charts. It continues with creating combination charts. Consequent parts describe alternatives to Excel charts, namely, Sparklines, Text charts, and Conditional Formatting charts. The last section is about constructing a curve and mathematical function that best fits the series of data points on a chart. The chapter will be using the Excel charts “Trendlines.” Examples include supply and demand curve functions and other business data sets. In addition to the mathematical function, the chart will show how to calculate the “Coefficient of Determination,” – which expresses the correlation between Trendline and data.

Part II

Chapter 5 an introduction to PivotTables. A PivotTable is a potent tool that you can use to "slice and dice" data. A PivotTable groups and calculates values and other non-numerical elements across rows, columns, and/or sheets. The grouped table, or the so-called PivotTable - draws the data from databases, spreadsheets, and other business intelligence programs. The table summarizes the data with one or more categories, displaying statistics such as sums, averages, counts, and more.

Chapter 6 describes the rules the PivotTables data sources need to follow for the PivotTable to work. It explains in detail how all the source data columns must have unique headers; the data source cannot have any totals, averages, subtotals, etc., as a part of the data. It also points out that using blank cells may result in calculation errors. Following all the rules of the chapter, you can create a great PivotTable successfully.

Chapter 7 is your hands-on manual for inserting, creating, customizing, and formatting PivotTables. The chapter explains the different table components and demonstrates how to drag the data fields to the four areas of the PivotTable. It also explained how to structure and modify the table to meet your requirements. Next, the chapter focuses on calculating the table's values. It describes using the built-in PivotTable functions, such as Sum, Average, Count, and more. The chapter shows the different ways to Refresh and update the PivotTable when the original database has changed. The final part of this chapter is about formatting. It examines the Layouts, Customizations, Styles, and color schemes of the PivotTable.

Chapter 8 proceeds with advanced PivotTable topics. It describes how to filter information contained in the tables - using both the fields in the Filter area and the filtering features of the lots listed in the Rows and Columns areas. The chapter continues by explaining how to group data, as well as grouping Row and Column elements. These grouping capabilities are instrumental in further analyzing the data to obtain a better picture of it - when the table is too large. The last part explains the different ways of sorting the PivotTable.

Chapter 9 explains how to perform calculations not part of the PivotTable standard calculations list. If the standard PivotTable calculation functions cannot do what you need or expect, you can create your formulas with Calculated Fields and Calculated Items. The PivotTable can include the supplementary Calculated Fields you create. In this chapter, we will explore the process of adding Calculated Items and Fields to PivotTables.

Chapter 10 covers PivotCharts. A PivotChart is like any chart created in Excel; the only difference is that these charts are made directly from the data. As in the original PivotTables, PivotCharts are dynamic, so you can change a PivotChart by updating the values in a PivotTable. This chapter explains all the techniques and features associated with PivotCharts.

Chapter 11 covers PivotTables-specific Filters, namely Slicers and Timelines. Slicers and Timelines are powerful and VISIBLE filtering tools for PivotTables. Slicers provide activation buttons that enable us to filter PivotTables. The Timeline is a kind of a Ruler created to display the sequence of date data in the PivotTable. This chapter aims to explain how to make Excel Slicers and Timelines and harness them for practical use. After completing this chapter, you can brilliantly utilize these tools to filter PivotTable data.

Chapter 12 is about Dashboards. The chapter demonstrates how to create several PivotTables and PivotCharts along with Slicers and Timelines to create Dashboard. You can produce several PivotTables and charts on separate sheets. Next, you will add them all to a single sheet combining them into a Dashboard. You will learn how to add, arrange and link Slicers and Timelines on the Dashboard to enable meaningful information formatting and manipulation of the data. You will learn the effect of using the Dashboard to demonstrate your data to your audience visually and dynamically.

Chapter 13 includes some real-life case studies and projects I was involved with over the years of using Excel, which were implemented. It reviews many of the techniques applied in this book so far on the topics of charts, PivotTables and PivotCharts. The objective of this chapter is to allow the readers to approach and solve their challenges and application needs– using what we have already covered. The chapter takes a few of this book's charts and PivotTables ideas and "dresses" them by applying them to cases. The chapter uses the Bar Chart to create a project management Gantt Chart. It shows how to add tiers on the X-Axis to create a multi-tier chart and utilize the PivotTable, PivotCharts, and Slicers to analyze an extensive database. The last part of the chapter demonstrates how to generate creative charts in a thermometer "style" and how to add images to chart labels.

Part III

Chapter 14 is about using the Excel Data Analysis ToolPak, an add-in that allows Excel users to solve statistical analysis problems WITHOUT the need for a solid statistical background. This tool solves finance, statistics, engineering, and more issues. The chapter will describe using three (3) features/tools. The first one is the "Descriptive Statistics" feature, which allows you to analyze data and get all "conventional" statistical summaries (sum, average, high, low, median, standard deviations, and a few more) with just a few clicks. The second feature is the "Histogram" tool that creates a frequency distribution and a frequency chart. The last tool described is the "Correlation," which generates all the various correlation coefficients between all the variables on a sheet.

Chapter 15 is about the What-if Analysis - a set of decision-making tools. These tools enable the user to investigate the impact of input changes on correlated outputs. This allows the decision-maker to make wiser choices for an optimal outcome. The two topics covered are the Goal Seek and the Data Table - Sensitivity Analysis. You will learn how to use these features for any of your models (budgets, forecasts, or other disciplines) – to understand the impact of changes on these models. These tools empower the users to evaluate and examine their decision models – potentially reaching better decisions. The chapter covers the Goal Seek and the Sensitivity Analysis tools.

Code Bundle and Coloured Images

Please follow the link to download the
Code Bundle and the ***Coloured Images*** of the book:

https://rebrand.ly/4ws4vfe

The code bundle for the book is also hosted on GitHub at **https://github.com/bpbpublications/Excel-2022-Pro-100-Plus-PivotTables-Charts-Reports**. In case there's an update to the code, it will be updated on the existing GitHub repository.

We have code bundles from our rich catalogue of books and videos available at **https://github.com/bpbpublications**. Check them out!

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Part - I

Chapter 1

Selecting Various Charts and Graphs

Introduction

A chart is a graphic presentation of numerical data visualization. Using a chart to represent data through visual representation frequently leads to a better understanding of the data and the information you want to convey to your audience. Excel has over 20 different chart categories. Almost every category has a few subcategories that belong to it. This chapter will review what the chart categories are and what they are used for. It will discuss the most frequently used charts, emphasizing creating the right chart for the right application.

This chapter will point out why specific charts are better than others. You will find that similar charts with different presentations could be better for your specific data and needs. You may find other charts in Excel; however, we focus on charts that are most frequently used in the industry.

