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Unit 1: Introduction to Excel

Learning Outcomes

1. Learners will be able to define business analytics and explain the significance of Excel in business analytics processes.
2. Learners will comprehend various data types, formats, and methods of importing data into Excel to facilitate data analysis.
3. Learners will identify key functionalities of Excel used for data review and analysis in business decision-making.
4. Learners will apply Excel tools to organize, manipulate, and visualize data effectively to support business insights.

Content

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1.1 Introduction to Business Analytics and the Importance of Excel
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1.0 Introductory Caselet

Get Data Smart: How to Use Excel and SQL to Discover Business Insights كتب " Get Data Smart: How to Use Excel and SQL to Discover Business Insights"

Neha is a new business analyst who has recently joined a fast growing e-commerce startup. Her manager requests that she research how customers shop to determine any patterns and improve sales

strategies. Neha is excited but a bit daunted: She knows she has lots and lots of sales data in various shapes — CSV files, Excel spreadsheets and even data scraped from the company's online store.
Along the way, she faces several difficulties after starting to work. Organising data There are several things Lorraine finds herself struggling to organise data in a way that makes sense and is effective: She's always bending over backwards trying to find the most important metrics she needs to track Her eyes hurt just for trying to spot increasing/decreasing trends. She knows that Excel is powerful to analyze the data but she doesn't know how to harness its features in the right manner. How does she clean and structure this data? What skills will she apply when solving problems? How can she produce more than just a set of visualizations to show her team?
Neha knows that she has nothing to lose and everything to gain by learning how to do business analytics in Excel – not only in her current job, but also in her opportunity to make evidence-based decisions. As she navigates through this process, she has decided to investigate various data types, importing avenues and major Excel functions that will help to take raw data to shinning business insights.

Critical Thinking Question
How can Neha use Excel's data analysis tools to clean up, sort and find hidden gems about customer purchase patterns in order to help her company make better sales categories?

1.1 Introduction to Business Analytics and the Importance of Excel

Business analysis is particularly useful in structuring data of what has happened and applying scientific methods to business data to predict, steer and make decisions towards organizational goals. Data-driven: Business users employ statistical tools and visual data models to uncover what their businesses' data has to say about trends and relationships. In today's rapidly changing business environment, analytics enables companies to differentiate themselves from competition, to do it better with customer satisfaction.
Studies Signs typically generate vast bodies of data from their various customer purchase records, market trends and other company activities. When this data is analyzed properly, organizations are able to:

- Drive smarter and faster decisions by using data-driven insights.
- Discover better business paths and identify weak points in your operational system with data.
- Analyze market trends to combine a plan to safeguard our future business.
- Learn how customers behave and what they prefer to inform better service.

Significance of Excel in Business Analysis

Fig 1.1 Microsoft Excel

Microsoft Excel remains the leader in business analytics tool usage because of its ease of access, easy use and great ability for data processing.

Many organizations of all sizes rely on Excel to produce incredibly powerful and complex data manipulation for everything from managment, analysis and generating Power Points.

Some of the Factors that Determine the Significance Of Excel in Business Analytics :

Data Organization and Management:

- The data set management capabilities such as tables, the filters, and the sorting systems in microsoft excel helps business users to manage large volumes of data efficiently.
- Organisations require Excel to maintain data, recover records and manipulate the data in structured formats.

Data Analysis Tools:

- • Based on data analysis, using built-in Excel function like SUM, AVERAGE, VLOOKUP and INDEX/MATCH to help users.

PivotTables can handle amounts of data easily with a simple, fast summary engine. Visualization Capabilities:

● Excel helps you to create effective data visualization tools (bar chart, pie chart, line and histogram).

● With conditional formatting, you can highlight important data trends or track the unusual or unexpected.

Statistical and Predictive Analysis:

● More analysis features such as regression analysis pair with trend lines and forecasting tools to help you better identify variance, trends and patterns.

● Users can avail some advanced statistical features via the Analysis ToolPak add-in.

Automation with Macros:

With macros and VBA (Visual Basic for Applications). Excel performs the automatic repetition of a same task assuming that no two tasks are identical.

● They help save time and data processing power and are faster. Scenario Analysis and Decision Making:

● Companies have strong tools to analyze the many possible outcomes and even input various variables by using Goal Seek and Scenario Manager.

● Assists with financial modeling and strategic planning. Cost-Effective and User-Friendly:

Excel can be an inexpensive analytics tool, but it demands literacy with the package before you begin using it.

It works on all platforms so users can deprive it from all over the globe. Typical Business Analysis Stats with Excel

· Sales Analysis: Used as tools for analysis, to aid in recognizing best sellers and help forecast of what the customers will want next.

· Financials: You are updated with their user created Balance Sheets, Income Statements as well as Budget forecasts by their key Financial statements.

· Stock Control- Tracking stock capacity and purchasing patterns.

Marketing Analytics - It’s to do with the comparison of marketing result as against specific customer markets data.

· HR Analysis: Analysing the employee ranking and employee's attrition.

1.1.1 Types of Business Analytics

Business analytics comes in three flavors —none of which taste like Braums—and each type offers insights that help companies make smarter decisions.

Fig 1.2 Types of Business Analytics

Descriptive Analytics

take action to improve outcomes. Purpose of Descriptive Analytics:

This allows organisations to see the corporate history at business and topic level.

How Descriptive Analytics Helps: 1.

combinations of products they purchase.

reduction of their sale productivity and customer feedbacks.

orders this quarter, they generated the sales that they were hoping for.

Data-Driven Decision-Making: Companies use learnings to make informed decisions about the future. In the light of our research, some findings are important for offering us more effective recommendations for planning business development in the future.

Descriptive Analytics Use Cases:

Retail: Past sales data allow store owners to understand which products yield the highest sales for various Seasons.

Example: Walmart looks at past sales data so it can order products that have a track record of being in style, such as winter wear or barbecue goods during their seasons. Amazon works through customer purchase data by adjusting their stocking strategy and making product recommendations in times when previous customers have purchased similar items.

Health care: Hospital workers analyze clinical data to identify when flu infections occur most frequently within each year.

Example: The US Centers for Disease Control and Prevention (CDC), which is drawing on data submitted by health care professionals, tracks flu trends when hospitals are being forecast for demand in busy times.

They were using descriptive analytics to observe day-to-day numbers of patient admissions with COVID-19 in order to reserve scarce resources like Intensive Care Unit (ICU) beds and ventilators.

Finance: A company analyzes its latest finance data each quarter to discover patterns of change in revenue and spending. They find this annual sales high in the fourth quarter and, as a result, push above-average sales efforts during the season.

Example: Utilizing transaction data from Mastercard, Scrapped provides descriptive analysis, of interest to financial institutions in identifying when habitual consumer spending cycles occur.

The PayPal analytical platform analyses historical flow data between customers and the company, to understand patterns of customer behaviour during different times of day which can then inform fraud protection.

Marketing: Business analyses the performance of its most recent social media campaign through social media metrics (like, comments, shares). Their data insights can help them understand what types of content is working and how to better plan the next step.

Case and Point: Coca-Cola measures 'Share a Coke' success by examining social media how. They use the information in future strategic planning for upcoming marketing efforts. Since Spotify collects information about user listens, the service knows what's trending musically from season to season—enough so that it can plan its promotional schedule accordingly including the popular "Wrapped" year-in-review promotion.

E-commerce: It doesn’t guess at web traffic, but instead uses data to show how frequently customers visit each product category. They then use this information to figure out what their buyers want most so they can put adequate focus on their ad promotions.

For example: Shopify and Flipkart track consumer interactions to measure statistics like page views and time spent in category against electronics or clothing. It thanks to the tracking system that they are able to identify the most visited areas of their products and directly advertise with precision based on customer taste.

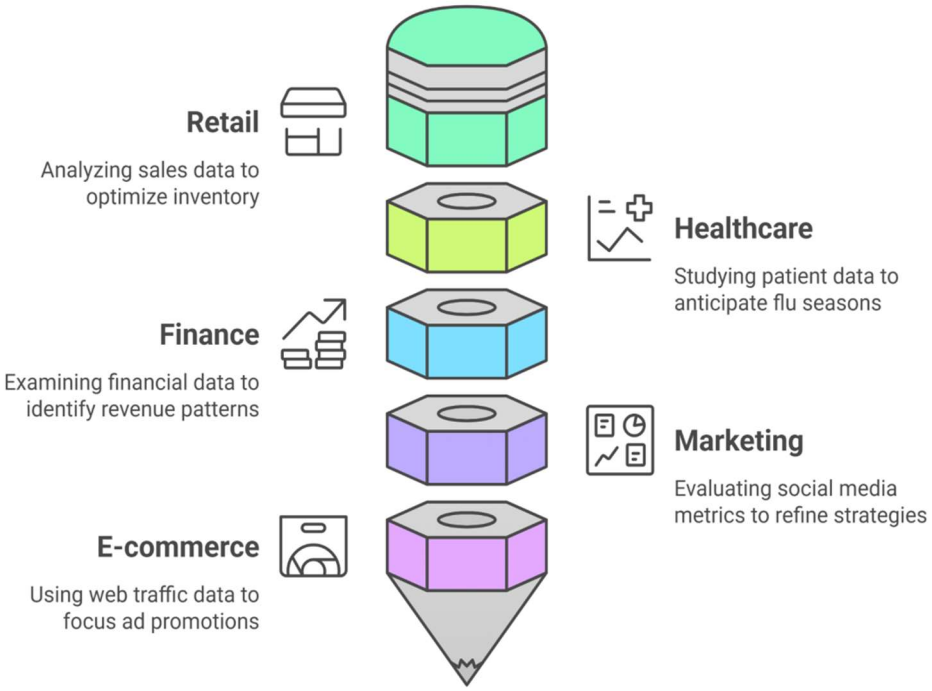


Fig 1.3 Examples of Descriptive Analytics

Did you know?

- 80% of Business Insights is from descriptive analytics enabling businesses to compile historical data to take actionable decisions.
- 65% of Organisations look to descriptive analytics to monitor performance, and uncover operational efficiencies.
- In businesses, 90% of Data Analysis Efforts are only used to understand past performance (descriptive analytics).

KPIs: Public organizations monitor operational success with certain key performance indicators that allow for monitoring of operations across domains. They evaluate productivity by monitoring numbers of dollars, up-to the minute-sales velocity and cost of acquiring new customers to product flow speed throughout their systems. KPIs are relied on by organizations to measure how well they have achieved their goals the metrics used to measure what specifically constitutes success.

Trend Analysis: Future forecast of business performance based on analysis of changes in data collected over time. Product supply time when you open a store is calculated by analyzing user movement pattern with high season sales information.

Predictive Analytics

Statistical model but data-driven with ML algorithm In predictive analytics, the primary analysis in predicting future market movements is statistical model but it's data-driven using machine learning algorithm. Predictive analytics allows companies to base their decisions on historical data and learn from it, predict risk areas, as well as discovering new growth opportunities. By doing so, businesses can be warned of potential problems and seize opportunities to expand, or to optimise its operations leading into an educated decision-making process. Business operations rely heavily on predictive analytics as an instrument of strategy for organizational functioning.

Did You Know?

Predictive Analytics-Healthcare: In this space, predictive analytics is used to predict patient health condition which enables care delivery before it becomes a problem and refining treatment.

Purpose of Predictive Analytics

What Predictive Analytics Aims to Do: It is the goal of predictive analytics, in a nutshell, to reveal data patterns and gain insight from what is already known about a situation by using that knowledge to build predictive models capable of forecasting future outcomes. It allows businesses to:

● Strategic shifts will also make it necessary to anticipate the next ones.

Administrative practice for identifying potential systematic errors is predictive. Predictive analytics ensures that operational efficiency is optimized by forecasting market predictions and dispensing the necessary resources.

● Individual service delivery will follow by predicting consumer behavior patterns and serve their customers in a better way.

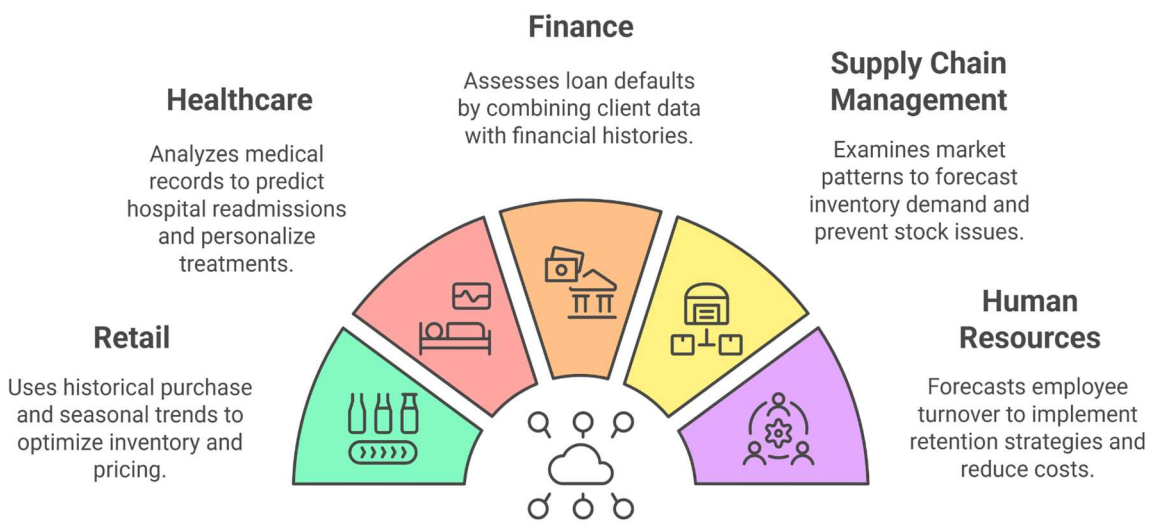


Fig 1.4 Examples of Predictive Analytics

Retail:

Use Case: Sample customer purchase behaviours and seasonal patterns as Data input to the forecasting model that retailers use for future revenue numbers wants. By an analysis on a consumer profile (customer information) and preference of a product in a market, items can be predicted effectively so that inventory management can be determined.

Benefit: With this insight, businesses can improve inventory management practices down to minimizing inventory waste and run more effective marketing campaigns. Personalized recommendation from predictive analytics retailers Generate etailers gives a personalized recommendation to each of its customer that will not just create more sales but the loyalty for their customer as well.

Example:

Amazon: Transforming its recommendation system Amazon also employs predictive analytics - asymptotic improvement in automating data with buying behaviour and customer preferences together as well as personal browsing information. It's the personalized recommending feature that makes majority of Amazon's revenue, by pushing big chunks of sales through these recommendations.

Walmart- Retail giants such as Walmart leverage predictive analytics to analyze customer's purchase history, browsing behaviour and other demography related data, and make personalized product recommendations. For example, if a customer is more likely to shop for apparel items more frequently, the system would understand that they may now need new ones and analyze what clothing they may own in terms of shoes, shirts and pants etc. keeping that item context in mind it should be suggesting relevant clothes to them. In fact, it enhances customer experience and increases sales and customer retention.

Healthcare:

Usage: Integration of patient history, treatment schedule and demographic information by clinical experts is useful for readmissions prediction. The predictive model helps determine which patients are more likely to experience complications and to be re-admitted to the hospital.

Advantage: Investigating via predictive modelling contributes to personalised clinical treatment leading to improved patient outcomes without imposing additional hospital costs. They can predict diabetes and cancer because they find the signs of potential health problems before fully fledged symptoms become apparent, so that doctors can act early.

Example:

Johns Hopkins Medicine: The hospital tracks ICU patient status via predictive data analytics that recedes through clinical signs to detect early warning signals of impending medical conditions (and preempt complications).

Blue Shield of California: Predictive analytics Blue Shield looked at claims information when evaluating patient history to direct preventive care at those expected to be high risk, thus driving down usage of the emergency room for customer visits.

Finance:

Application:In predictive modelling, the client's behaviour and clean financial data is utilized by lenders to measure the risk estimation of loan defaulter using the credit score and income levels. The platform enables businesses identify its at risk borrower profiles.

Benefit:Utilizing predictive analytics and operations assists decision maker in superior decision making across all stages of credit underwriting, which leads to reduction in NPL. Predictive analytics software allows for instant discovery of suspicious spending.

Example:

JPMorgan Chase: The bank employs predictive analytics to understand whether a transaction is fraudulent by comparing recent behavior to historical performance data and spotting outliers.