Structure

The following chart categories and several subcategories are covered as follows:

- Column chart
- Line chart
- Pie chart

- Bar chart
- Area chart
- XY (Scatter) chart
- Bubble chart
- Waterfall chart
- Map chart
- Surface chart
- Combo chart
- Funnel chart

Objectives

This chapter aims to familiarize you with most of the Excel charts' galleries. The following figures contain the most frequent charts used in Excel that you should familiarize yourself with. Please take a look at the following screenshot:

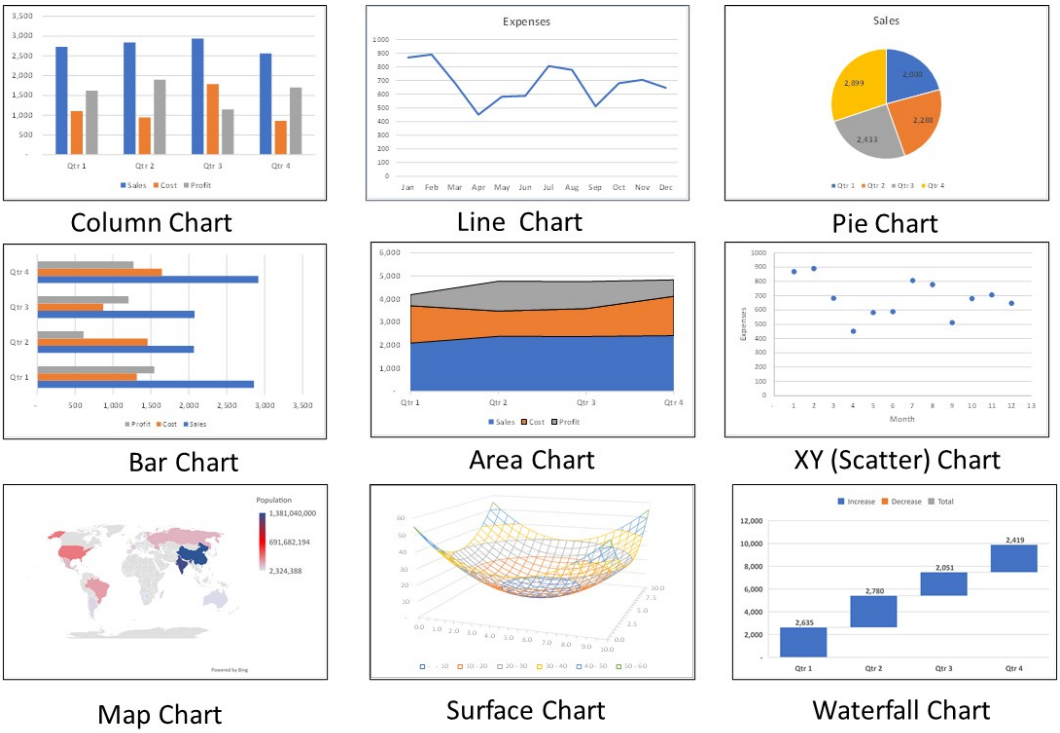

***Figure 1.1**: Most frequently used Excel charts*

Column chart

Column charts are typically used to display data changing over time or to illustrate the elements' comparisons. Text elements are displayed along the horizontal axis. The chart displays the vertical bars going across the chart horizontally.

Figure 1.2 displays single series and multiple series column charts examples.

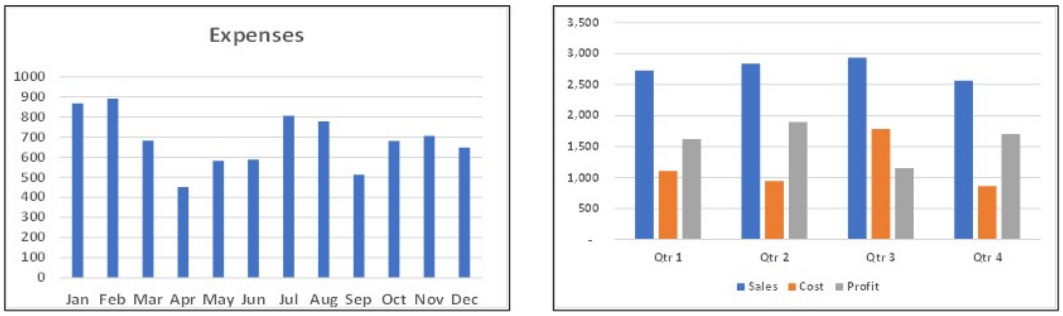

***Figure 1.2**: Single series and multiple series column charts*

You will find under the Column Charts category a couple of subcategories.

Stacked column charts

The stacked column charts can be used to compare categories as part of a whole. It is used for comparing sets or changes over time or changes across categories.

This example compares two sets of data using the chart. The data was sorted in descending order of the total population. In a few examples in this book, you will find that it is a good idea to sort chart data in descending order to better understand the data. Please refer to the following *Figure 1.3*:

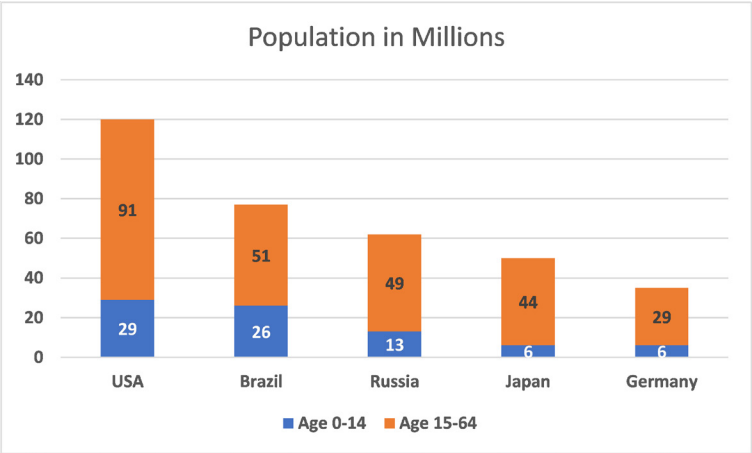

***Figure 1.3**: Stacked column chart - population in millions age 0-14 & 15-64*

Percentage column charts

This time, the percentage represents parts of the whole. These charts are used for populations or budgets, comparing different categories. The same populations are shown from a different perspective. Percentage column charts effectively compare each item's value-based contribution to a total (sum) across categories. Values on the Y axis always range from 0 to 100%. See the following *Figure 1.4*:

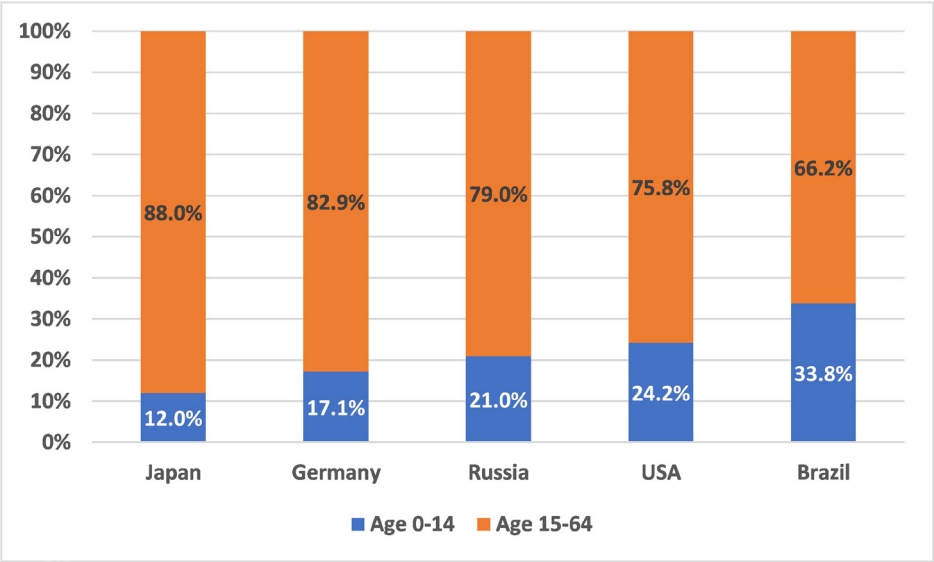

***Figure 1.4**: Stacked percentage column chart - Population in millions age 0-14 & 15-64*

Looking at the preceding percentage, the column chart of *Figure 1.4* note that data was sorted from the highest to the lowest percentage of the population aged 15-64. The chart reveals how the population is aging much faster in Japan and Germany compared to Brazil. The stacked percentage column chart demonstrates it much more clearly than the stacked column chart in *Figure 1.3*.

3-D column chart

A 3-D column chart is a three-axis chart (x - horizontal, y - vertical, and z depth). This chart is a creative way of demonstrating a 2-D to a 3-D chart. When we have large data sets, we need a better visualization than the 2-D chart. *Figure 1.5* is an example of a 3-D column chart. Please take a look at the following screenshot:

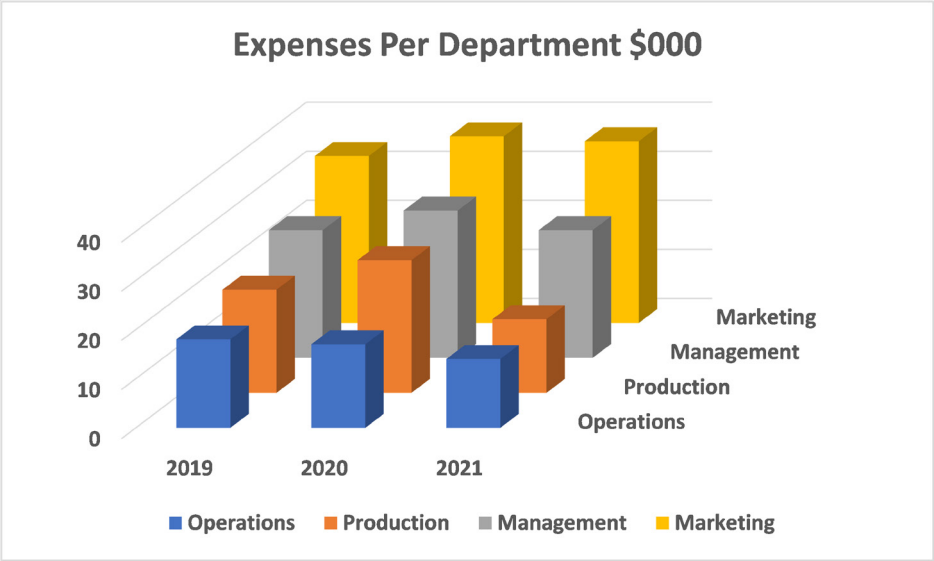

***Figure 1.5**: A 3-D column chart*

Line chart

Line charts work well to present evenly spaced data or when the X-axis has text, but they are not a good chart to use when the x-axis is numeric. It is useful when comparing one or more data sets. The advantages are that lines provide a simple presentation. These are easy to create. You can reach multiple data sets, and the lines work well with positive and negative values. Please take a look at the following screenshot:

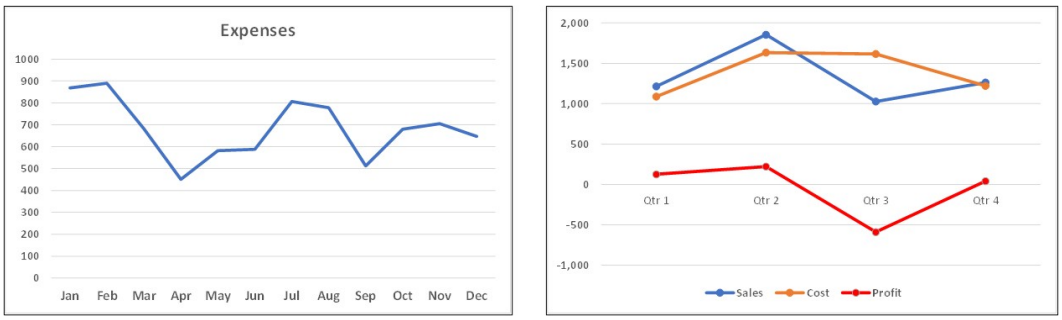

***Figure 1.6**: Line charts*

Try avoiding using a line chart in these two circumstances:

- If the values on the X-axis *are not spaced evenly*– avoid the line chart. It is misleading. See the left chart in *Figure 1.6*. The line chart does not take into

consideration the gap between the years 2012 and 2018. Use the XY-scatter chart instead. You will see that the following scatter chart spaces on the X-axis numerical data and dates are correct.

- Avoid the line chart when several lines cross each other many times. See the chart on the right of *Figure 1.7*.

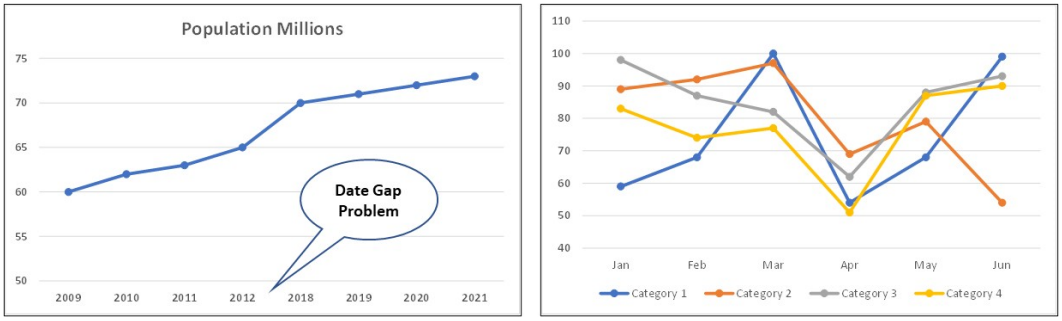

***Figure 1.7**: Two line charts you want to avoid*

Pie chart

The pie chart typically displays values as part of a total. It is best used when you have one data series to plot *and less than seven categories*. The categories can be visualized as part of the whole pie. If you have too many categories, a few tend to be very small and are lost on the pie. *Figure 1.8* shows a 2-dimensional and a 3-dimensional pie chart.

	Sales
Mumbai	164,934.00
Pune	427,738.50
Hyderabad	225,477.00
Bangalore	112,486.50
New Delhi	258,531.00
Chennai	288,802.50

***Figure 1.8**: A 2-dimensional and a 3-dimensional pie chart*

If you have too many categories, you may use the pie chart subcategories. Pie charts have three subcategories in Excel: (1) "Pie of a Pie," (2) "Bar of Pie." These are used to display smaller "slices," and (3) a "Doughnut Chart" is used when you have more than one group of categories.

Pie of pie or bar of pie charts

The pie of pie chart and bar of pie chart is used when you have several slices smaller than about 10% of your pie, and it is difficult to see the slices as part of the larger pie. The smaller parts are represented in a separate pie or a separate bar.

Pie of pie chart

The example in *Figure 1.8* charts the inventory on hand in a doughnut bakery. Five of the ingredients are too small as part of the original pie chart. These smaller categories are displayed in the secondary pie chart. *Chapter 2, Chart Elements, Styles & Analysis*, will explain how to create the chart and how to choose how many smaller categories are displayed separately on the secondary pie.