FICO Score: The FICO model is the predictive modeling of an individual's likelihood to pay that becomes a tool for banks to priice credit and other interest items.

Supply Chain Management:

For example, businesses employ market trend analysis and incorporate it with customer information to predict future inventory needs and vendor shipping performance. With predictive analytics companies to make more informed decisions regarding their procurement systems and supply chain inventory control.

Pro #4: Enables companies to avoid overstock and out-of-stock of inventory, ensuring smooth flow in supply chain operation. Businesses that leverage predictive analytics increase their capability to forecast demand, manage suppliers and schedule deliveries.

Example:

Procter & Gamble (P&G): Utilizing Predictive Analytics, P&G is able to reduce inventory levels by slotting written demand patterns and vendor performance in Logistics Costs as well as by increasing Manufacturing Productivity.

UPS: The company's advanced forecasting uses data on previous traffic activity, weather and delivery times to develop the most efficient delivery routes which reduce fuel idling time.

Human Resources:

Use Case: Predictive models use employee work place morale measurements and to identify expected employee attrition events, along with the profitability of said turnover.

Benefit By focusing on retention and employee engagement, HR dept's can develop effective programs that reduce the cost of search and training by maintaining continuity and decreasing time to proficiency. Companies find emerging leaders via predictive models analysis.

Example:

IBM: At IBM, predictive analytics allows the company to predict the workforce by analysing satisfaction with travel time and compensation benefits. Early identification allows the organization to pursue preventative retention measures which eliminate future costs of hiring and training their replacement.

Google: Better retention and heightened employee engagement are achievable if Google can analyze performance results with employee surveys also measuring data about the workplace.

Diagnostic Analytics

Diagnostic analytics- This is the business analytics that concentrates on why things are happened in past and also to support future pulling. It falls in the middle of Descriptive Analytics (tells us what happened) and Predictive Analytics (tells us what will happen). Diagnostic Analytics Diagnostic Analytics allows organizations to identify patterns, correlations and causal factors that influence business performance, typically accomplished with the help of various statistical techniques an data exploration methods.

Objectives of Diagnostic Analytics:

Break down the business trend of problem observed into its practical elemental causes.

· Pattern Recognition: HT study some of the relations between a number of factors in the past data.

· Dynamic Decision Support – Stream actuating data that impact operational outcomes.

· Predictive and Prescriptive Analytics Interface An interface to the forecasting (predictive) models, the planning/optimization (prescriptive) models via the Management Model.

Key Techniques in Diagnostic Analytics:

· Drill-Down and Exploratory Analysis – Effortlessly break down aggregate statistical information for diluted root cause analysis.

· Correlation and Regression -To determine how much the variables are related and to establish cause and effect.

· RCA (Root Cause Analysis) – Identifying what has led the business logic to its current result.

· HTS Analysis – Discovering patterns and anomaly behaviors by modeling historical trends over time.

· Comparative Analytics – Comparing datasets in different time periods, territories or lines of business to discover differences.

Use Cases of Diagnostic Analytics in Business:

· Finance: Reasons for decreasing income (changing market) or changes in consumer behavior.

• Health: Why hospital readmissions spiked by looking at patients' back stories and medical outcomes.

· Marketing: Explanation about why a recent ad campaign that did not perform well, based on engagement rates, demographic response, and environmental factors.

Supply Chain Management: Uncovering the cause of logistical delays is part of supply chain management, reviewing shipping logs and a suppliers' performance.

Diagnostic Analytics as Part of the Business Analytics Model:

Diagnostic Analytics is a part of the process in data-driven decision-making, it falls between Descriptive and Predictive Analytics:

· Descriptive Analytics: What has happened? → Captures history and trends.

· Diagnostic Analytics: What happened? → Explores causes and correlations.

·? Predictive Analysis – what might happen next? → Trend in variables considering the previous information.

· Treatise: How will it be done? → Suggests you the best possible move as per estimation.

Prescriptive analytic

Prescriptive analytic appliances deliver actionable suggestions that help improve predictions and decisions, while deploying neural networks to analyze data for trends are used to predict optimal results. This tool is utilized in practically all sectors of the economy to optimize processes and offer innovations that contribute to the satisfaction of customers.

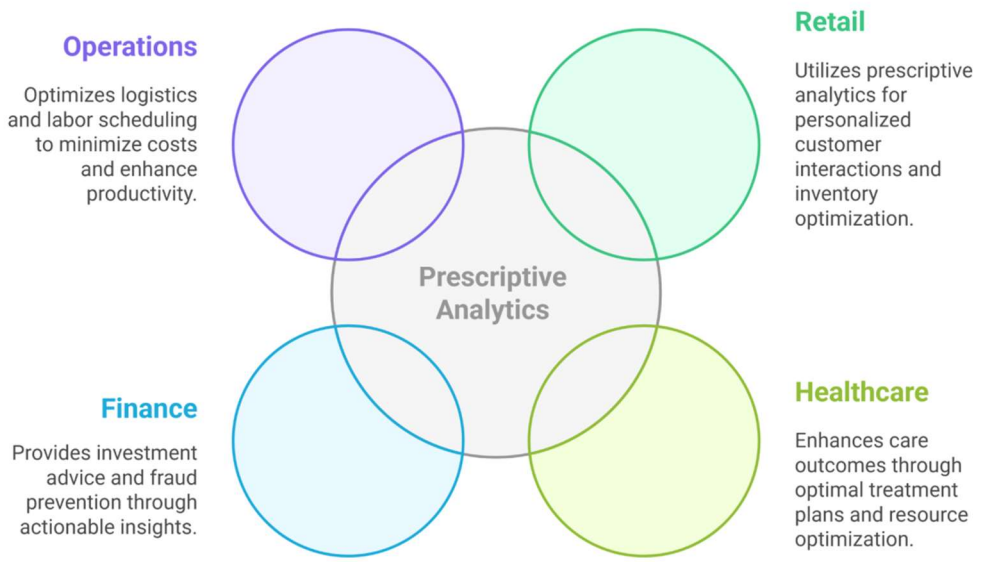


Fig 1.5 Prescriptive Analytics

8 – Retail: Prescriptive analytics are used in retail to develop bespoke customer experiences and to maximise inventory holding.

Examples:

· Personalized Product Offer: The analytics recommends the product based on the specific customer preferences from customers' browsing and buying behaviour for such retailers.

Advantage: By incorporating better customer satisfaction, there would be an advantage of reduced inventory cost and increase in sales performance.

Healthcare: To create better care results, cost savings and efficiently used resources in operation, healthcare institutions use prescriptive analytics.

Example:

· Treatment Recommendations: The system processes patient data from clinical records and determines the executive-driven recommendations for ideal care that can be given in terms of available resources.

Finance: Prescriptive analytics allows financial institutions to make decisions by providing them with actionable insight on investment opportunities, and is used to design better risk management processes as well as fraud detection algorithms.

Examples:

· Investment Consultation: Banks and other financial institutions use market analysis, financial risk evaluation and detailed investor profiles to construct tailor-made investment plan for clients.'

· Fraud Protection: Electronic systems are checked by computers provided by the financial companies which help to minimize fraud.

Operations: This approach in prescriptive analytics enables organizations to further optimize their logistics networks & supply chain management, and employee services - thereby reducing costs while improving efficiency.

Examples:

· Route Optimization: By means of prescriptive analytics, logistics companies can write the best delivery routes that maximize speed and minimize fuel burn.

· United Parcel Service million gallons of day by basically was conserving diesel fuel, if you want to look at it that way, routing and optimizing delivery routes through their ORION system.

\\, with a demand pattern dependent type so that both the effectivity and the expense are minimized.

Marketing:

Through the use of prescriptive analytics, marketers know exactly where to spend budget with maximum impact and can stretch their campaigns into highly measurable outcomes.

Examples:

Advertising budget optimization: Prescriptive analytics recommends how best to allocate advertising budgets by accounting for expectations surrounding the return of investment of advertising on different mediums.

Google Ads prescriptive analytics will suggest where to move budget to deliver the best performance in a campaign.

Customer segmentation and engagement : By using prescriptive analytics, organizations can identify profitable customer groups and design 'intelligent' engagement strategies for each.

Coca-Cola uses prescriptive analytics in order to create programs that appeal to consumers. Benefits: The most effective Prescriptive Analytics is perfect for a few reasons: it maximises your Marketing Return on Investment in two ways1 and delivers increased customer engagement and, ultimately, more Conversions.

Activity: Business Data Analysis with Excel

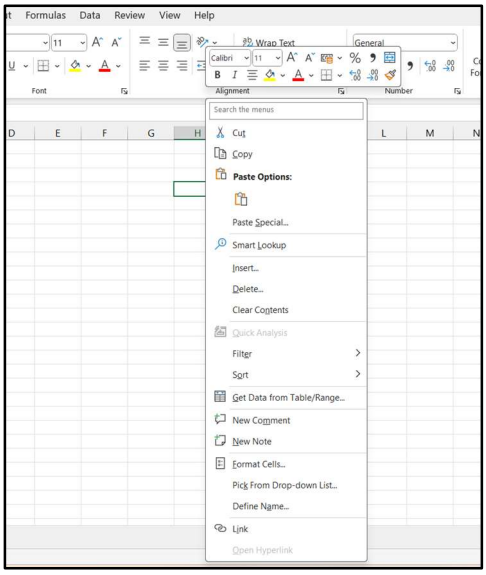
The idea is that companies use data to make better decisions. As a business analyst, you need to analyze a company's sales data in Excel for trends and insights.

Instructions:

Choose a Source Dataset You must use some set of data that we can work with (some example sample data is provided) - e.g. sales units, product types, customer localities, or dates of purchase.
Format Data in Excel: Place your data into an Excel table and use the sorting and filtering capabilities to easily target specific types of dates.
Analyse Data: Calculate analytics in Excel, use basic Excel functions like SUM, AVERAGE and COUNTIF to get the total sales, average revenue per region, how many products were sold by each category.
Visualize the Data: Create charts and graphs (such as bar charts, line charts, and pie charts) to illustrate sales trends and highlight key patterns.
Leverage Conditional Formatting: Highlight top-performing products through conditional formatting to easily identify best-selling items.
Make Data-Driven Recommendations
Respond to the following according to your reading:
The bestselling products/locations?
What is the sales pattern overtime that you observe?
What should the company do to increase sales in light of your information?

1.2 Data Types and Formats in Excel
Data types and format in ExcelDifferent formats are used in the management of data in Excel.
In Excel, handlers can process and also visualize their information when they doing the analysis. I need (due to the fact that they play a critical role" in ensuring business accuracy via e.g Financial Modelling, Data Analysis & Reporting when using Microsoft Excel"..:)) to have good knowledge of "Data Types and their formatting techniques."

How toRecognizede Different Kinds of Data in Excel
In Excel you can check what type of data a cell or range of cells contain by selecting the cell in question and right-clicking. Then, click on Format Cells. The available data types (for example, Number, Date, or Text) will be shown in the Number tab here.



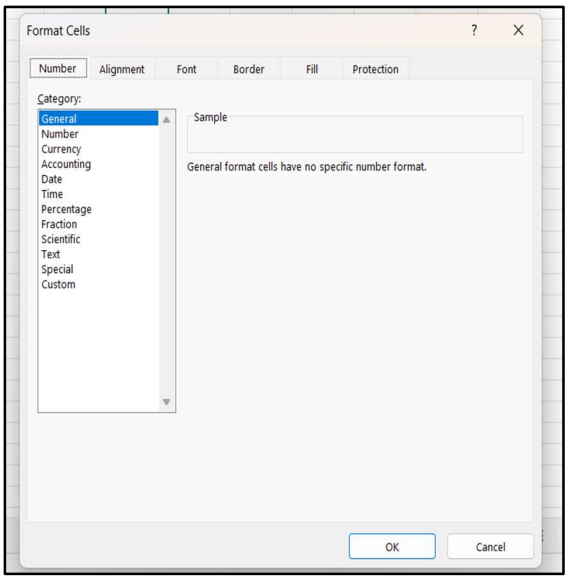


Fig 1.7 Selecting the Format Cell Option **Fig 1.8 List of Data Types in Excel**

Or, you can go to the Number group on the Home tab and see a few data types.

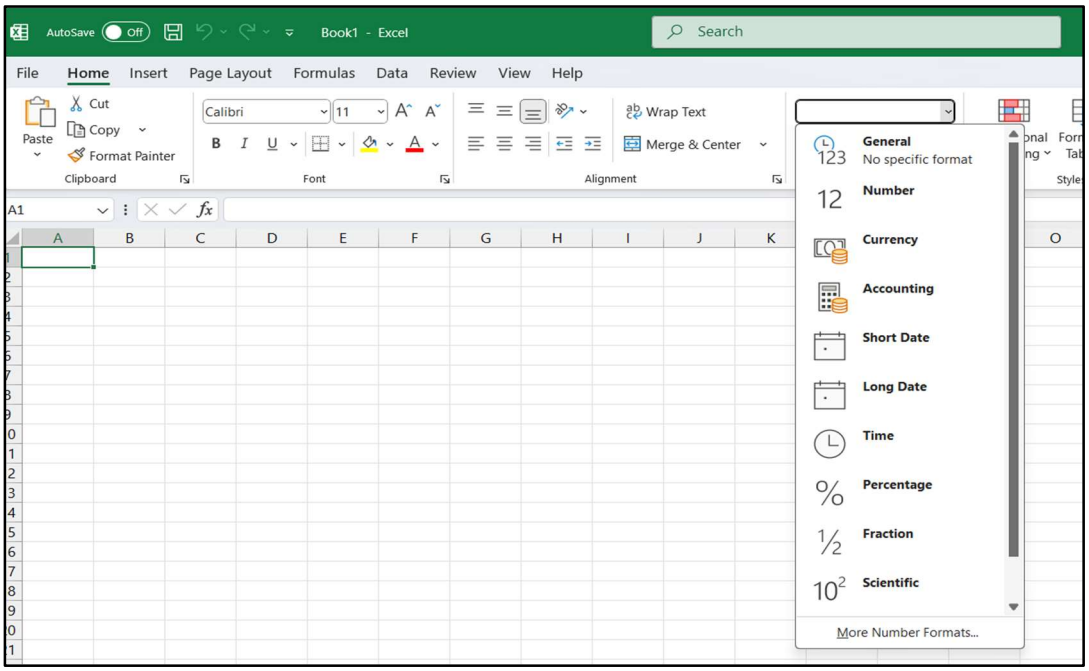


Fig 1.9 Data Types in Excel

1.2.1 Data Types in Excel

Excel Data Types specifies the kind of value stored in a data set. Adequate comprehension on different data types is indispensable to support good practices when analyzing and visualising the data, while trying to take decisions. In Excel, data can typically be sorted into one of two groups: Numerical (Quantitative) Data and Categorical (Qualitative) Data.

Numerical Data (Quantitative Data)

Numerical data are numbers which can be assigned a numerical value. Again it is of two types:

Discrete Data:

· Made up of numbers that can be counted.

· It is not divisible into smaller units in a meaningful way.

Examples:

\begin{itemize} \item The size of a class (\textit{\textbf{e.g.}\ 25, 30}).

· Number of parking cars.

· Quantity of selling within a 24-hour period.

Continuous Data:

Describes values that can be represented as a number within a range. Includes decimal or fractional values.

Examples:

· Height of a person (5.8 ft).

· Temperature (such as 37.5 C).

· Distance traveled by a vehicle (e.g., 12.4 km).

Categorical Data (Qualitative Data)

mcat:C01" category13-id="LC4_bucketCats tractable.type : A property of some data model cases that allows factoring a list into the base of an expression and a multiple inside might also include numbers for categorical attributes) Categorical: Non-numeric values used to classify objects into groups or labels. It is divided into two types:

Nominal Data:

Symbolizes or annotates categories as unordered or unranked. For labeling only.

Examples:

· Product attributes (Red, Blue, Green).

· Types of fruits (Apple, Banana, Mango).

· sex (Male, Female, Other).

Ordinal Data:

· Symbolizes or tags categories/items with a meaningful order over ranking.

· R is not a symmetrical function of ranks.

Examples:

· Satisfaction of customers is (Low, Medium and High).

· Level of schooling (Primary, Secondary, Tertiary).

· Ratings for movies (1 star, 2 stars, 3 stars etc.).