Since the pie of pie chart displays the smaller categories in the secondary pie, you can see the difference between the pie chart on the left of *Figure 1.9* and the pie of pie chart on the right side. The pie of pie chart displays the smaller categories in a way that one can see them. Please take a look at the following screenshot:

Item	Inventory
Oil	1500
Flour	500
Milk	200
Eggs	100
Sugar	100
Glaze	40
Jelly	40
Butter	20
Salt	10
Yeast	10

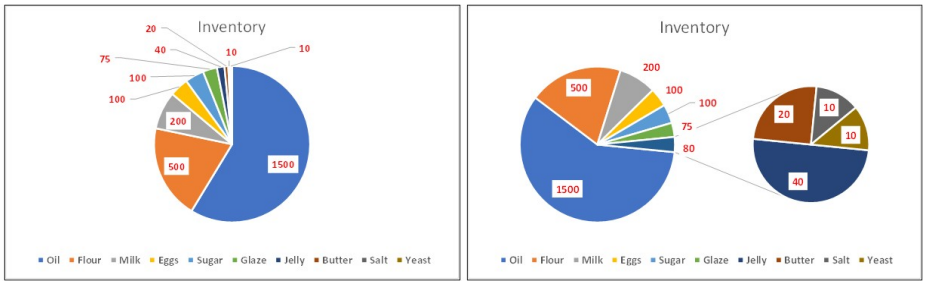

***Figure 1.9**: A pie chart versus a pie of pie chart*

Bar of pie chart

The bar of the pie chart, similar to the pie of pie chart, allows you to display the smaller categories separately. The difference is that the smaller categories are displayed as a bar instead of a pie. The additional part on the right of the chart is similar to the preceding stacked column chart (Microsoft Excel refers to it as a bar – when in reality, it is a column. The bar chart is explained as follows.)

Using the same example, the pie chart is shown on the left in *Figure 1.10*, comparing it to the bar of the pie chart on the right side. The bar of the pie chart displays

the smaller categories in a group to the right. Please take a look at the following screenshot:

Item	Inventory
Oil	1500
Flour	500
Milk	200
Eggs	100
Sugar	100
Glaze	40
Jelly	40
Butter	20
Salt	10
Yeast	10

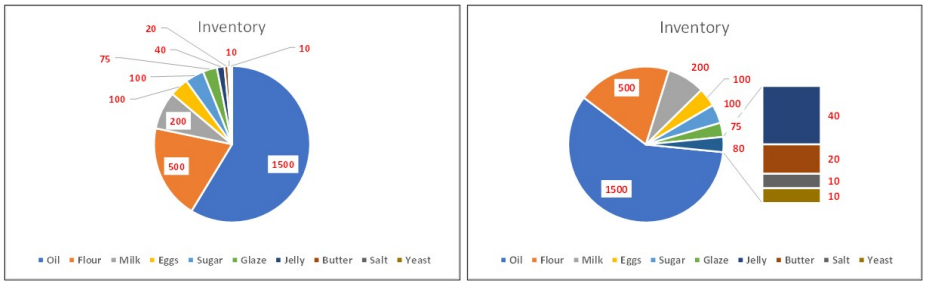

***Figure 1.10**: A pie chart versus a bar of pie chart*

Doughnut chart

This chart is another chart falling under the pie chart category. The doughnut chart is a tweaked version of the pie chart when you have two or more groups of items to display. It is easier to view and compare the different groups as the doughnut chart can show in layers multiple numerical data layers.

Looking at *Figure 1.11*, we have on the left the data that was used to create a pie chart and a doughnut chart. The only difference is that the doughnut chart has a hole in the center. Please take a look at the following screenshot:

Administrative	12
Production Mgt.	3
Manufacturing	24
Transportation	3

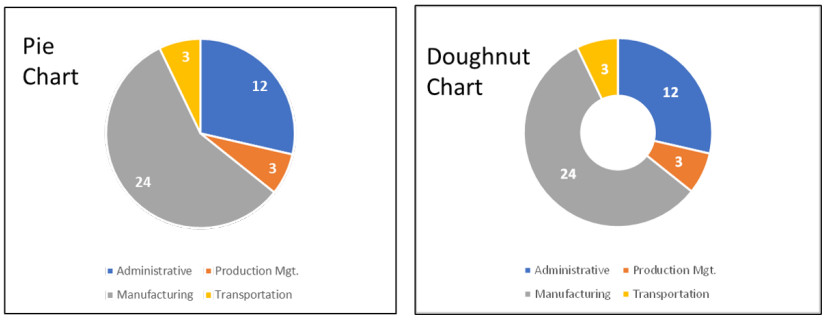

***Figure 1.11**: A pie chart versus a doughnut chart*

Figure 1.12 shows a doughnut chart's advantage over a pie chart when you have more than one group. In this example, the company needs to compare the labor force in two locations. The doughnut chart contains the two locations in two separate rings. This can be done with two, three, or more data sets with additional rings. Clearly, more than one category works better for us than the original pie chart. Please take a look at the following screenshot:

	New Delhi	Mumbai
Administrative	12	4
Production Mgt.	3	1
Manufacturing	24	15
Transportation	3	3

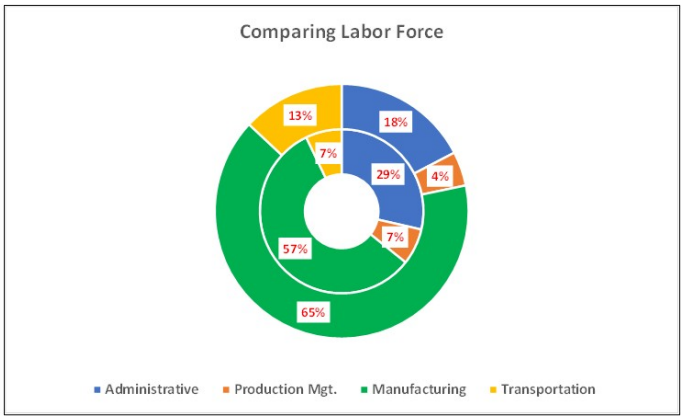

***Figure 1.12**: Doughnut chart example*

Bar chart

Bar charts are almost identical to column charts. In the bar charts, data is presented horizontally. The numbers or values are displayed on the x-axis, and the category names are displayed on the y-axis.

The main reason to choose bar charts over column charts is when the data contain longer labels or names. In the bar chart, you have enough space for each bar to be labeled appropriately.

Figure 1.13 displays the same data in column and bar charts. Note that when we have longer data labels, the labels are displayed better in a bar chart. Please take a look at the following screenshot:

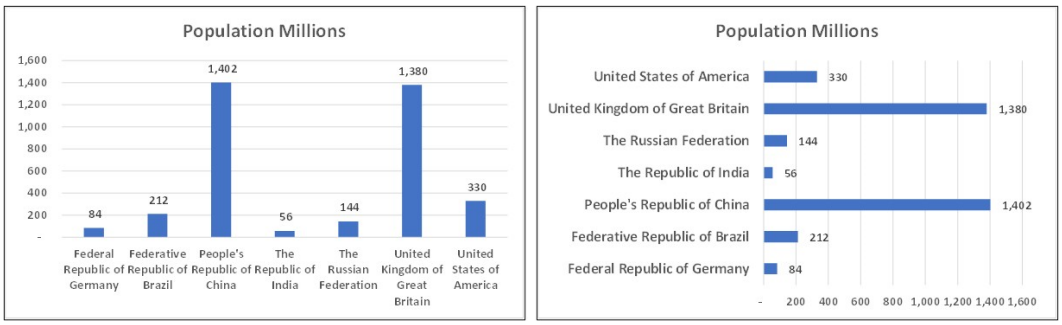

***Figure 1.13**: A column chart (left) versus a bar chart*

It is time for me to point out again (as we did with the stacked column charts earlier) that it is better to sort the numerical data in descending order before you create a

chart. In doing so, the reader has a better sense of how the data is. It is part of the "*Pareto Chart*" that will be shown again later. See *Figure 1.14*:

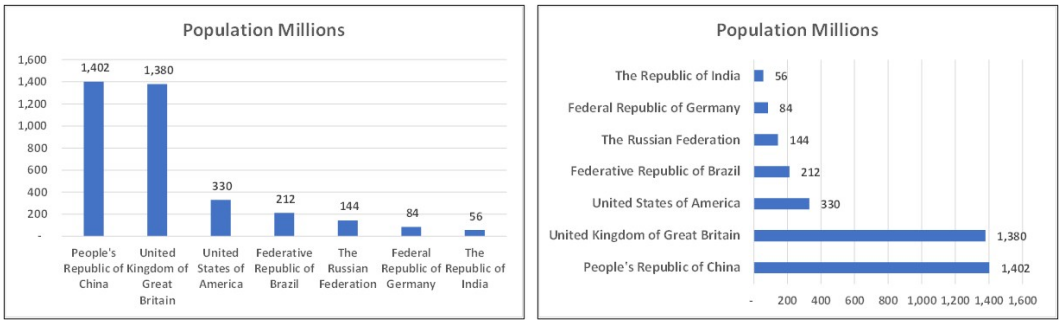

***Figure 1.14**: A column chart and a bar chart with sorted data*

Area chart

When you have many data elements and numerical data, it may be wiser to use the area chart. It allows for better visualization. Trying to use any of the other charts results in cluttered charts. The reader has a hard time understanding the data. See *Figure 1.15,* displaying a crowded line chart. Please take a look at the following screenshot:

	Product 1	Product 2	Product 3	Product 4	Product 5	Product 6
New York	434,094	415,480	261,884	331,356	235,268	189,134
Chicago	259,740	304,288	157,460	538,216	287,076	435,936
Seattle	349,700	167,136	173,790	434,094	415,480	261,884
Los Angeles	251,356	315,268	209,134	216,364	195,254	174,142
Washington	433,984	331,356	435,936	371,548	419,806	439,902
New Orleans	309,270	538,216	535,100	490,012	472,906	448,804
Miami	371,548	434,094	666,172	608,476	475,068	537,812
Nashville	490,012	216,364	797,246	726,940	514,750	621,116
Philadelphia	397,910	338,538	928,318	845,404	554,434	703,116

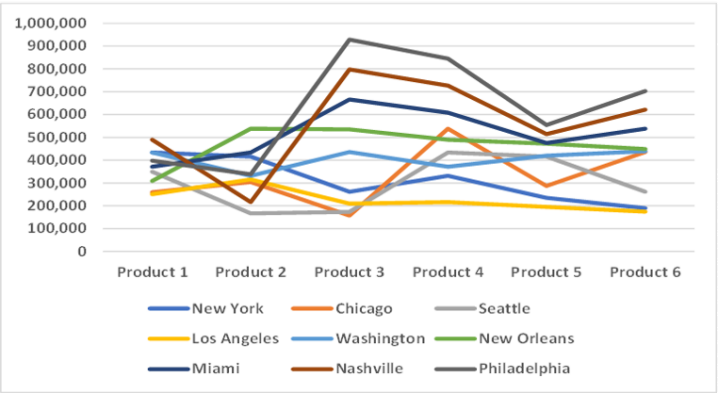

***Figure 1.15**: Using a line chart with many data sets*

The stacked area chart with the same data results in a better presentation. Please take a look at the following *Figure 1.16*:

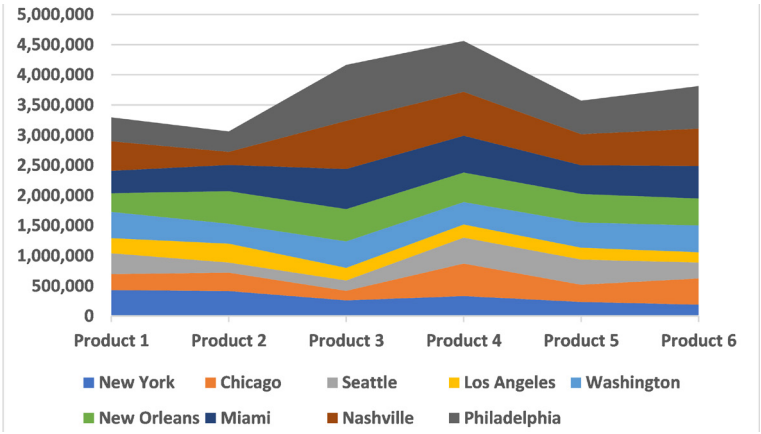

***Figure 1.16**: Stacked area chart*

XY (Scatter) chart

The scatter chart is used to identify or detect relationships between two numeric variables. Understanding the relationships enables us to use the data to forecast and calculate the '*strength*' of the relationship, namely the correlation. *Figure 1.17* displays a few scatter charts visualizing this idea. The charts express the trend (linear, nonlinear, positive, negative) and the 'strength' (correlation) of the relationship between two variables. One variable is on the x-axis, and the other is on the y-axis. This will be explained later in the book when it discusses trendlines. Please take a look at the following screenshot:

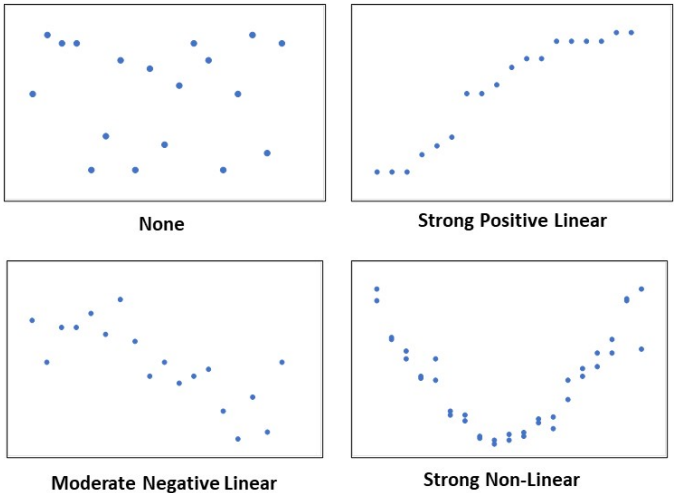

***Figure 1.17**: Scatter charts displaying different relationships of two data sets x and y*

Scatter charts are used for a variety of applications. In the business world, they forecast sales over time, calculate supply and demand curves, and examine productivity related to experience or sales as a function of marketing budgets. These charts are applied in other disciplines. A couple examples are the relationship of a baby's weight to age, car weight and gas usage, and many others.

This book will demonstrate, in *Chapter 4, Animations, Sparklines & Conditional Formatting*, how to use the Excel scatter chart Trendline to compute the line function and the relationship, R^2, using the correlations coefficient. Using this chart, you will be able to check your data determining the mathematical relationships and the strength of these relationships. *Figure 1.17* displays two examples. One is the relationship between supply and demand to price. The second displays the relationship of customers' purchases to their household income. See the following *Figure 1.18*:

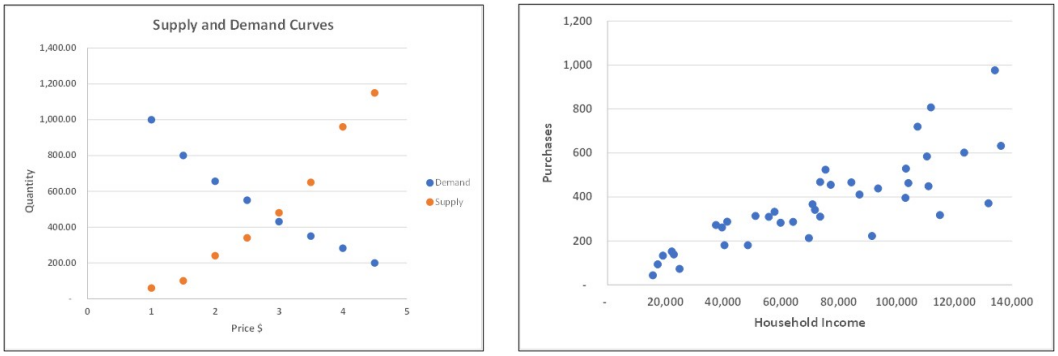

***Figure 1.18**: Scatter chart examples*

Bubble chart

The bubble chart is one of the subcategories of the scatter chart. The scatter chart has two dimensions or inputs, one for the x-axis and one for the y-axis. The bubble chart allows you to add a third dimension reflected in the size of the bubbles, thus making it more evident. The size of the bubble conveys the third dimension.