1.2.2 Data Formatting in Excel

In Microsoft Excel, the data entered in a worksheet is all formatted using the same format by default and this tends to make the data look monotonous, drab and downright confusing. It features a formatting toolspool which allow you to manipulate data in way that its meaningfulness is retained and only the appearance of it modified.

How to format in Excel?

Below is the procedure for applying the formatting:

- Choose the range of cells to apply the format to.
- Chose the correct formatting instrument in the toolbox.
- Style is viewable on the sheet.

Contain formatting tools for text and the cell in appearance that In the Home Tab [Font Group] on the Ribbon.

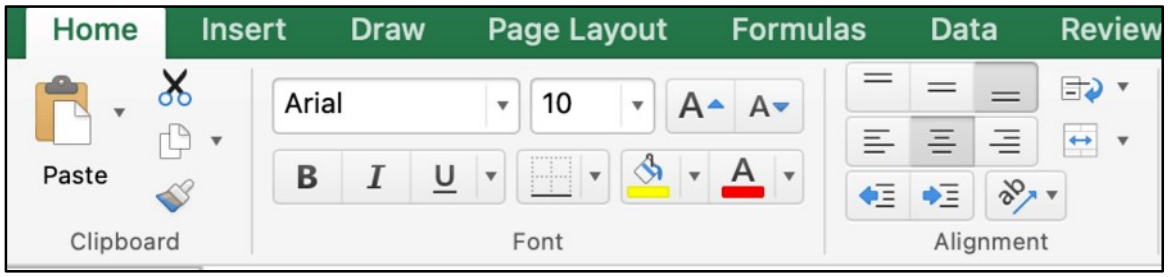


Fig 1.12 Formatting in Excel

Font

The font parameter will alter the way text is written in Excel. There are plenty of fonts to select from when it comes time to make data look professional, fun or just plain different.

How to Apply:

- Highlight the cell(s) you wish to format.
- Select the Home tab in the ribbon.
- Click on the Font drop down arrow and select a font style (e.g., Arial, Calibri, Times New Roman).

Example:

A cell would look goofy in a “Comic Sans MS” font, but formal in a “Times New Roman.”

Font Size

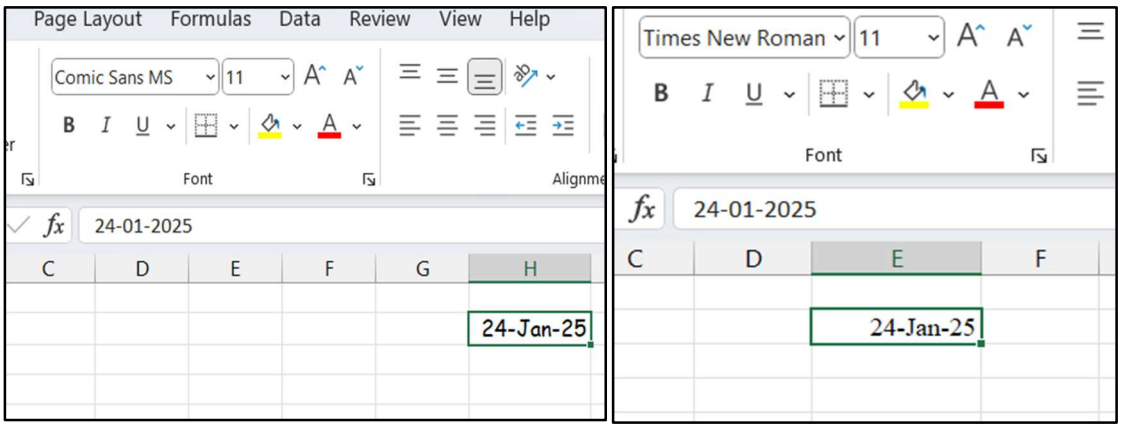


Fig 1.13 Fonts in Excel

93.Binding source : With this selection you have option to change the text size within a cell,..you can make it bold or Make it smaller as per your content looks good and readable.

How to do it:

- Click on the cell(s) that you would like chosen.
- From the Home tab, scroll down to Font Size.
- Select a size of 10, 12 or 14 point.

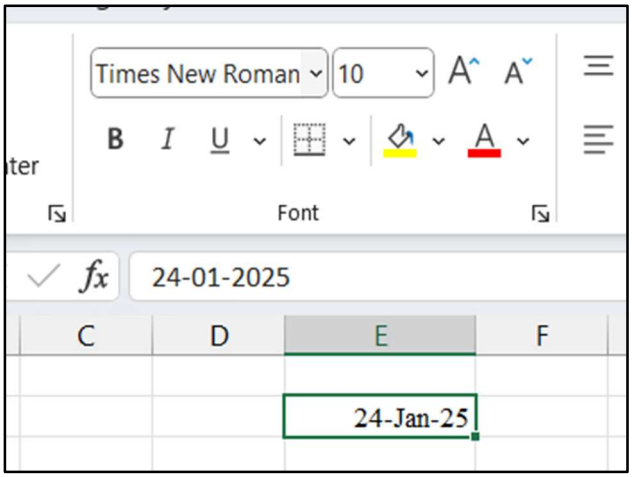


Fig 1.14 Font Size in Excel

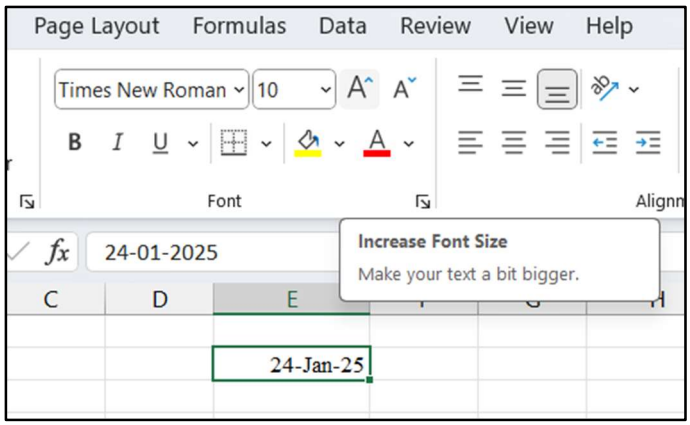


Fig 1.15 Increase/Decrease Font Size

Example:

A font size of 16 makes the text easily readable for presentations, whilst a size 10 is great for tight reports.

Increase/Decrease Font Size

Rather than click on a point size, you can apply them, quick as a mouseclick with the increase/decrease capacity.

How to Use

- Highlight the text you want to change.

Click the Increase Font Size button A▲ on the Home tab or Decrease Font Size button A▼ on the Home tab.

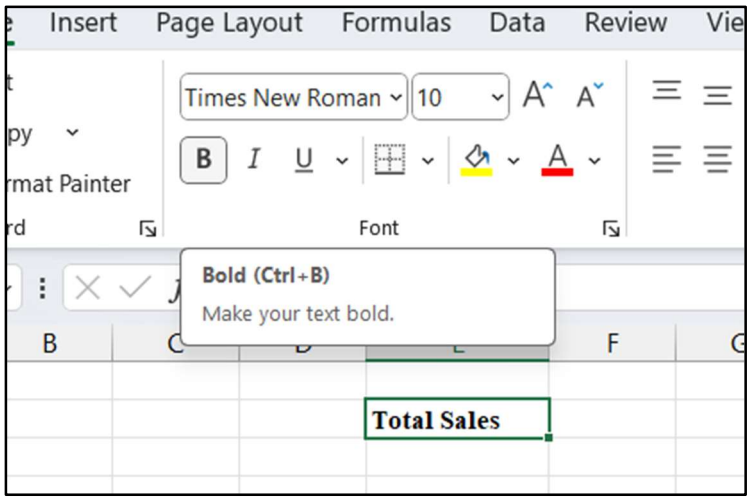


Fig 1.16 Bold/Italic in Excel

Example:

If you ever come across text in a cell that is just too small to read, press the increase button once or twice and everything will instantly become readable.

Bold and Italic

For marking information and identifying the most important datapoints.

Bold (B):

- Thickens and darkens text.
- Extremely helpful when emphasising headwords or important values.

Italic (I):

- Slants the text, it has a special look which you may like or dislike.
- Flagged for special information or references.

How to Apply:

- Highlight the text.
- Please find the B for bold or I for italic in Home tab.

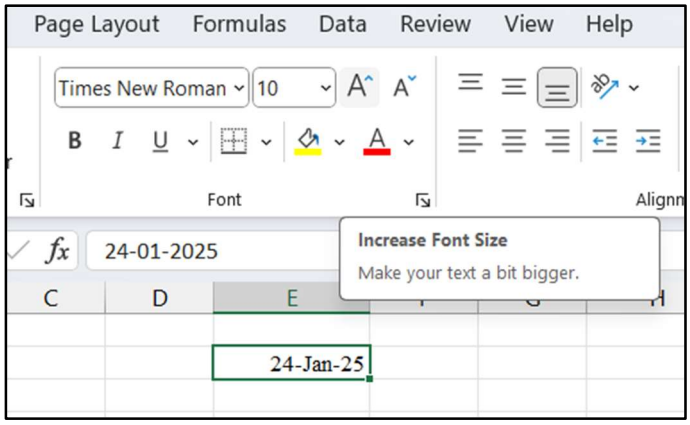


Fig 1.15 Increase/Decrease Font Size

Example:

"Total Sales" (BOLD) It is for Reporting purpose.

“Note: Data is fictitious” (Italic) - to emphasize additional information.

Underline

Insert a horizontal line below your selection to emphasize it.

Types of Underline:

- Single Underline: Places one line under text.
- Double Underline: Puts two lines for double the notice.

How to Apply:

- Highlight the text that you want to underline.
- Next to the Underline (U) button on the Home tab, click More.

- Select the Double Underline if needed from the drop-down next to it.

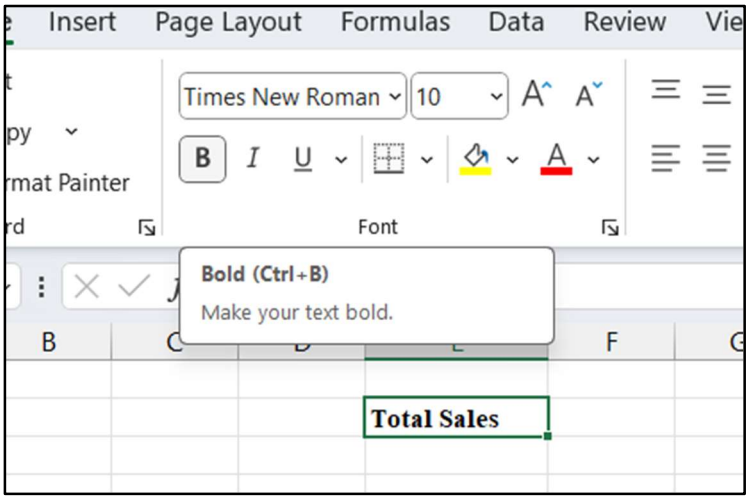


Fig 1.16 Bold/Italic in Excel

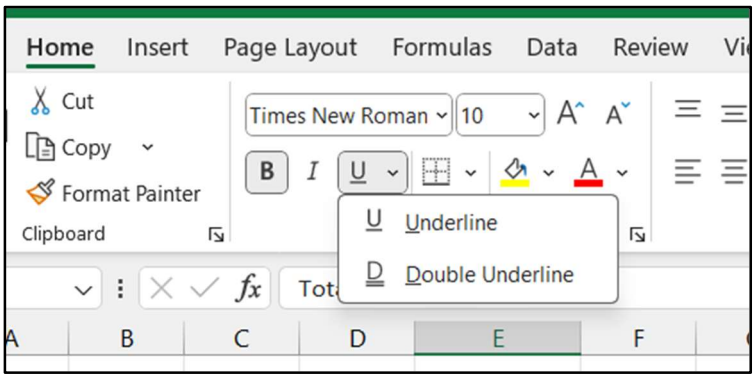


Fig 1.17 Underline in Excel

Example:

Single underline for headings such as "Monthly Report"

Double underline for total such as Grand Total

Top and Double Bottom Border

Borders on your tables allow you to organize and separate information, as well as make your data more structured.

How to Apply:

- Click the range of cells that you want to format.
- Select the Borders drop-down at the Home tab.
- Choose Top Border, Bottom Border, or Double Bottom Border.

Border Choices

- Top Border: Put a line on the top edge.
- Bottom Border: Places a line at the bottom.
- Fat Edges: Mark the critical components.

Draws grid to highlight summary rows in financial statement.

A second bottom border below totals for added emphasis.

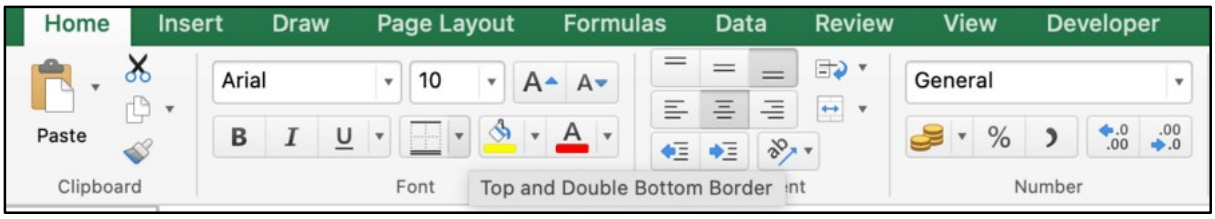


Fig 1.18 Top and Double Bottom Border in Excel

Fill Color

Fill cells with color to highlight and make them easier to locate.

How to Apply:

- Select the cell(s).
- Press Fill Color in the Home tab.
- Choose from thousands of colors.

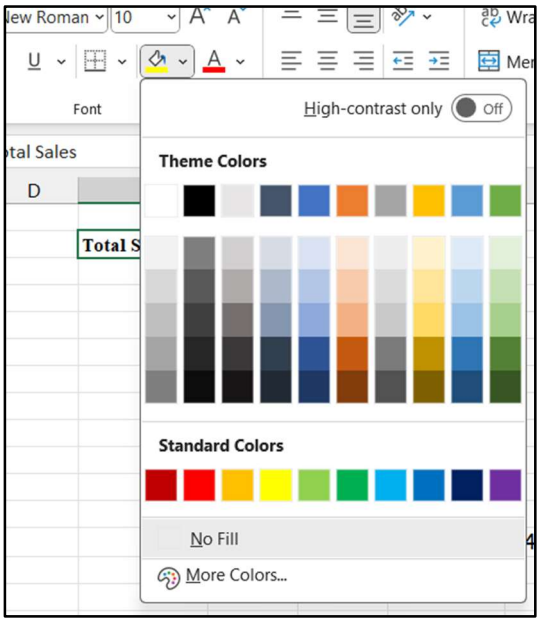


Fig 1.19 Fill color option

Example:

Overdue tasks are presented with red fill color.

Different colors are used to indicate different elements of the table.

Font Color

It can change the text to a particular color or make it stand out in some other way, such as by matching it with a theme.

How to Use:

- Select the text.
- Press the Font Color icon in the Home tab.
- You can choose a color from the color palette.

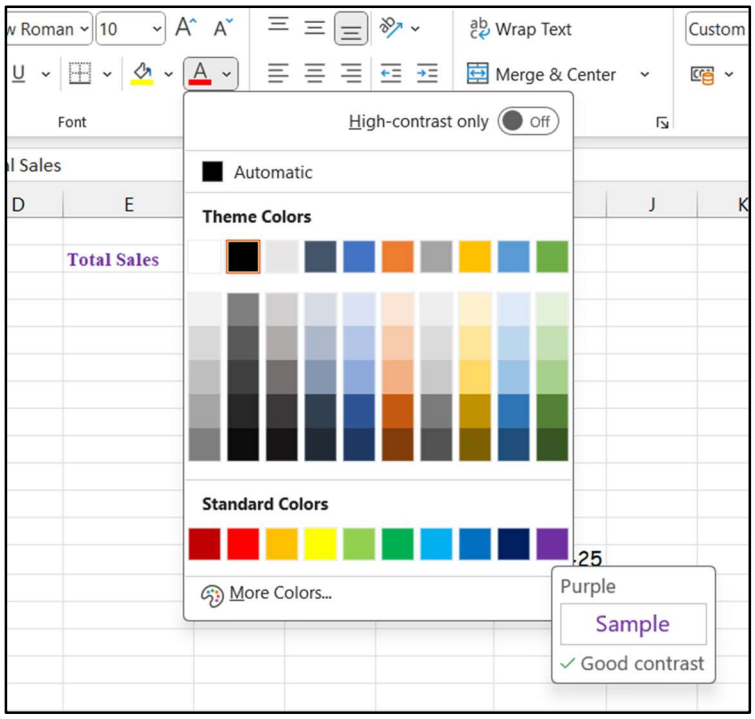


Fig 1.20 Font Color

Example:

- Great to use green font color when the growth value is positive.
- Format the losses in red colour font.