Table 1.1 displays the data of the Magic Kitchen Products sales in different cities. It has three columns of data.

City	Sales People	Sales	% Market
New Delhi	4	$275,000	4.10%
Mumbai	14	$610,000	9.10%
Pune	19	$3,000,000	44.74%
Hyderabad	18	$1,220,000	18.20%
Bangalore	24	$1,600,000	23.86%
Totals	79	$6,705,000	100.00%

***Table 1.1**: Annual sales summary*

We can create a scatter chart using only the first two columns, # of Sales People vs. Sales. However, it is not using the last column, namely, the market share. See the following *Figure 1.19*:

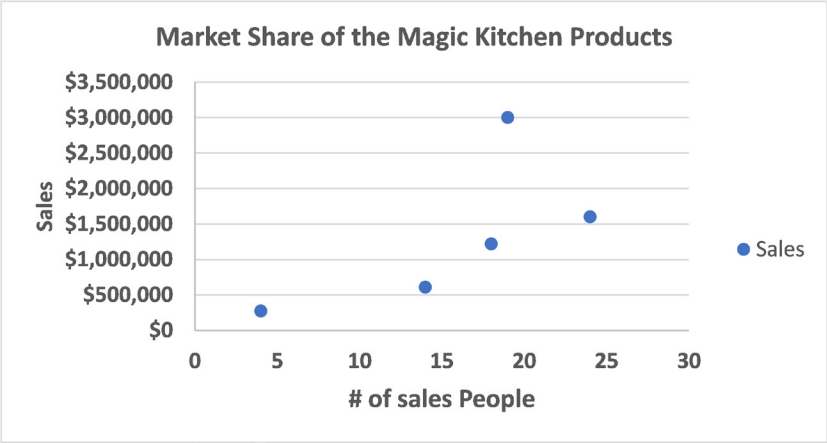

***Figure 1.19**: A scatter chart of the first two columns of table 1.1*

using the third dimension, represented by the size of the bubbles chart adds the third dimension and visualizes, using the third dimension, the size of the bubbles. See the following *Figure 1.20*:

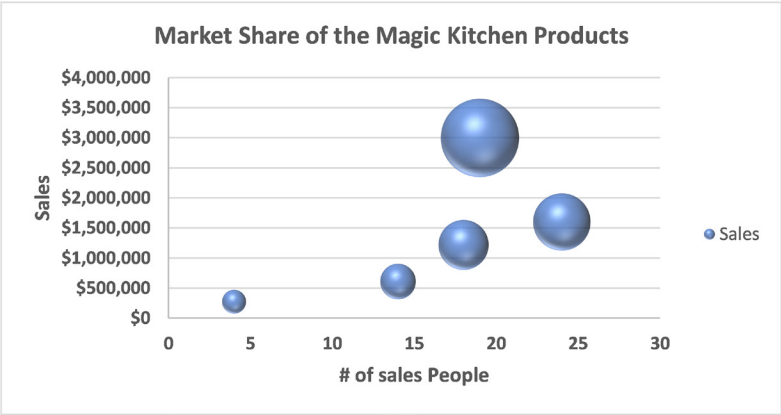

***Figure 1.20**: A bubble chart displays the market share of table 1.1*

Waterfall chart

The waterfall chart is a picture that demonstrates how the initial value changes by increasing or decreasing values, leading to the final total. This waterfall chart is not part of Excel 2013 or the previous versions. You can search and download chart templates online if you have an older version of Excel.

The first example of Waterfall chart, *Figure 1.21*demonstrates how to use this chart. In the example, we can see the impact of the cash flow over time for the year 2021, with a total at the end of the year.

	Cash Flow 2021
Start	32
Jan	21
Feb	25
Mar	14
Apr	-15
May	9
Jun	49
Jul	-24
Aug	-11
Sep	38
Oct	21
Nov	2
Dec	16
Total	177

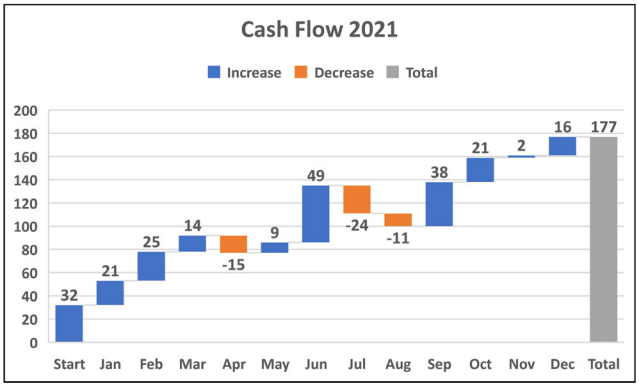

***Figure 1.21**: A waterfall chart for the 2021 cashflow and total*

The following example, in *Figure 1.22*, displays a different instance of using a waterfall chart.

	1st Quarter
Revenue	33,213
Cost of Goods	(11,232)
Gross Margin	24,111
Admin Cost	(1,813)
Net Profit	22,298

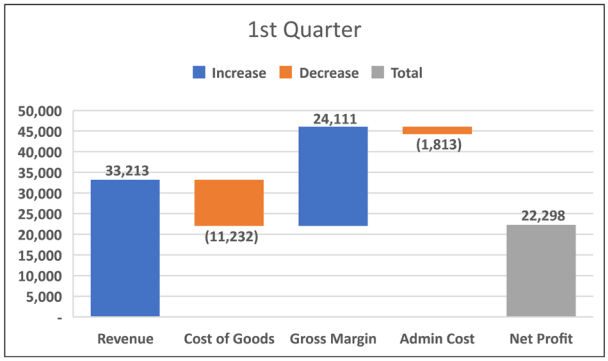

***Figure 1.22**: A waterfall chart 1st quarter revenue and expenses*

Map chart

This Excel Map chart enables us to use the world map or smaller regional maps. The maps for the charts are downloaded automatically by Excel from Microsoft's Bing browser. The map chart feature links to Bing by itself. You can create a smaller regional map as small as using only a few states in the USA – or have part of the world map regional map. The other option is to use the entire world map. You must list the locations and associated data on an Excel sheet and insert the map chart. The

following are two examples created with the Excel map chart. See *Figure 1.23* for a regional map:

Country	Population
India	1299
China	1,370
Pakistan	191
Afghanistai	39
Myanmar	43
Nepal	29

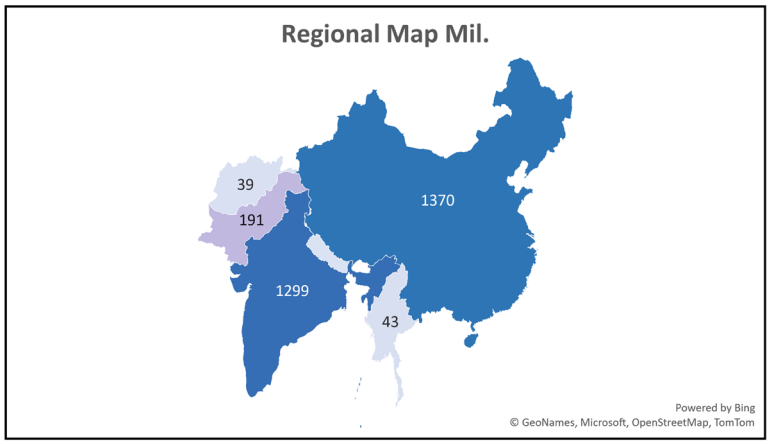

***Figure 1.23**: A regional Excel map chart*

Figure 1.24 is a chart for the world map.

Country	Population
China	1,381
India	1,311
United States	324
Brazil	207
Russia	147
Mexico	122
France	67
Argentina	44
Australia	24
Sweden	10
United Arab Emirates	10
Namibia	2

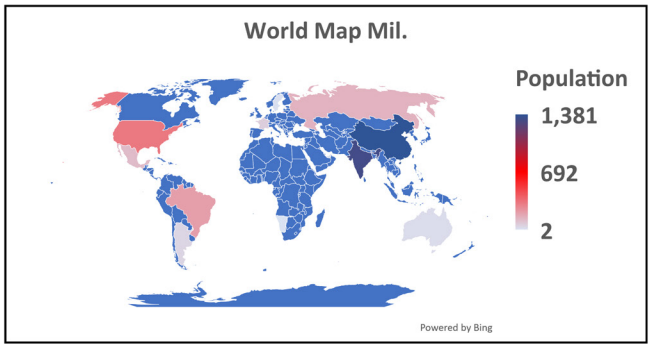

***Figure 1.24**: A World Excel map chart*

Surface chart

Surface charts are three-dimensional charts. You can create a surface chart to visualize the inputs and the outcome if you have two inputs, independent variables, and a calculated dependent variable. We use numerical values – however, the X and Y axis can handle non-numeric values. The following two examples demonstrate the surface chart.

The first example is of the function $Z=(X-5)^2+(Y-5)^2+5$. The function is calculated in Excel for the range of $X=0, 1, \ldots, 10$ and the Y with the same inputs again, $Y=0, 1,$

…, 10. The function was calculated in an Excel Data-table that you can see on the left side of *Figure 1.25*. (Excel's Data-table is explained in detail in *chapter 15 Goal Seek and Sensitivity Analysis*) Once it was calculated, Excel conditional formatting was used to map the values on the table. When *X=5* and *Y=5*, Z the calculated function in the range, was at its lowest point of *Z=5*. The surface chart provides superior visualization of the input and outcome. When *X=5* and *Y=5*, the function takes the lowest value of 5.

Using charts as a visualization tool is, in general, good practice. In this specific example – you demonstrate your idea visually to an audience that does not have a mathematical background. It is clearly visible in following *Figure 1.25*:

$Z=(X-5)^2+(Y-5)^2+5$

X \ Y	0	1	2	3	4	5	6	7	8	9	10
0	55	46	39	34	31	30	31	34	39	46	55
1	46	37	30	25	22	21	22	25	30	37	46
2	39	30	23	18	15	14	15	18	23	30	39
3	34	25	18	13	10	9	10	13	18	25	34
4	31	22	15	10	7	6	7	10	15	22	31
5	30	21	14	9	6	5	6	9	14	21	30
6	31	22	15	10	7	6	7	10	15	22	31
7	34	25	18	13	10	9	10	13	18	25	34
8	39	30	23	18	15	14	15	18	23	30	39
9	46	37	30	25	22	21	22	25	30	37	46
10	55	46	39	34	31	30	31	34	39	46	55

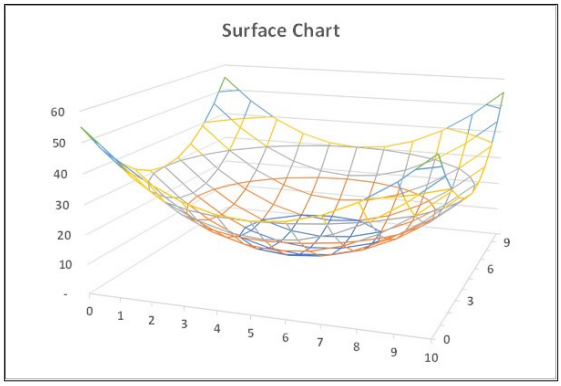

***Figure 1.25**: A surface chart of the calculated function $Z=(X-5)^2+(Y-5)^2+5$*

The second example is an optimization problem determining a plant location in China. Management wants to decide where to place the manufacturing plant in China based on the site of the warehouse destinations, the quantity to ship to each site, and the shipping costs. Once the problem was set up, it was solved using the Excel Solver optimization Add-in. The analyst found a plant location that minimizes the annual shipping costs. The analyst used a surface chart to demonstrate to management the solution. The price was calculated in a table for all possible destinations in China. The table is similar to the table on the left side of *Figure 1.23* (the table is too large to display here. You can see it in the Excel workbook for this chapter.) The table used to create the surface chart of *Figure 1.26* is as follows:

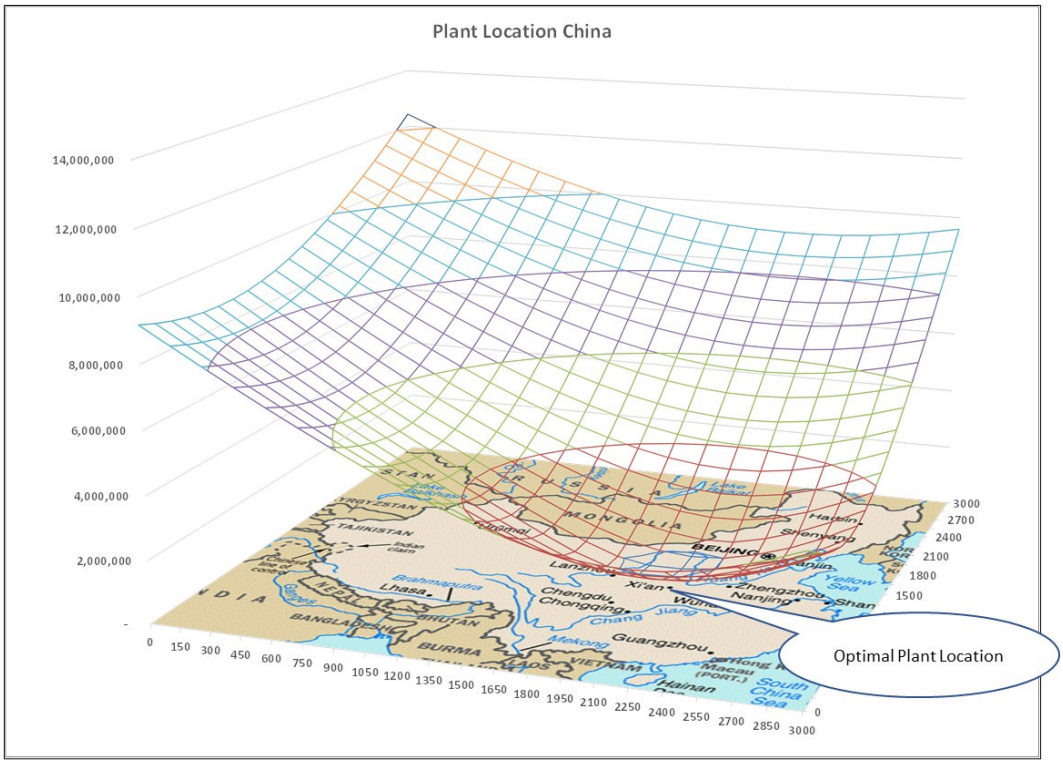

***Figure 1.26**: A surface chart of the plant location costs in all locations in China*

In this example, if your audience lacks the analytic tools to solve the problem, the chart is an excellent instrument to convey the solution.