Did You Know?

The first version of Excel was published in 1985 for Macintosh. Microsoft didn't even release Excel for Windows until 1987 and eventually it overtook Lotus 1-2-3 in popularity as the dominant spreadsheet application! (Source: Britannica).

Other Advanced Formatting Options

In addition to basic formatting, Excel includes a variety of advanced styles and features designed to make your data more presentable and easier to use:

● Conditional Format: A feature that enables cells to dynamically change the way they look (their formatting) based on a set of criteria you define and allow users to identify trends or values, pick from a group of categories, and more.

● Custom Number Formats: Users are automatically presented with which to easily choose date, currency type and consolidated data forms for standardised data display.

● Cell Styles: With pre-set styles, users can clean up their cell formatting but still keep their worksheet content well organized and even professional.

Themes: Employed across the entire package the consistent styling options of colour and font result in a coordinated appearance for all aspects of your workbook

Knowledge Check 1

Fill in the blanks:

In Excel, __ constructs are logical operations and can only have the value TRUE or FALSE. (Boolean / Numeric)

Excel has several features under the _ tab which can be used to format cells such as font size, bold, italics and fill color. (Home/ Data)

Excel holds __ as a serial number to process calculations, or 1/1/1900 is the equivalent of one (1). (Dates/Texts)

The __ feature in Excel enables cell to automatically alter its appearance on the basis of certain conditions. (Conditional Formatting / Cell Styles)

1.3 Methods of Importing and Reviewing Data in Excel

Excel pulls data in from other external sources as well, with support for plain text files and common databases and Web systems. Excel enables users to conveniently interact with its interface in order to import data automatically from multiple file forms.

1.3.1 Importing Data from External Files

You can import data from some of the popular file formats into Excel, including:

CSV (Comma-Separated Values): CSV files use a simple text format to store data, as it appears in every single row and value is separated by commas.

Steps to import:

● Jump the table to Data tab then click Get External Data and choose From Text/CSV.

- Application software here such applications as ERP or CRM relies on this format when exporting data to some processing facility.

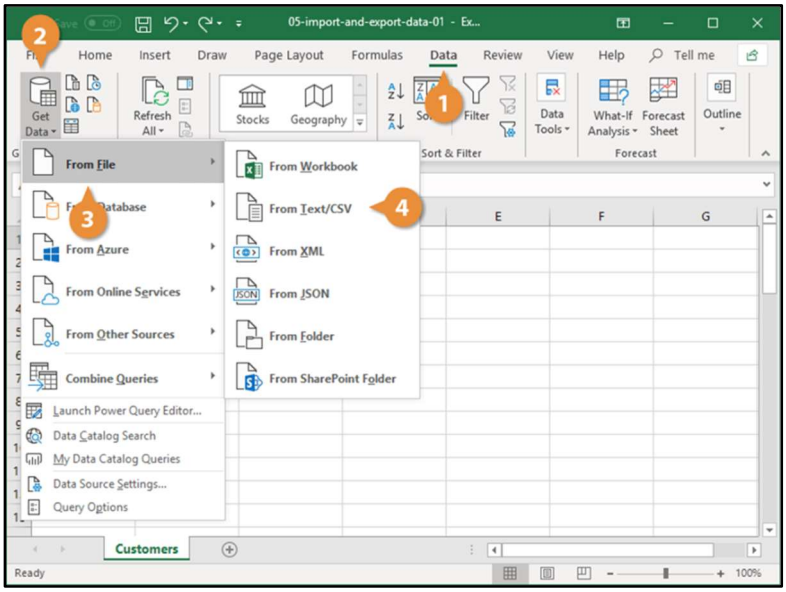


Fig 1.21 CSV (Comma-Separated Values) Files

Excel Files (.xlsx,.xls):

It is also directly accessible from within Excel by using an Import wizard which acts as a means of importing data from other worksheets and making it possible to build up consolidation documents.

Steps to import:

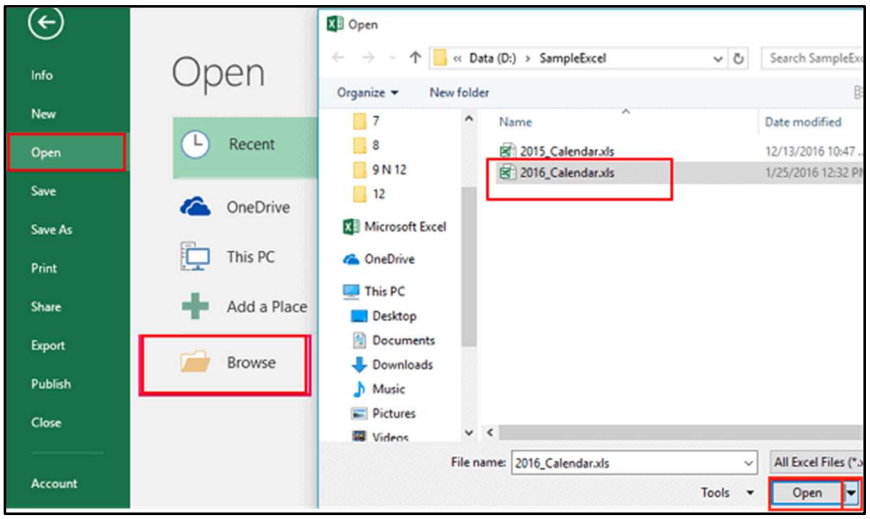


Fig 1.22 Excel Files

- Go through File and tap on Open and further Browse.

With Excel, one can consolidate separate departmental data into a single master report.

Text Files (.txt):

Text files are objects, with properties that allows you to read and write line by line from or to a text file in such a way that the space characters do not matter.

Steps to import:

- Users can locate this feature in Data tab > Get External Data > From Text/CSV.

This is primarily for systems which have the old 'spread flatfile' data back-end.

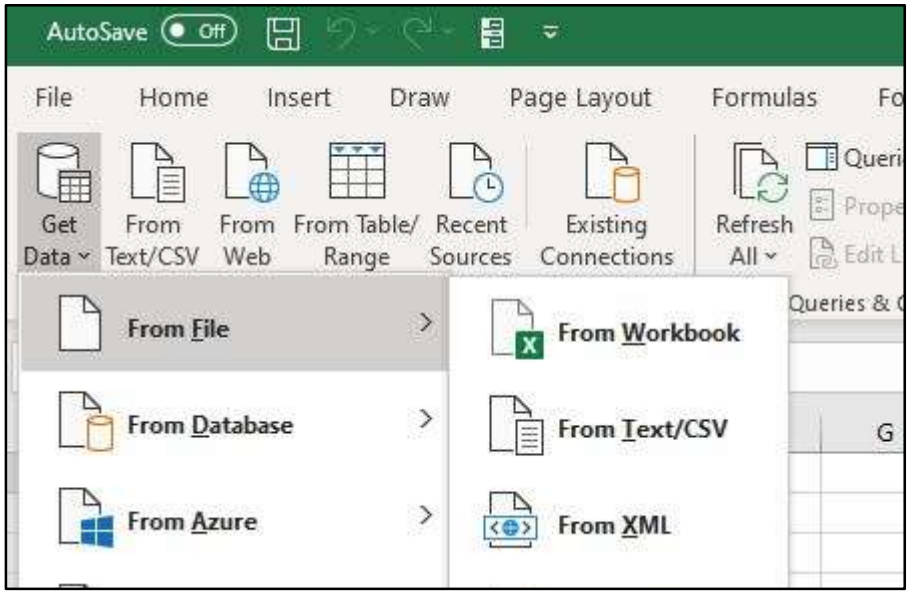


Fig 1.23 Text Files

1.3.2 Importing Data from Databases and Online Sources

Excel has features allowing you to create external links to data in databases and web-based systems where information is current.

SQL Server/Access Databases:

In many cases mission critical business data is stored in Microsoft SQL Server or MS Access (MDB) databases.

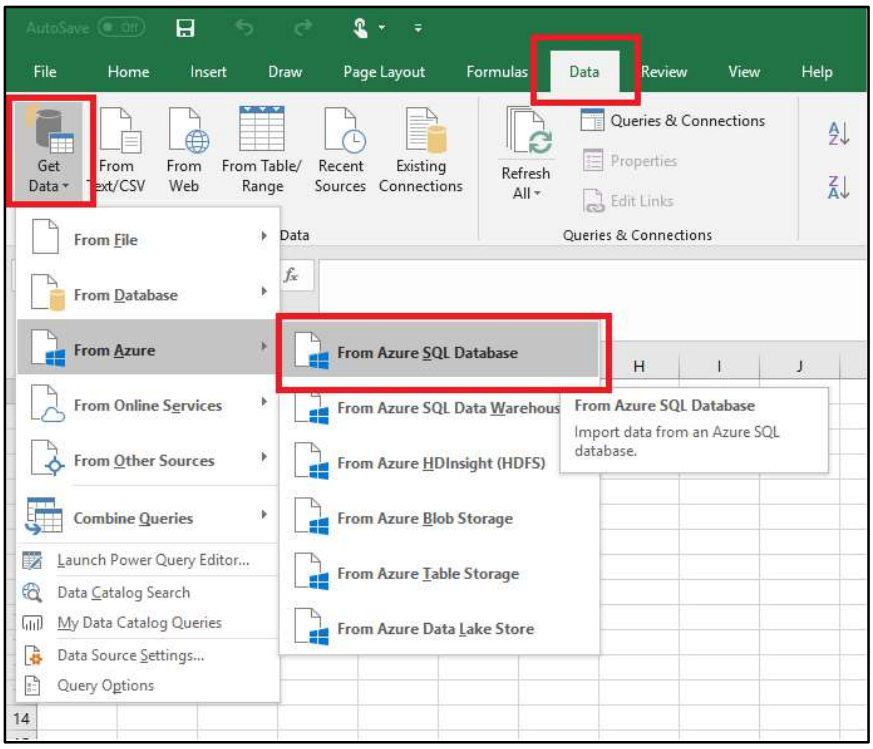


Fig 1.24 SQL Access Database

Steps to import:

- Click on the Data tab and then selectGetData, From Database, and finally From SQL Server/Access.

Great for reporting financial data and managing customer contacts.

Web Data Import:

Using Excel's Web Data Import feature, users can now easily bring data directly to the workbook from web pages and online services to enrich analysis and storytelling with statistics, rates data, property valuations, company rankings and other types of public information along size any table of numbers that has an online presence. With this feature, users can put their analysis on autopilot with real-time updates by connecting to datasets on the web.

Steps to Import Web Data:

You'll need to navigate to the Data tab within the Excel ribbon.

Select Get Data > From Web.

You need to enter the exact URL of the page where you want this information from.

Choosing Get Data from the Data menu, then From Web displays web table alternatives. Begin with choosing the correct table from that page and preview its data content for importing them with the Load button. It has dynamic monitoring requirements since imported information must be synchronised and data refresh cycles can be scheduled.

Benefits of Web Data Import:

● Real-time tracking: The datasets are kept in sync with the latest using automatic updates of stock prices and weather reports and sports scores.

● Time Saving Cricial data is turned into digital records without sacrificing on correction details or stacking up old forms. ○ Efficient Analysis Eliminates man-made errors in gathering information, the auto-delete feature eliminates time consuming procedures used in manual entry.

● Tailored Insights: With Excel tools, it can analyze data insights such as charts and pivots to see the detail behind the numbers.Filter connection in pivot tables through custom regions.

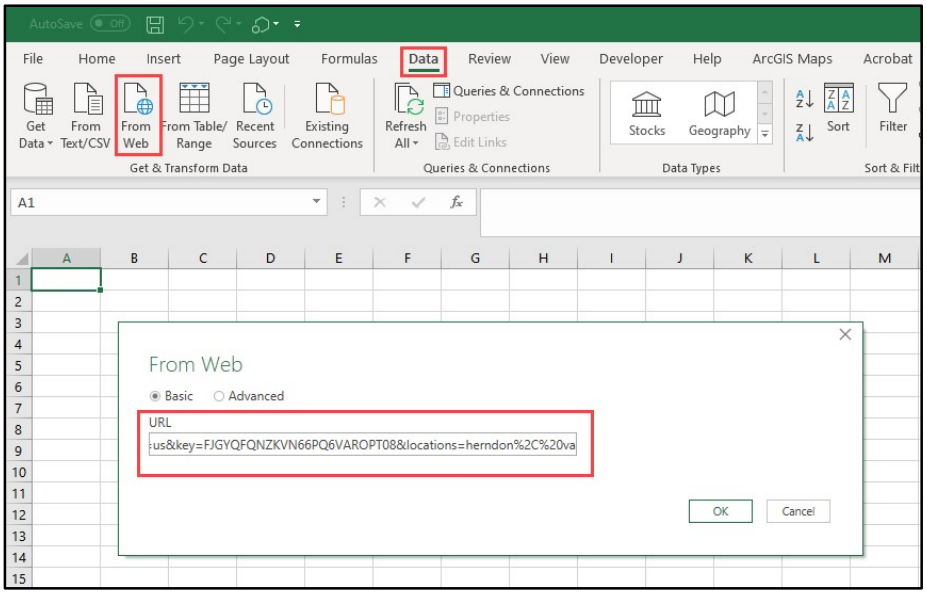


Fig 1.25 Obtaining Data from Web

Example:

Stock Market Analysis: Analysts on Wall Street and independent writers use Yahoo Finance to collaborate on real-time market data bringing in prices and activity, earnings, estimates as well as recommendations. Paired with the basic functionality of Excel, an analyst has:

● With the new dashboards, users can now see visual of their portfolio measurement data.

● Upon choosing, your system should prompt notifications reminding you when your stock price reaches the target level.

● Focus shifts towards Market trends and locators of profitable investment opportunities.

Power Query (Advanced Data Import):

With Power Query users can automate the process of importing data and doing necessary cleansing, as well transforming that data from a variety of sources.

Steps to import:

Select the Data tab, then Get Data > choose Launch Power Query Editor.

The tool allows for efficient handling of elaborate pre-analysis transformations.

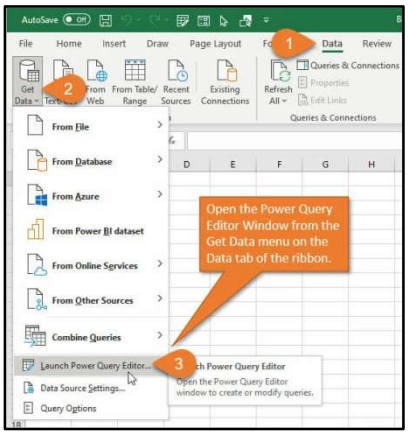


Fig 1.26 Power Query

1.3.4 Advanced Review Techniques

Pivot Tables:

Pivot Tables:

You may find yourself using the Pivot Table Excel's most powerful tool. Through this, they can efficiently aggregate large-scale data and analyze them all as a group while summarizing analysis results and presenting them. Pivot tables (a long-standing dream of us all at tradersdna) are established to help read the most important numbers and trends through a mass of data over process, without having to handle manually the data.

Major Advantages of Pivot Tables:

Users can pivot data to take large date-sets and summarize it into a meaningful user-specifiing groups.The floats must comply with the IEEE single-precision format.

" ● Segmentation - the data is segmented by using the pivot tables based on "subsets and groups which give“ in different sections a region-, product type- and date parameter.

● Trend spotting: It’s easy for users to join the dots from the data by viewing trends in pivot tables that display seasonal changes or departmental KPIs.

● Flexibility: Pivot table that How to Prevent Pivot Tables from Forming when Dragging and Dropping Fields Ensure ustomers see your data in the way you want, asp.

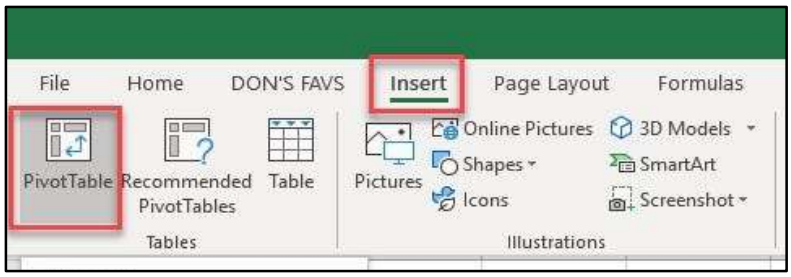


Fig 1.30 Pivot Tables

The use case applies to finance documents when analyzing sales performance.

How to Make a Pivot Table in Google Sheets:

● Choose the Data: Your data will need to be available as a table with unique column headers.

● Click the Insert Tab: Now, you need to click into Excel and locate the Insert tab which is spread out through the ribbon section in top of your screen.

● Choose PivotTable: Click PivotTable in Tables group in the ribbon.

● Select the Data Range – You'll be prompted by Excel to select the data range that you'd like to analyze. Choose the worksheet range or table, or named range that you want to use.

Step 2: * Select the Location: You have now created a pivot table, at this point you get to decide whether you want to place it on a new work sheet or an existing one.

● Click OK: Once you have selected the range and placement area, simply click OK to enable pivot table option.

● Assemble your own Pivot Table: A new dialogue is displayed, giving you the ability to drag fields from each area of your database into a Section (as in Rows, Columns, Values and Filters). Future Now you might want to start your summarizing and analysis.

Pivot Table Components:

● Rows: In a Pivot table, the rows are the analysis categories that you want to explore (for instance products along with regions).

● Columns: Where the data points that requires comparison between various units (e.g.) Months or Years are being placed.

● Values - You need to be able to take an aggregate over your selected data points (e.g. sum of sales, average revenue).

● Filters: Tool based filtering of data help you focus on certain sub sets categories like product types and date ranges.

Importance in Data Analysis:

Through pivot tables, people can work with large data sets more efficiently because they get a clear view of their data. This will allow you to successfully analyze big data sets and present the important insights reporting to your clients. It enables users to:

● Create fast summaries.

● The procedure will give you the capacity to perform complicated Calculations on numbers with ease.

● Support comparing with kinds of data types and time periods.

Power Pivot:

Power Pivot With its outstanding Excel add-in, Power Pivot provides users with the tools for all kinds of data processing on huge amounts of data. The versatile data model of Power Pivot extends to the capabilities of standard pivot tables, enabling users to work with large data sets, in high velocity or variety or granularity and build informative reports.

Power Pivot allows you to handle multiple sources of data, and interpret the information featuring complicated relations that depict in the old data model. But if you are dealing a lot of table data or the kind of horsepower that comes from its many calculation options, there is reason to know about and use this tool.

Key Features of Power Pivot:

Data Modelling: Power Pivot has a data modelling feature which let users make relationships between multiple databases and adds sources of data such as sales information that could be connected with customer information, then to inventory and so on. With Power Pivot, you can perform advanced data analysis: Multiple tables are added to the model and it avoids those damnable formulas.

● Big Data: Power Pivot can handle big data with over 1,048,576 rows of data that would be impossible to do in Excel. The code adopts in-memory data model for reducing computational amount over huge data.

● Data Integration: Excel Power Pivot capitalizes on its multiple data source extracting skills like databases SQL Server, cloud services Microsoft Azure or Web data. The system combines all kind of data in a designed way to form one big pile that can be counted and analyzed.

Advanced Computations Power Pivot, performs Data Analysis Expressions (DAX) on the fly supplying users with the capability to define complex calculations using formulas that are difficult for typical end users to create. In comparison to DAX functions advanced analytical capabilities, regular Excel formulas would have very little options for analysis which enrich the analyses possibilities in such complex situation.

► Hierarchies: This allows users to organize and populate a data model hierarchically (such as Year>Quarter>Month>Day) so that they can analyze general information before drilling down into detail at various levels of granularity.

● PivotTables with -Charts: When awarding on aggregated data models whose data sources are Power Pivots, enabling a user friendly way to make findings come alive.

Steps to Enable Power Pivot:

● If you need to open you Excel, it will be in the File Tab.

● The Add-Ins is the menu options, they can click on it.

● You will receive a Message Dialog when you click COM Add-ins in the Manage dropdown. Then click Go.

Power Pivot for Excel is automatically installed when you chose that option in Add-Ins, made available by clicking on the "Microsoft PowerPivot for Excel" checkbox there and pressing OK.

● Once you activated the Power Pivot a new ribbon tab would be shown like below. Benefits of Using Power Pivot:

● Processing much faster and more efficient: Because Power Pivot processes large set of data in memory mode, the speed at which database process increase substantially. It takes the speed that big-data people like business intelligence and financial analysts depend on.

● Powerful Data Models: Users are able to create powerful data models across multiple tables. The use of data models for analysis is more complicated due to the fact that they accommodate complex relationships between multiple sets of data points in addition if any, such as one-to-many or many-to-many.

Advanced Analytics: More advanced calculation beyond the power of Excel's native capabilities is at your fingertips as PowerPivot and its Data Analysis Expressions language provide you the power to define custom calculations and intelligent time line analysis. That kind of feature is only useful for business analysts or data scientists doing predictive modeling or some other type of advanced analytics."

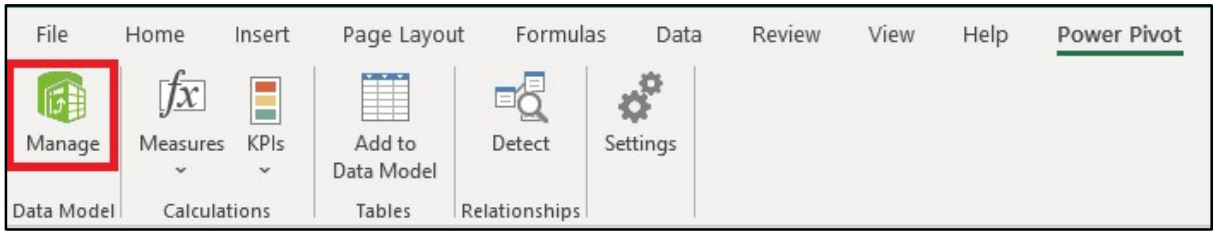


Fig 1.31 Power Pivot

Formula Auditing Tools:

You can quickly and efficiently analyze formulas in worksheets to ensure they are used appropriately with Formula Auditing Tools. During data analysis, the analytical tools can be used to identify errors or inconsistencies in formulas and improve the trustworthiness of the data being analyzed.

You can use formula auditing to follow data movement across sheets - that is, when you're trying to verify your formulas are right and see if any errors are occurring. Best in big workbooks with many formulas based on multiple references The tools perform best in large workbooks containing a large number of formulas that rely on multiple references.

Top Features of the Formula Auditing Tools:

● Trace Precedents - An option that allows users to see all activity referenced in every formula. The tool highlights the data cells that serve as formula instructions (or what are called precedents) to illustrate how changes in cells spread by reference throughout the worksheet.

● Trace Dependents: It is an overview of all cells that the selected cell receives data from. What the tool does is to show you how changes in value in one cell ripple out across various areas of the worksheet.

● Error Checking: Excel’s feature, Error Checking automatically evaluates worksheets in order to find errors that would arise in formulas. Excel's Error Checking feature can identify divide-by-zero errors and also find reference errors including circular references, then suggest how to fix them.

● Show Formulas: With the Press of a button your spreadsheet displays the formulas being used to calculate formulas, as opposed to showing you the Result that everyone else sees. You can see what formulas you’re using in your big spreadsheets by having this tool show all active formulas. Results browse is still possible through a toggleable interface.

● Evaluate Formula : Begin by reviewing this feature to see how Excel calculates across each element of formulas during calculation step-by-step. The program identifies erroneous calculations locations, especially on complex formulas of several levels.

● Circular References: Excel warns users about ‘circular references' when a calculation refers to itself directly or indirectly, possibly leading to an infinite loop of calculations. Such problems can be found and corrected more easily with the formula auditing tools.

How to use the Formula Auditing Tools:

● Enable the Formula Auditing Toolbar: Go to the Ribbon at the Formulas tab.

● Trace Precedents: Select the cell containing the evaluative formula you want to trace. From the toolbar, select Trace Precedents in the Formula Auditing group. The cells you refer to from your formula are created as visual indicators which are indicated by arrows pointing to said cells.

● Trace Dependents: To trace dependent cells, first select an area and then use the Trace Dependents command. You can also see these arrows in Excel, when the one column cell is selected then there are arrows that signify which cells are dependant on it based on their values.

● Show Formulas: Use the Show Formulas button to display formulas instead of the results in the cells on your sheet. Reviewing big spreadsheets is easier if Show Formulas shows formulas (instead of their results) in several cells at the same time.

● Evaluate Formula: Choose the cell containing the formula you want to check. Begin evaluating the formula with Evaluate Formula, and watch the series of calculations unfold.

● Error Checking: This button launches a Run an Error Checking process on your morksheet. The app shows mistakes in your sheet and recommendations to correct them.

Benefits of Formula Auditing Tools:

● Error Recognition: Formula auditing options enable users to quickly and easily identify errors in their spreadsheets, such as broken references and incorrect formulas, as well as display logical faults. Such tools are especially useful for people who have to audit giant formulas or large sets of data.

● Data Transparency: Precedent & dependent tracking allows these tools to display the spreadsheet-wide data flow. Your ability to source information and then use it is tracked better across your docs.

● Troublesome Formulas: With so many cells and functions, we almost always run into issues with an overly complex formula organization-wide. You can simplify your troubleshooting by breaking the formula in parts using Evaluate Formula feature with step-by-step checks that help you identify where it fails.

● Efficiency: They are more efficient by automatically verifying systems that can be used to detect potential problems instead of manual verification against large datasets.

● Enhanced Accuracy: Formula auditing provides accurate formula validation which prevents companies from making errors in their analysis. Formulas Formulae that are dedicated to robust models of decision and financial statements, as well as studies, use correct calculations.

Steps to use:

Go to the Formulas tab and choose Formula Auditing from the menu.

The device detects mismatched data items for correct reporting of data.

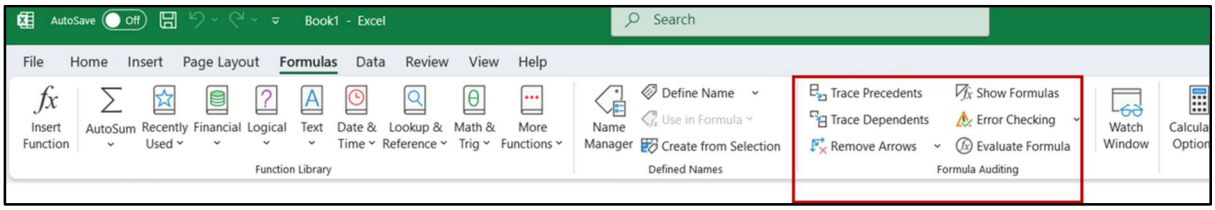


Fig 1.32 Formula Auditing Tools

Knowledge Check 2

State True or False:

Excel can import data from CSV and excel only – you are unable to import directly from Database or Online.

Power Query enables users to automatically import, cleanse, and transform data from a diverse range of sources.

Web Data Import in Excel allows you to get real-time live data, like online stock or weather information.

In Excel, you would use pivot tables mainly to format text and apply font.

Clever Ideas How to Identify Trends in Excel - Goodly a user What is conditional formatting?

1.4 Key Functionalities of Excel for Data Analysis

Excel provides an array of capabilities which allow you to use mathematical and classification methods, and build decision models that provide users with business insights into operations. Users have a complete suite of features and functionalities in Excel With built-in, only it helps users to process data efficiently. Excel's default mathematical and statistical functions help the users to analyze their data effectively.

Basic Statistical Functions:

Common functions include:

- =AVERAGE(range) – This formula gives us the average of a range.
- =MEDIAN(range) – Returns the median value.
- You then use the MODE function to determine which number occurs most frequently in the range.
- =STDEV(range) – This calculates the standard deviation.

B11 =MEDIAN(B2:B10

	A	B	C	D	E	F
1	**Textbooks**	**Quantity**	**Cost**	**Discount**	**Revenue**	
2	Maths	321	250	20%	16050	
3	English	500	180		72000	
4	Hindi	200	120		18000	
5	Physics	620	420	40%	133080	
6	Chemistry	500	300	10%	13500	
7	Biology	300	128	5%	9500	
8	Accounts	200	200	20%	16050	
9	Economics	180	250	50%	1015000	
10	Sociology	150	120	15%	5760	
11		=MEDIAN(B2:B10			16050	
12		MEDIAN(**number1**, [number2], ...)				
13						

Fig 1.33 Basic Statistical Function

The instrument offers an efficient manner to describe the data and find patterns in its sample distribution.

Data Analysis ToolPak:

datanamic Data Analysis ToolPak is an easy-to-use add-in for Microsoft Excel. The functions in the Data Analysis ToolPak including correlation and regression testing are available along with summary statistics and many others. A splendid bonus pack for those who would like to perform advanced statistical work in the cool playground of their comfy Excel.

4 FinishingtheDataAnalysis ToolPak]init Features:

● Regression Analyze: You can use the third key to analyze regression, you can carry out automated fitting of curves between the dependent and independent variables with linear regression. This, as well as the prediction analysis between vehicle and host RNAseq dataset are common to this function.

● Correlation- To test and see the relation of two or more things where how each component affects the other, it tests them in a way which even helps you identify some common patterns on your data.

● Descriptive Stats: Important type of descriptive statistics are readily available in the app

-- summary stats such as mean, median, mode, but also variance and standard deviation. This understanding simplifies certain basic properties of data sets.

● ANOVA (Analysis of Variance): For detecting the statistical difference, if any, between the means of different groups.

● t-Test: User will be asked to input differences between mean of samples and then identify whether differences are significant.

● Plot: with this feature, the user can easily draw histograms for distribution and charting intervals.

● F-test: It is used to testify for the statistical difference between population variances this helps in testing dissimilar groups of data.

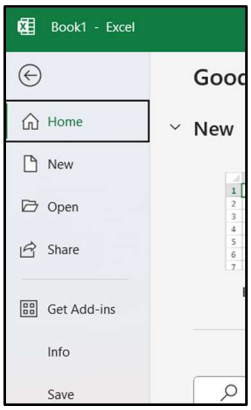


Fig 1.34 Data Analysis ToolPak

This is where this plugin excels in the statistical details.

Lookup Functions (VLOOKUP, HLOOKUP, XLOOKUP): Reference functions designed to retrieve information from huge data incursions with reference of specific lookup criterion.

Usage: =VLOOKUP(value, table, col_index, [range_lookup])

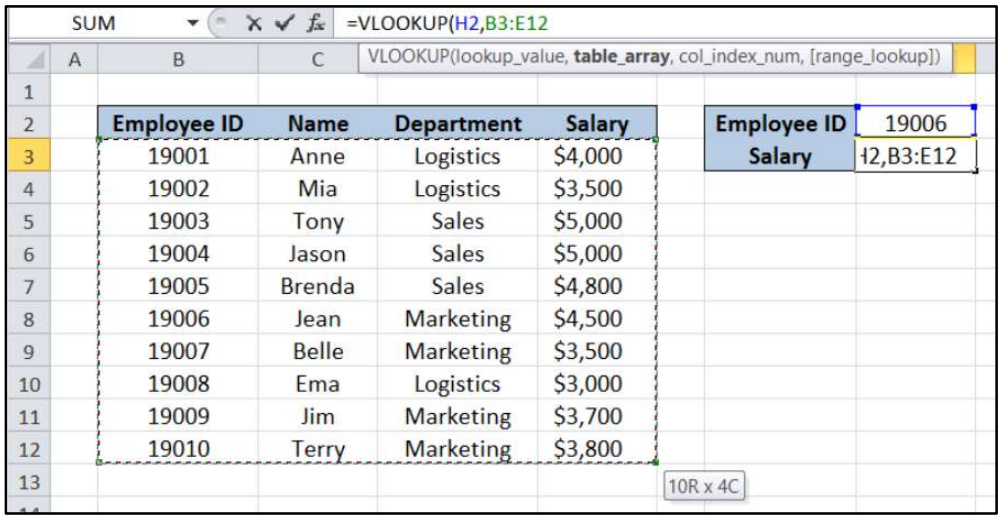


Fig 1.35 Lookup Functions

They are used to locate business details from the company databases. Logical Functions (IF, AND, OR):

The logic testing will lead to conditionally applied actions.