Combo chart

Combination charts display two or more related data sets on the same chart. When the data sets have different magnitudes, we scale them differently on this chart. One scale on one axis, one to the left of the chart, and one on a secondary axis on the right. *Figure 1.27* displays the revenue and the profit margin on the same combination

chart. The left vertical axis displays the payment, and the right, the secondary axis, shows the profit percentage on the right-side scale. Please take a look at the following screenshot:

Year	Revenue	Profit Margin
2017	381,213	3.20%
2018	287,322	4.20%
2019	403,109	3.80%
2020	404,999	5.20%
2021	438,521	4.50%

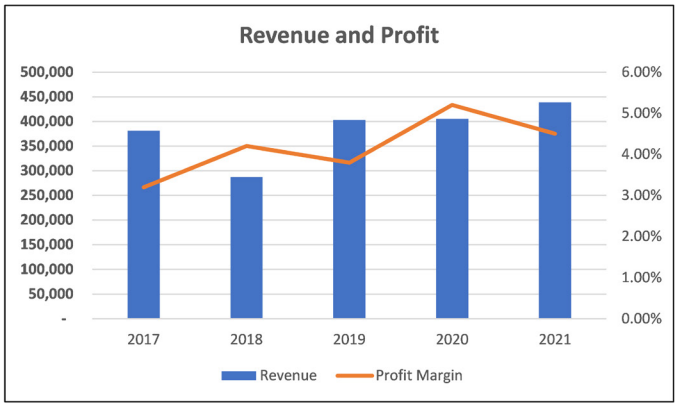

***Figure 1.27**: A combination chart with revenue and gross margins for the years 2017-2021*

The example of *Figure 1.28* charts the population distribution of a small city. It displays actual population distribution on one scale and the percent cumulative distribution on a second axis on the right. This combination is also named a *Pareto Chart*. The most significant benefit of combination charts is their ability to show relationships between data sets. Whether to demonstrate the Pareto principle or another type of influence and interaction, a combination chart is the best way to communicate this easily. Please take a look at the following screenshot:

Age	Number	% Cumulative
Under 1	3,795	1.38%
1–4	15,192	6.91%
5–14	39,977	21.47%
15–24	38,077	35.34%
25–34	37,233	48.89%
35–44	44,659	65.16%
45–54	37,030	78.64%
55–64	23,961	87.36%
65–74	18,136	93.97%
75–84	12,315	98.45%
85 +	4,250	100.00%

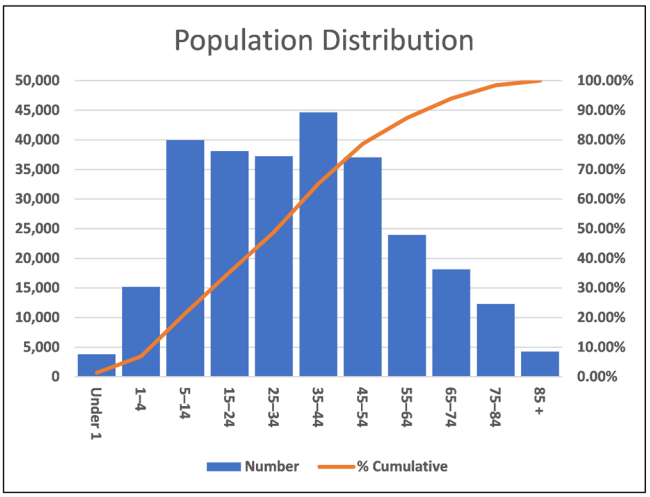

***Figure 1.28**: A combination chart of population age distribution and cumulative percentage population*

Funnel chart

A funnel chart is used to display information about the declining phases of a process—the example of *Figure 1.29* exhibits such a funnel chart. A company ran a TV commercial advertising a product in a game on March 28. Following the advertisement, the company received 335 orders on the first week of March 29, 300. On the following week, 223 and so forth, on the following weeks as shown in *Figure 1.28*. The funnel chart displays the orders over time through the week of April first. Please take a look at the following screenshot:

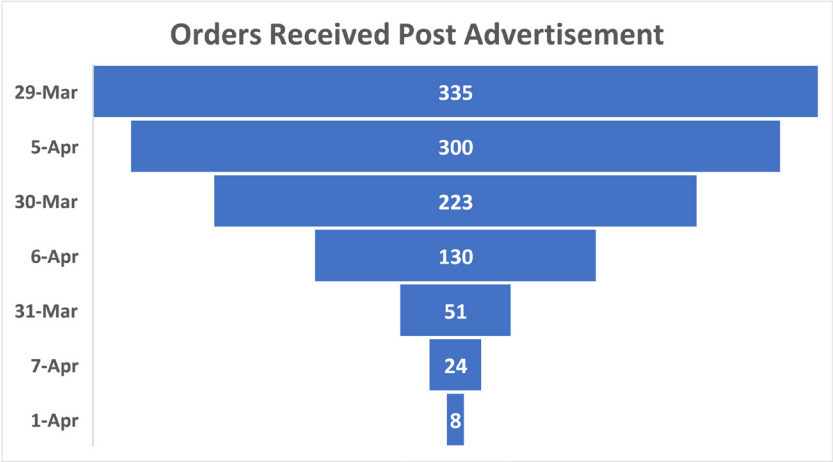

***Figure 1.29**: A funnel chart of declining orders over time*

Conclusion

This chapter introduced the most frequently used Excel charts in industry, government, and research. The idea is for the readers to understand where, when, and how to use these Excel charts. In a way, it is also an art, using the creativity as well as the know-how of the designers.

In the next chapter, you can use all the Excel charts tools. You will use the chart elements, the different menus, styles, scaling, and formatting tools. All the charts used in this book can be found on the Excel workbooks you can download from the book's website.

Points to remember

- A chart is a graphic presentation for data visualization.
- Charts assist you in visually understanding data and comparing multiple data series.

- Charts enable your audience better understand your data. Most people understand a picture better than a database.
- A good chart can help you make your point.

Multiple choice questions

1. **Why are charts necessary?**
   a. Because charts can quickly convey a great deal of information
   b. They help viewers remember the data presented
   c. They enable making informed decisions
   d. All of the above

2. **What is a bubble chart?**
   a. They are used for counting bubbles in the database
   b. The bubble chart allows you to add a third dimension reflected by the size of the bubbles
   c. Measure the distance between bubbles that are used to make foam
   d. The chart is used for the distance between circles

3. **When are we using a surface chat?**
   a. When we want to express the surface measurements of a regional map
   b. To graph the boundaries of an object
   c. To chart the boundaries of a three-dimensional figure
   d. None of the above

4. **What is a combination chart?**
   a. A chart that has at least two data series
   b. A chart that has more than one chart type
   c. A chart that allows you to choose two Axis scales
   d. All of the above

Answers

1 D

2 B

3 D

4 D

Questions

1. Why are we using charts?
2. What is the difference between column charts and bar charts?
3. What are map charts used for?
4. What is the Scatter (XY) Chart used for?

Key terms

- **Using charts**: Charts are used when the data itself is not adequate to demonstrate the correct relationships of the data.
- **Columns and bar** charts allow the reader to recognize patterns or trends.
- **Line chart**. A line chart is used to show information that changes over time.
- **Scatter chart**. A chart shows prelateship between one series and one or more other series.
- **Pie chart**: The pie chart is typically used to display values as part of a total.
- **Combination charts**: Combination charts display two or more related data sets on the same chart.