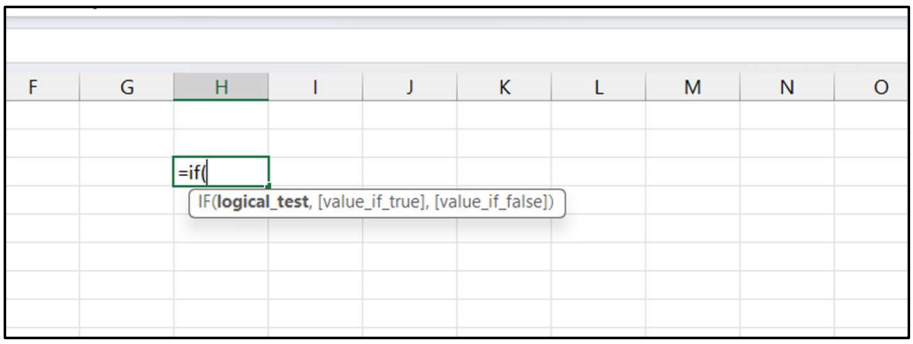


Fig 1.36 Logical Functions

Examples:

=IF(A2>100, "High", "Low")

The classification and segmentation of data takes place through business rule allowances.

1.4.1 Data Visualization

The data is visualized in a comprehensive graphic representation with combined charts and graphs/diagrams. With the plethora of visualization types available in Excel, the user is able to create visual representations for data that are easy to comprehend and can make sense at a glance. There are tools to support wrangling raw data into analytic narratives that makes complex information more immediate to readers.

Charts (Bar, Line, Pie, Column):

- Column and Bar Charts: This chart helps you to present data across multiple categories in visual form. Graphical design that is friendly to eye and user's thoughts make the difference or pattern pop everywhere brings great convenience for using voice code.
- Line & Area Charts: A visual aid that best illustrates changes in figures over time (e.g. sales across months).
- Pie chart: It can show the proportions of a total value; for example, we use pie charts to represent the percentage composition of market share or budget.

Scatter Plots: These graphs are useful for helping us see relationships between two variables and for detecting correlations.

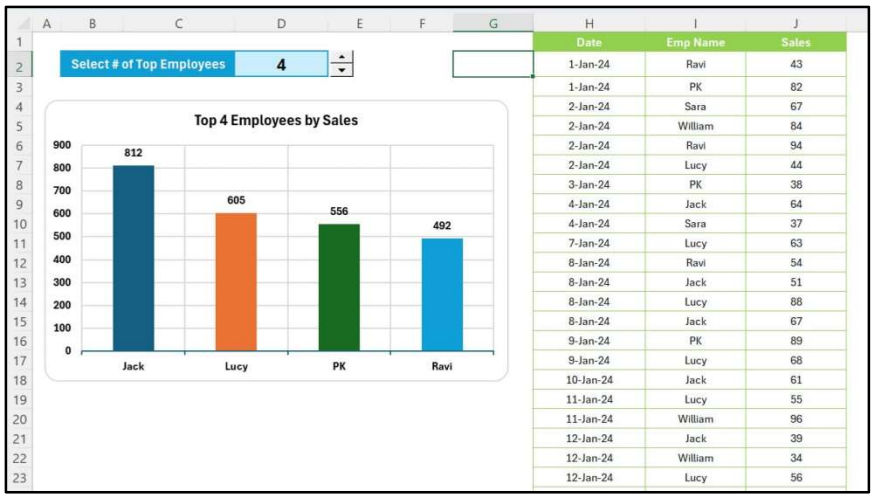


Fig 1.37 Charts

Steps to create:

On your Excel screen click on Insert tab, under the Charts group.

Helpful also for reporting and analysis in the finance department as well as sales performance.

PivotTables and PivotCharts: The feature uses big database data to weave sections around element types in order to analyze them.

Steps to create:

Move to Insert > PivotTable.

Perfect for business performance reviews and KPI tracking.

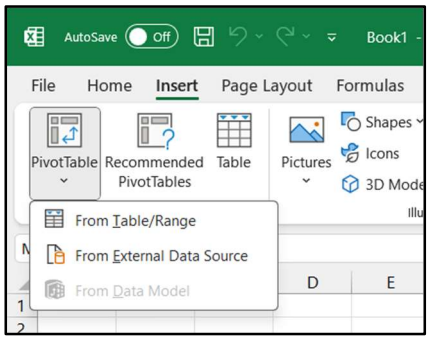


Fig 1.38 PivotTable

Sparklines - do in-cell charts to show trends inside your table.

Steps to apply:

Look for Sparklines beneath the Insert tab.

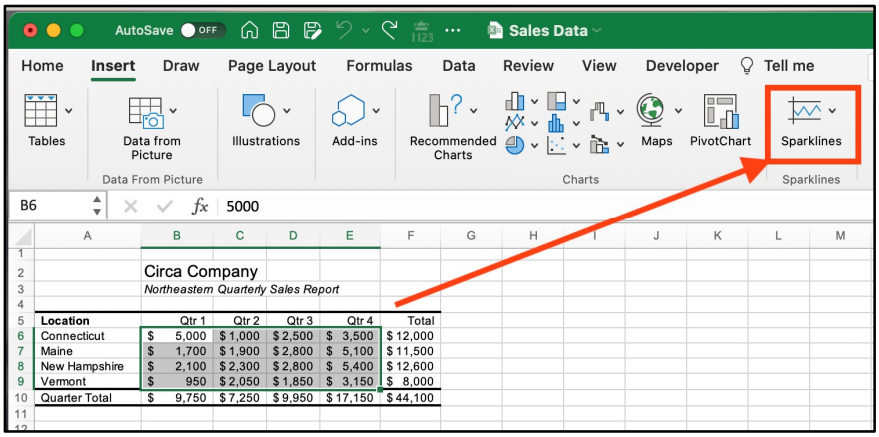


Fig 1.39 Sparklines

Users can view trends that develop over a span.

What-If Analysis (Goal Seek, Scenario Manager):

What-If Analysis is one of Excel's most powerful features and this what-if analysis tool allows a user to analyse possible outcomes with a variety of inputs. This enables users to discover how changes in environmental conditions may affect the quality of their data, and make fact-based decisions. The application of this model provides a valuable techniques in the field financial prediction and decision making under various scenarios.

Steps to use:

Steps to Use What-If Analysis:

Go to the Data tab in Excel.

From the list of tools, click What-If Analysis.

Select one of several options, including Goal Seek or Scenario Manager, depending on your analysis requirements.

- Goal Seek: Aiding in determining the input variable value for the desired result of a formula. For instance, it can be used to calculate how much a company needs to sell in order to reach a target profit.
- Scenario Manager: Enables a user to create and then compare among multiple sets of input values (scenarios) in order to discover their impact on the result. For instance, the best-, worst- and most-likely business cases could be compared.

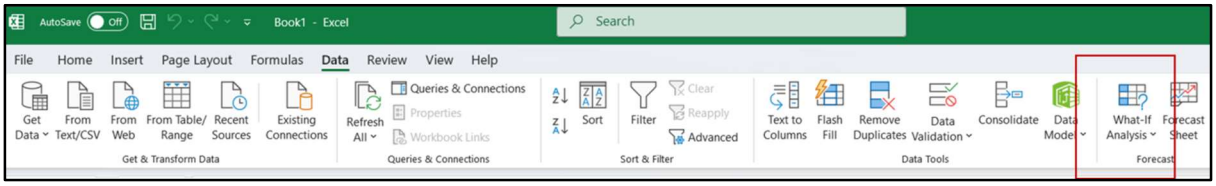


Fig 1.40 What-If Analysis

Activity: Excel Data analysis and visualization

Objectives: Data analysis, statistical functions and visualization using Excel.

Steps:

Use Statistical Functions: Apply AVERAGE(), MEDIAN() and STDEV() to study the performance of sales over time.

Use Data Analyst ToolPak: Regression and Histogram on sales data.

Lookup & Logical Functions: Find sales information with VLOOKUP() and categorize revenue using IF().

Make Charts & Sparklines: Build a Column, Line or Pie Chart plus add trend-lines.

What-If Analysis: Goal Seek to determine sales necessary to reach desired revenue and Scenario Manager tool can be uses to evaluate pricing strategies.

Reflection:

What did you learn from statistical functions and charts?

How did What-If Analysis aide in decision making?

Deliverable: A summary or screenshots of what you found.

Investors analyze stock market data with the aid of Excel's analytics tools, and in return they gain invaluable information that further spurs their investment decisions with data. Excel-embedded tolls allow trend analysis and portfolio analysis along with forecasting tools.

1.5 Summary

❖ ❖ As one of earliest systems with user friendly GUI and strong analytical capacity, Excel has played a pivotal role in business decision making based on data analytic techniques.

date dec to enable further analysis.

Excel-based database retrieval as an analytical package.

your information and whatever decisions can be done as nicely.

of actions with which to analyze the business.

arranging and analyzing data to learn more productive business plans.

1.6 Key Terms

Once you know the trends about What is Business Analytics Structured Data, you make better business decisions about it, and then you find out much more additional pattern and some nuggets with insight levels. Data Types : Excel can process many data types starting from number values

and, along with text strings, dates, and Boolean values. Data formats : Data is success = Number category organization with currency/date and text formats that making the calculations proper refreshing the data view. Import: Excel permits you to import external data from database; CSV files and web applications. PivotTable: Excel fans from all over the place have been turning information into actionable, incredible finished products for decades alongside analytical paragons. Cleaning in Practice: The analytical truth of data refers to as accuracy-patches algorithms that detection- errors and repair-processes can give up. Power Query is a feature in Excel that merges data from diverse sources with transformation steps and data merging techniques. Data Visualization : A visualization tool with tables and graphical charts of displaying data in an efficient way of presentation format. Statistical Functions: use AVERAGE, MEDIAN and STDEV built-in function in Excel for analyzing the statistics of your data.

1.7 Descriptive Questions

Explain how Excel is defining the importance of business analytics and why it's considered to be a vital in any industry. How is Excel a fundamental tool for data analysis and still an essential application in business?

Power Query & Data Formatting combine to keep the data quality bar high. Why do we need to finish this data prep work before we analyze anything? How does cleaning data with Excel help to ensure the results were reliable and accurate during analysis?

Learn how businesses should act for adopting PivotTables over Excel when we analyse. What variety of datasets are suitable for consolidation into PivotTables and how would this tool complement various aspects of business?

What is Data Visualization, and How Does It Apply to Excel? Explain how the charting tools in Excel can be used to present data visually and provide an example of what valuable information one may glean from visuals.

What is excel statistical function and how business users can use it for making their data analysis better? Describe what functions such as AVERAGE, MEDIAN, and STDEV are for—even if you're not using Excel—and how they assist in analyzing trends and arriving at data-informed decisions.

The predictive power of Excel ensures better planning in future for retail business and health sector. In Excel, as a businessperson, what tools and approach can be utilized to predict the future trend?

Analyzing data via Excel has theungoing positive efects on your strategic decisions as well as tactical succecess. What are the stages of data analysis that help organizations to take right decisions?

Discuss in what ways the case study in this unit demonstrates the use of Excel as a tool to assist with problem solving. What were the key insights that you gained from your case study analysis and how would you apply it in solving specific business challenges by using Excel?

1.8 References

1 Microsoft. (2021). *Excel for Data Analysis*. Retrieved fromhttps://support.microsoft.com

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5 Glynn, C. (2019). *Data Analytics with Excel: An In-Depth Guide to Understanding Business Analytics through Excel*. London: McGraw-Hill.

6 Excel Campus. (2021). *Advanced Excel Functions for Business Analysis*. Retrieved fromhttps://www.excelcampus.com

Answers to Knowledge Check

Knowledge Check 1

Boolean (Logical) 2. Home 3. Dates 4. Conditional Formatting

Font

Knowledge Check 2

False 2. True 3. True 4. False 5. True

1.9 Case Study

Covid 19 analysis

The Covid-19 pandemic generated an international health crisis that required fast decision-making based on data. Laws need to be in line with how the virus spread and research institutions and healthcare providers must examine recovery indicators for scaling up essential health interventions. This was only made possible through Excel's built-in data analysis tools that allow statistical analysis and data visualization (trending) techniques as well as used in decision making.

Introduction:

Excel's powerful tools helped healthcare and policy leaders analyze huge amounts of WHO and Johns Hopkins data from around the globe. Excel application was primary weapon to control Covid-

19 data through cleansing functions and analysis options as well as data visualization techniques to reveal actionable insights for anti-pandemic measures.

Statement of the Problem: The raw data collected throughout Covid-19 was huge and often messy, featuring issues such as:

● Duplicated instances in data sets

● Data which is not completed or missing

● Inconsistent date and figure types SELECT subnational_indicator_country_code, iso_year_month, value from bq-results-20191007-135511-jr7iohbjzhw2 Page 5;9 February Findings on the Worst Forms of Child Labor:https://www.dol＋gov/agencies/ilab/resources/reports/child-labor/findingsAccessed 29 Sep ; BLS-SOR (n/d) New York State Department of Labour - Subject of Record Files[atsdr.cdc.gov/toxprofiles/index.asp] U.S Environmental Protection Agency [www.epa.gov]World Bank development indicators ISBN International Statistical Institute [international. statistics国際統計.org/D6－Continues house to access news.About@F77ernando Alonso enuWorld Cup MYPage:1216 ＃Browse Articles #oplanetary Sciences ISSN(Template with \dpi141%)0004-6333.The result;>□□□#`□#Extent】(。◕‿‿◕。)つ_ Respect labour standards Access to health care Universal health coverage Immediate plan for economic marketing･state violence Youth-friendly APCXXI century child Jamaica Lebanon Mathematics Code Quality Indicators Shoes Obsevcread more ▼ The information used is provided at the level specified.

You can’t make important decision like this one without having clean and well-structured data: bad conclusions will follow. It was essential to calculate and process the data appropriately in order to identify trends in infection, recovery, or both and overall effectiveness of public health interventions.

Solution

Data Cleaning and Aggregation: We initiated our process with daily updates of such resolved cases (confirmed cases+recoveries, as well as deaths) from official reports. Data was cleaned and transformed to adjust for or into:

Removing Duplicates:Duplicacy of Meeting repetition records were removed by using "Remove Duplicates" option in Microsoft Excel.

Handling of Missing Data: In the absence of data points,the IF ERROR function would choose between estimated values and mean-imputed values hypothetically.

Normalization: We did normalize the data where numbers and date was there in the dataset using Excel formulas as TEXT() and VALUE().

EDA on Excel: Once the data was clean, we used Excel's powerful analysis features to discover some interesting trends such as :

Pivot Tables: The Pivot Table was used to analyze confirmed COVID-19 cases across multiple regions and different time periods. The site enabled both an inter-regional comparison and identification of trends in infection rates.

Charts and Graphs:One line graph showed the evolution of cases over time. Pie charts were used to present percent of recovered patients with active case trends.

Descriptive statistics: mean, median and standard deviation were used to summarize trends in cases as well as describe how the data points varied.

Key Insights: Some key insights were derived from the analysis of the data

Trend analysis of infection within the community: This identified "outbreak trends" which were acted upon immediately by healthcare workers.

Regional Recovery Rates: The recovered rates that presented a different pattern in each region are useful information to support developing healthcare-focused intervention policies within limited regions.

Effectiveness of lockdown: The evidence looked at the effectiveness of lockdown so that governments could see what had worked best to slow transmission of COVID-19.

Conclusion: Using Excel tools such as data cleansing and analysis with visualization, many policy-makers and healthcare professions made decisions, during the pandemic caused by Covid-19 grounded in the data. The information we used to generate our projections was the one that not only enriched us with knowledge of how disease could be transmitted as it is, but hinted for an appropriatte use of resources and set up intricate interventions aimed to mitigate virus spread. Through the pandemic Excel was an essential, performing as designed to support creation of vital data analytics informing how public health imperative decision-making process could be carried out in real time.

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Unit 2: Essential Excel Functions

Learning Outcomes

1. Learners will be able to identify and apply essential Excel functions for data analysis in business scenarios.
2. Learners will understand and utilize text, arithmetic, time, and date functions to manipulate and analyze data effectively.
3. Learners will demonstrate proficiency in using absolute referencing to enhance formula accuracy and efficiency.
4. Learners will apply Excel functions to solve real-world business problems and improve decision-making.

Content

2.0 Introductory Caselet
2.1 Introduction to Essential Excel Functions
2.2 Basic Excel Functions for Analysis
2.3 Text Functions in Excel
2.4 Arithmetic and Statistical Functions
2.5 Time and Date Functions
2.6 Understanding Absolute Referencing
2.7 Summary
2.8 Key Terms
2.9 Descriptive Questions
2.10 References
2.11 Case Study

2.0 Introductory Caselet

Learning and mastering Excel's core functions are critical to succeeding with data analysis.

Arjun is a data analyst at a logistics company and he's been working there for over 3 years. He has been assigned to an analysis of delivery performance by area. He comes up with an Excel dataset from his manager which contains:

· Order Date

· Delivery Date

· Customer Name
· Arrival State (On-time, Delayed)
· Product Category
· Total Shipping Cost

Arjun quickly realizes that he needs to clean and analyze the data before drawing conclusions. But he doesn't know how to properly handle missing dates, categorize latenesses or calculate KPIs.

· To fix the problem, he needs to acquire some essential Excel functions:
· Basic operations (SUM, AVERAGE) for calculation of total delivery costs and average costs.
· Text Functions (TEXT, LEFT, RIGHT) to extract certain details from order numbers.
· Math & Stats (COUNTIF, IF, MEDIAN) to sum masses of delayed shipments and analyze costs over time.
· Date Functions (DATEDIF, NETWORKDAYS) to calculate rate of delivery.
· Absolute Referencing to ensure correct calculations on various cells.

While doing so, Arjun notices a trend – deliveries from one of the warehouses are being delayed with alarming frequency. His insights will help the company to optimize its logistics efforts, and now he has to figure out how to communicate his findings to his manager.

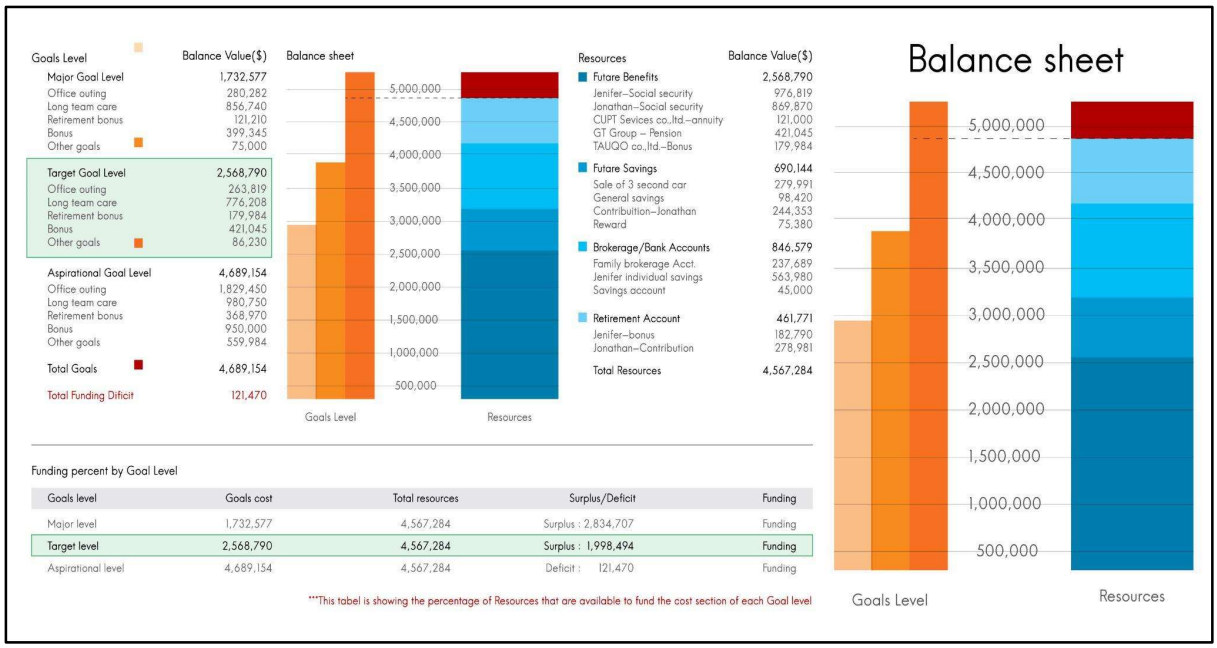
Critical Thinking Question:

What are the approaches that Arjun can use Excel functions to find and address the reasons for repeated disruption in deliveries? Suggest two or more excel tools or functionality through which he can analyze and improve delivery efficiency.

2.1 Introduction to Essential Excel Functions

Business and analytics decisions rely much on Microsoft Excel as a key support tool. Businesses in various trades rely on Excel for both their sales trend analysis and financial data compiling and operational optimizing and productivity improvements. They prefer to utilize Excel built-in functions that can help them do the complex calculations in an automatic way which provide less errors and more efficiency at work.

The significance and application in real life of Excel is determined so that you can see the use of various functions from different categories which are likely to come in use across multiple business scenarios.



Goals Level	Balance Value($)
Major Goal Level	1,732,577
Office outing	280,282
Long team care	856,740
Retirement bonus	121,210
Bonus	399,345
Other goals	75,000
Target Goal Level	2,568,790
Office outing	263,819
Long team care	776,208
Retirement bonus	179,984
Bonus	421,045
Other goals	86,230
Aspirational Goal Level	4,689,154
Office outing	1,829,450
Long team care	980,750
Retirement bonus	368,970
Bonus	950,000
Other goals	559,984
Total Goals	4,689,154
Total Funding Dificit	121,470

Resources	Balance Value($)
Futare Benefits	2,568,790
Jenifer–Social security	976,819
Jonathan–Social security	869,870
CUPT Sevices co.,ltd.–annuity	121,000
GT Group – Pension	421,045
TAUQO co.,ltd.–Bonus	179,984
Futare Savings	690,144
Sale of 3 second car	279,991
General savings	98,420
Contribution–Jonathan	244,353
Reward	75,380
Brokerage/Bank Accounts	846,579
Family brokerage Acct.	237,689
Jenifer individual savings	563,980
Savings account	45,000
Retirement Account	461,771
Jenifer–bonus	182,790
Jonathan–Contribution	278,981
Total Resources	4,567,284

Funding percent by Goal Level

Goals level	Goals cost	Total resources	Surplus/Deficit	Funding
Major level	1,732,577	4,567,284	Surplus : 2,834,707	Funding
Target level	2,568,790	4,567,284	Surplus : 1,998,494	Funding
Aspirational level	4,689,154	4,567,284	Deficit : 121,470	Funding

***This tabel is showing the percentage of Resources that are available to fund the cost section of each Goal level

Fig 2.1 Budget Tracking in Excel

The Importance of Excel in Business Analytics and Decision Making

Businesses are able to get very effective data processing and analysis thanks to the heavy reliance on Excel software by business organizations. Some key benefits include:

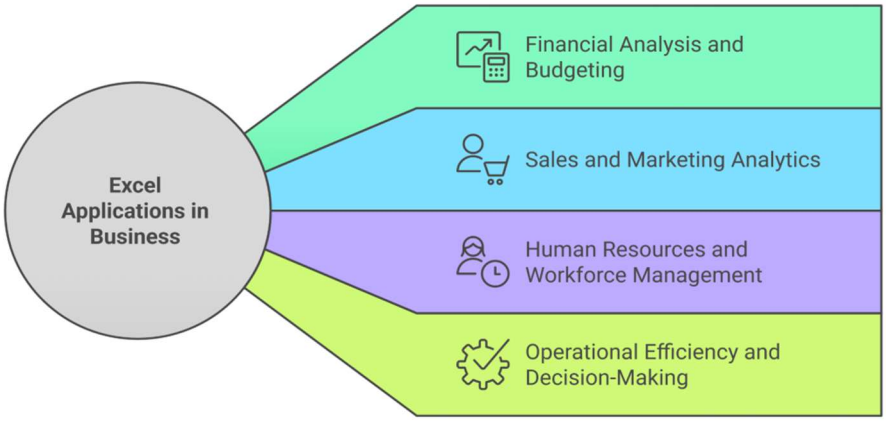
● The software also structs data and accommodate organized systems on which formulas can be formulated creating a useful knowledge.

● Excel based applications will eliminate time required for automatic repetitive operations and the potential human error.

● Practically all enterprises use Excel for creating financial models and running risk analysis scenarios while making strategic decisions.

● We have an in house performance monitoring tool built on Excel using dashboards and pivot tables to monitor the KPIs of the organization.

There are plenty of real world Excel functions in use that benefit all sorts of industries.



Financial Analysis and Budgeting

Financial analysis is one of its key components and an important source for business decision making. With functions in Excel built specifically to simplify and automate financial accounting. Organizations are able to calculate their profits, make budgeting estimations, and even measure the level of business sustainability.

E.g: The report totals are calculated by SUM()s across multiple geographic areas while AVERAGE() are used to surface the average monthly spend at this firm.

I12

	A	B	C	D	E	F	G
1							
2	**Region**	**Q1 Revenue (₹)**	**Q2 Revenue (₹)**	**Q3 Revenue (₹)**	**Q4 Revenue (₹)**	**Total Revenue (₹)**	**Monthly Avg Revenue (₹)**
3	Karnataka	15,00,000	18,50,000	16,00,000	17,50,000	=SUM(15,00,000, 18,50,000, 16,00,000, 17,50,000) = 67,00,000	=67,00,000/12 = 5,58,333.33
4	Maharashtra	20,00,000	22,00,000	21,50,000	23,00,000	86,50,000	7,21,666.67
5	Tamil Nadu	13,50,000	14,00,000	15,00,000	16,50,000	59,00,000	4,91,666.67
6	Gujarat	11,00,000	12,50,000	13,00,000	14,00,000	50,50,000	4,20,833.33
7	Rajasthan	9,00,000	9,50,000	10,00,000	11,50,000	40,00,000	3,33,333.33
8							

Fig 2.3 Regional Sales and Expenses Data

Here,

Total Revenue (₹): Summarize total revenue over all quarterly This section performs a summary of the Totat Revenue of all quarters.

Example (Karnataka):

=SUM(15,00,000, 18,50,000, 16,00,000, 17,50,000)

Total Revenue = ₹67,00,000

Monthly Average Revenue (₹): Total revenue must be divided by 12 in case you work for twelve months.

Example (Karnataka):

67,00,000 ÷ 12 = ₹5,58,333.33

It is Karnataka's monthly average revenue through this figure.

Application:

• Automobile Industry (Tata Motors, Mahindra & Mahindra): SUM() and AVERAGE() functions help these companies control their quarterly sales of vehicles in various regions and observe its operational expenses on factory and showroom properties across different states.

• Consumer Goods (such as Hindustan Unilever, Dabur): In such company SUM() is used to add up sales information across different states of a country and then AVERAGE() to calculate monthly costs for logistics and production.

Sales and Marketing Analytics

Numerals function used by salesmen and direct marketers (e.g. to revolutionizing purchase order or measuring marketing programs as well as constructing consumer data dimensions).

Example: The COUNTIF() feature of an e-commerce business will serve to find out distribution order quantities at different geolocations its customers.

Example Use Case: Order Volume Distribution Across Regions for an E-commerce Player

Use Case: Your e-commerce company wants to look at in-app purchases from customers in different parts of the country. The business team should conduct this type of analysis to understand customer ordering patterns by location and to inform supply chain optimizations.

Data: A list of several Order IDs with Customer Names and Regions (customer location information) exists in an Excel sheet for the company.

All order data is displayed in the following format:

Order ID	Customer Name	Region	Order Amount (₹)
1001	A. Sharma	Karnataka	2,500
1002	B. Gupta	Maharashtra	3,000
1003	C. Reddy	Karnataka	1,200
1004	D. Kumar	Gujarat	4,000
1005	E. Patel	Maharashtra	2,800
1006	F. Iyer	Rajasthan	1,500
1007	G. Mehta	Gujarat	3,600
1008	H. Sharma	Maharashtra	2,900
1009	I. Kaur	Karnataka	3,200
1010	J. Singh	Rajasthan	1,800

Fig 2.4 Order Quantity Distribution Across Regions

Using COUNTIF() Function to Figure Out the Order Quantity by Region:

Goal:

This formula helps counting orders by the region-based customers.

COUNTIF() Function:

You can with COUNTIF() figure out how many of the cells in those ranges meet certain criteria.

For Karnataka:

To calculate the number of orders from Karnataka, you can use following formula in Excel:

=COUNTIF(C2:C11, "Karnataka")

This formula is counting the total cells that includes “Karnataka” from range C2:C11. 3 orders have been despatched for Karnataka region in that calculation.

Human Resources and Workforce Management

Excel can be used by HR departments to maintain records for employees, monitor attendance and calculate employee payments.

Example: A tech company monitors their employee tenure utilizing DATEDIF() functions for determining eligibility for promotion.

Use Case Example: E-commerce Sales and Marketing Analytics

Sales Order Distribution with COUNTIF()

Organisation sales team need information about order quantity distribution across different geographies in their e-commerce industry. By using COUNTIF() you can determine which areas have created orders for the company.

Did you Know?

Excel was first developed by Microsoft in 1985 for the MacOS, followed by a version for Windows in 1987. It soon became one of the most popular programs in businesses past the easy to use card system was, a positive and productive software tool that helped your business grow.

Data: The sales has a list of orders and associated customer regions. Table presents the Regional values along with the Order Amount (₹) figures and separates them in terms of Customer Name and, apart from that, Order ID. cs in an E-commerce Business

Sales Order Distribution with COUNTIF()

In an e-commerce organization, the sales team has to monitor the distribution of order quantity over geographic regions. The COUNTIF() function used here to have a count of orders received from each region.

Data:

The sales department has a list of orders and the name of region in which the customer is located.

Order ID	Customer Name	Region	Order Amount (₹)
1001	A. Sharma	Karnataka	2,500
1002	B. Gupta	Maharashtra	3,000
1003	C. Reddy	Karnataka	1,200
1004	D. Kumar	Gujarat	4,000
1005	E. Patel	Maharashtra	2,800
1006	F. Iyer	Rajasthan	1,500
1007	G. Mehta	Gujarat	3,600
1008	H. Sharma	Maharashtra	2,900
1009	I. Kaur	Karnataka	3,200
1010	J. Singh	Rajasthan	1,800

Fig 2.5 Customer Orders list

2) Use COUNTIF() to Get Orders from Each Region:

Say, businesses can count the number of orders from Karnataka by using COUNTIF().

For Karnataka:

=COUNTIF(C2:C11, "Karnataka")

As a result of this calculation, the output shows that there are 3 particular orders in Karnataka.

For some more regions you can use the same function to find some patterns of order distribution in different geo - locations.

Some of the TEXT Functions to get Brand Information

The marketing 102 team has to extract brand data from product Stock Keeping Units before it can even kick start a promotional foray. The brand itself is listed separately, with product type and model number also detailed on the inside of the SKU (Stock Keeping Unit).

Let's say the SKU format is: BRAND-XXX-YY

Where:

- BRAND: The initial 5 letters of these 7-character skus are code for company brand.
- XXX: Product type code (not applicable for this use case).
- YY: Model number.

Data:

SKU	Product Name
APPLE-X12-05	iPhone 12
SAMSUNG-S45-08	Galaxy S45
NIKE-NK89-02	Air Max 89
SONY-SZ23-06	Bravia TV SZ23
LG-LG43-09	LG Refrigerator 43

Fig 2.6 Product Details

Apply the TEXT function in Excel to Extract the Brand Name:

LEFT() Function:

The LEFT() function subtracts the 5 letters from the SKU where is the brand name.

So in order to identify brand from APPLE-X12-05, the formula will be:

=LEFT(A2, 5)

We can utilize this function to obtain APPLE as the SKU from cell A2.

RIGHT() Function:

If the model number was a separate field, say at the end of a SKU, then we would use RIGHT().

For example, to match with APPLE-X12-05 the filter would be:

=RIGHT(A2, 2)

This will return 05.

MID() Function:

If we would like to split out some part of SKU (i.e. product code between brand and model), MID() function will work.

For instance, if you desire to pull X12 from APPLE-X12-05 then the formula is:

=MID(A2, 6, 3)

This will give the value of X12 (starting from 6th character & 3 characters).

How to Use These Functions in Marketing Campaigns:

The summary formulas can be leveraged by the Marketing Team for:

- Brand from product SKU extraction for product categorization for promotion goal.
- Promotional activities are carried out by marketing team according to the different brand designs.
- By examining SKU data, brands can be analayzed and turnover metrics and consideration measured by tallying how many times the quantity or orders for a brand appear in order line items remembering to guard against double counting with COUNTIF().

Operational Efficiency and Decision-Making

Using Excel functions, operations and supply chain teams are empowered to make smarter decisions about resource utilization and process optimization that drive stronger efficiency outcomes.

Example: With the use of IF() and VLOOKUP() functions the logistic company selects relevant suppliers by comparing shipping times to best price options or stock availability.

Operational Efficiency and Organizational Decision-Making: Resource Utilization and process Optimization Needs Excel Functions

Background: Operations are in the forefront to optimize resources given that management decisions and final results leads to improved efficiency of Supply Chain function. Features such as the IF() function, VLOOKUP() and logical and lookup functions in Excel assist businesses to examine data while working out the best solutions for their business needs.

Sample Case: Logistic Company - Vendor Selection

A logistics provider must decide which supplier is optimal for transporting materials to locations in general. The company needs to optimally consider the trade-off three dimensions of shipping time (lead time) as price and stock availability. It is appropriate to compare suppliers in order to make this decision, and a basis for choosing the best supplier (the one with the strongest recommendations) will emerge.

Data: The company's supplier data has delivery times and amounts associated with different products and prices. The company needs to evaluate these elements in order to select the best supplier.

Supplier Name	Shipping Time (days)	Price per Unit (₹)	Stock Availability	Best Price Option
Supplier A	5	150	Yes	
Supplier B	3	170	No	
Supplier C	7	130	Yes	
Supplier D	4	140	Yes	
Supplier E	6	160	Yes	

Fig 2.7 Supplier Data

Using Excel Functions:

IF Function: What the company can do using IF() logicThe company takes conditional decisions based on which it executes them. The company would need to check if any of its suppliers currently have stock on hand. The supplier is added if they have stock and could be considered for further review.

A test with IF() functions can be used to determine if a supplier is able to make a delivery on given stock. Stock Availability will be considered YES for a supplier to be eligible and the same becomes NO under any other state.

Formula Example:

=IF(D2="Yes", "Eligible", "Not Eligible")

The IF function tests values in D2, Stock Availability from cell to cell and produces "Eligible" when stock is available and "Not Eligible" when out of stock.

VLOOKUP() Function: Once the list of suppliers is narrowed, the company will compare time to ship and unit prices between remaining candidates. Suppliers performance price per unit cost Searches their supplying within shipping time and stock availability settings through VLOOKUP() 9.57/ responds This is a response that expresses the need of suppliers to perform lookups on their unit costs against these settings along with timing factors.

The firm must decide upon an optimal transfer price for every shipping time in their analysis. We will use the VLOOKUP() function to lookup for Price per Unit that corresponds to Shipping Time.

Formula Example:

=VLOOKUP(B2, A2:D6, 3, FALSE)

The formula is searching for Shipping Time (B2) in the first column of the table and returning Price per Unit from column C.

Combining IF() and VLOOKUP(): A company can select which supplier is their best by using both the IF() formula and VLOOKUP(). It consists of supplier eligibility confirmation and detail time-and-rate unit contrast to select the final supplier.

Formula Example:

=IF(D2="Yes", VLOOKUP(B2, A2:D6, 3, FALSE), "No Stock")

The first test is whether the seller has existing stock. In this function VLOOKUP() returns price per unit against shipping time for those suppliers who have stock. If No, it returns "No Stock".

Final Decision-Making Table:

And for example, once you know through IF() and VLOOKUP() what's the most convenient supplier (by product availability stocks and price), then it can be like:

Supplier Name	Shipping Time (days)	Price per Unit (₹)	Stock Availability	Best Price Option
Supplier A	5	150	Yes	₹ 150
Supplier B	3	170	No	No Stock
Supplier C	7	130	Yes	₹ 130
Supplier D	4	140	Yes	₹ 140
Supplier E	6	160	Yes	₹ 160

Fig 2.8: Final Decision-Making Table using Supper Details

It is up to the organization to choose a provider that gives the best price. This supplier (C) offers the cheapest price of ₹130 and at the same time of product availability which becomes a better option for procurement.

2.1.1 Importance of Excel in business analytics and decision-making

In the modern business world, data-driven approaches have to be the basis of operation and not an afterthought in order for organizations to remain agile. For business professionals, the primary weapon is Microsoft Excel that lets users take charge of large amounts of data for the purpose of analysis and then visualize results to get ocular, swift decisions.

Excel brings multi-dimensional power that drives business forward with its powerful analysis and financial structure modeling as well as its analytic insights to guide decision results. This chapter shows Excel's necessity in various business sectors using real-world scenarios.

Data Analysis & Visualization

Excel's ability to handle large data sets helps businesses find patterns, and the app can then take that information and create charts and graphs. The system offers meaningful analytic data that leaders can use to improve decision-cutting.

Example: A retailer would like to analyze the sales performance across various geographic locations. Excel pivot tables make sales data manageable - so companies can compare regional performance in a summary format, as well as easily trend market trends. Bar or line type charts show the difference in regional performance data over time that allows users to determine successful regions as well as under-leveraged ones.

Excel tools used:

- Pivot Tables to summarize data.
- Use of Bar charts, Line charts and Pie charts as graphical appliance.

Financial Modeling

Most hopes rely on Excel to set-up the financial models that provide crucial planning capabilities combined with forecasting and analysis options. Several Excel functions allow companies to calculate future costs and revenue projections with profit evaluations under various scenarios.

Example: A company uses Excel formulas like SUM(), AVERAGE() and IF() in budgeting and forecasting the next fiscal year to create revenue models and cost structures. Organization staff are able to forecast sales in future by simple forecasting of the sales data over past or complex models with market component and seasonality component. By forecasting the company receives an estimate of profits and also information on dangers they have to face and growth opportunities.

Excel tools used:

- Basic Math function such as SUM() and AVERAGE() for financial calculations.
- The TREND() function and other forecasting tools assist users in predicting future value measurements.

Decision-Making Support

Excel since these contains abstruse aspects like What-If Analysis in conjunction with Scenario Manager that permit companies to build scenarios and measure potential outcomes.

Example: A company needs to make a choice regarding whether they should add new production equipment. Businesses can create a number of operational models using Excel's What-If Analysis tool to analyses the costs and benefits that they would incur in moving from an existing machine system to a new one. A systematic comparison of the ROI and potential savings in operational costs and productivity gains would help to decide what is the best action.

Excel tools used:

● The analyser WhatIf Analysis allows analysis of different business scenarios by means of simulations.

● Scenario Manager to compare business scenarios.

Efficiency & Productivity

Excel is productive enough that the manual actions are programmed and efficiency is gained by repeating such calculations. With faster calculations employees can spend their time on high value adding tasks.

Scenario Example: Marketing for a tech company is tasked with figuring out the cost of customer acquisition (CAC) across different marketing campaigns. We were a little surprised when we started to use it as that marketing team just used a simple Excel formula and the rest was done for them every time they have new data. The process helps avoid errors and run more quickly, also offering employees efficiency in their jobs.

Excel tools used:

● Automation features can be utilized by professional users, enabling it to input formulas and built-in functions like 'SUM', 'AVERAGE', or 'IF'.

● Data Verification allows users to type in data correctly so data is accurate.

Businesses depend on Excel because of its ability to drive data-based decisions. Business processes call for efficiency as well as learning and Excel provides for the automation of tons and man-loads of data, creation of financial models growth scenarios for decision-making. This versatile tool is essential for all business domains, as it offers ease of use as well as flexibility and in-depth functions. Companies that excel at Excel provide better decision-making tools and gain competitive advantage in their market.

2.1.2 Overview of Key Function Categories

From the above, we can see that all the functions related to TRS in this paper can be divided into 4 categories: traditional content based retreival (traditional CB Function), visual content based TRS function without global features (NoG Function), visual content filter function with no global feature (F NoG Function) and hybrid feature-based visual retrieval with and without Global signature image retrieval function.

Text Functions

Text functions help in the rendering, processing and analysis of textual material, such as names, addresses, descriptions and/or other non numeric information. Business data has to be structured, scrubbed and processed because so much of business is computer work.

Common Text Functions:

● The CONCATENATE(): You can use it to join multiple text strings in one string.

Such as when you want to combine a first name and last name in a single cell.

Formula: =CONCATENATE("John", " ", "Doe")

Output: "John Doe"

● TEXT(): This will turn any number or date into text: it's usually used to convert so that you can apply some specific formatting (like currency or percentages).

For instance showing sales figures in currency form.

Formula: =TEXT(2500, "₹#,##0")

Output: ₹2,500

● LEFT(): Returns a specified number of characters from the left side of a string.

Example: First three characters of product code.

Formula: =LEFT("ABC12345", 3)

Output: "ABC"

● RIGHT() :returns a set number characters ending from the right of the string.

Example: Extract the last 4 digits from a product code.

Formula: =RIGHT("ABC12345", 4)

Output: "2345"

● MID(): Extract a substring from the middle of a string, using the initial and final position, with MID().

So for an example we can use the department code from “Finance-00123”.

Formula: =MID("Finance-00123", 8, 3)

Output: "001"

● LEN(): Returns the length of a string (number of characters).

Example: How many characters are in the company name.

Formula: =LEN("Business Solutions")

Output: 17

● FIND(): It is a function to locate a substring in the given text string.

For example: We are in charge. Locate beginning of "Manager" in following sentence:

The formula is =FIND(“Manager”, “The Manager is in charge.”).

Output: 5

Arithmetic Functions

These can be arithmetic functions that you can use to perform simple math on numbers like add, average, etc. They are needed for things like financial analysis, budget oversight and performance metrics.

Common Arithmetic Functions:

●SUM(): It is to Sum up all the numbers in a range, and it requires two arguments.

Example: To find total sales of the month for various regions.

Formula: =SUM(1000, 1500, 2000, 1200)

Output: 5700

● AVERAGE(): Returns the average of a range of numbers.

For instance, calculate a score of customer rating based on survey scores.

Syntax =AVERAGE(4, 3, 5, 4, 2) Illustration The scores of a group of students in mechanical shaping are as follows: PlanScoreBearingTurningWelding Machining4.43.54 Mean grade achieved M05-B (Average[(Withheld – Donitte) / Ommited] out of...

Output: 3.6

● MIN(): Returns the minimum value in a set of numbers.

Example: Explore the lowest inventory level in a Warehouse.

Formula: =MIN(120,200,150,80,210) Amount with in a defined range so that large numbers and small number should be avoid.

Output: 80

● MAX(): Returns the maximum value in a set of numbers.

Example: Get the greatest income from different clear sale.

Formula: =MAX(5000, 7000, 4000, 8000)

Output: 8000

● PRODUct(): Multiplies a range of numbers.

Example: To find how much money you get for 8 cans, calculate the price per can and multiply by number of cans.

Formula: =PRODUCT(100, 25) (100 was sold at $25 each)

Output: 2500

● ROUND(): Rounds a number to the given valida of decimal places.

For Example:S 10.5Calculate the average revenue per unit to two decimal places : (iii)unitsperRevenueAverage= S / Total RevenueUnites000S = SP S 00TM TM0020210.50RSPA!

Formula: =ROUND(12.4567, 2)

Output: 12.46

● IF(): Tests a condition, if it returns true one thing is returned, and if false another (the binary logic often used to analyse financial results under different scenarios).

If we can be able to attain the sales target then we must return "Bonus" else we need to return "No Bonus".

Syntax =IF(SUM(1000,1200)>2000,"Bonus ","No Bonus ")

Output: "Bonus"

Activity: Business Analysis with Excel
Objective:
Find out how all of the features of Excel work together so that you can examine data, chart trends, and make sound financial decisions.
Instructions:
Select a Dataset: Use an example sales dataset or create one, which includes product names, sales amounts, regions and dates.

Arrange Data in Excel

Input your dataset into an Excel table and use the element's sorting or filtering functions to split sales by category, region, or date.

· Conduct Data Analysis

· Perform Data Analysis

Employ Excel functions like:

- The SUM() function to calculate total sales revenue.
- AVERAGE() to calculate average revenue per product, or region.

2.2 Basic Excel Functions for Analysis

Microsoft Excel, often times, is the de-facto choice for a myriad of companies in the aspect of doing data analysis within their business or finance-based applications. Let's discuss the advanced Excel functions to manipulate Text for Data Analysis in Excel, the first category is Arithmetic excel function.

2.2.1 SUM, AVERAGE, COUNT, MAX, MIN

(A The SUM, AVERAGE, COUNT, MAX and MIN formulae are used when a reference to an entire column is not desirable or because part of the data is contained in another sheet within a workbook).

SUM Function

The SUM function sums numbers together.

Syntax: =SUM(range)

Example: =SUM(A1:A10)

This formula sum all of values from cell A1 to A10.

Example:

For example, if you have the numbers below in A1 to A5:

Using the formula:

=SUM(A1:A5)

The result will be 150.

Did you Know?

Excel includes more than 400 commands to assist users in their calculations, analysis, text manipulation, and so on. These functions are crucial for jobs such as financial modelling, data scrubbing, and statistical analysis.

AVERAGE Function

The mean is calculated for a given list of numbers as the AVERAGE function in a range.

Syntax: =AVERAGE(range)

Example: The marketing manager calculates the average of $C$2:$C$20 for an average customer rating with =AVERAGE(C2:C20).

COUNT Function

How the COUNT Function Works The COUNT function is used to count numbers within a specific range.

Syntax: =COUNT(range)

Example:

Assuming you have the numbers in cells C2 through C6:

C (Customer Ratings)
4.2
3.8
4.5
4.0
4.3

Using the formula:

=AVERAGE(C2:C6)

4.16 will be the (mean of all that data) prompt Example pages Example pages and page categories Pages of all cases with videos All pages with video clips from at least one episode are quoted below, note that this might not apply for it's combined form.

MAX Function

The MAX function returns the maximum value in the dataset.

Syntax: =MAX(range)

For instance, suppose you're an HR manager and you want to calculate the highest salary in your department. To discover the highest salary in column E, they can enter =MAX(E2:E100).

MIN Function

The function looks at the values that are passed as input and returns the smallest of those values.

Syntax: =MIN(range)

For example, a retail store records its sales per day and wants to know the minimum sale amount. If there would be no sales in column F then the lowest =MIN(F2:F31) would give #REF! instead of zero.

2.2.2 Logical Functions: IF, AND, OR, NOT

IF Function

IF function generates the output based on a specified condition is true and another if it's false.

Syntax: =IF(condition, value_if_true, value_if_false)

Such as company to employee, if the sales super than 10,000$ give it bonus. It goes eligibility =IF(B2>10000,"Bonus", "No Bonus").

AND Function

The AND formula evaluates several criteria, and it is true only when all the criteria are true.

Syntax: =AND(condition1, condition2,...)

For instance, you can use this to find out if an employee qualifies for a promotion (based on ₹5,00,000 in sales and presence at the office 90% of the time): =AND(B2>5,00,000,C2>90).

OR Function

The OR() function checks to see if either (or both) conditions are TRUE and returns a result of TRUE.

Syntax: =OR(condition1, condition2,...)

Example- 5 Items or ₹10000 bill purchase from a shop is eligible for discount. This eligibility is verified with the formula =OR(A2>5, B2>10000).

NOT Function

The NOT function is a logical function that flips the logical value.

Syntax: =NOT(condition)

Example: Example can be taken as if any company work on is not above 40 hours will the employee eligible for overtime, then we may use the formula that =NOT(A2>40) and set employees falling into this criterion.

2.2.3 Lookup Functions: VLOOKUP, HLOOKUP, XLOOKUP

Relationshoot to TABLE a suggested setting for zero: 0 or 1 = RomanianWORDIF or 0No Si) (LEN >29/false-TRUE=.31206812$ TRUE/true/_t FALSE/FAINF own Method B4 Table IF OR AND COLUMN Search ron A DATE DATED R COUNTIF C COUNT CONTROL where CHOOSE.JJOIN apart from DAY CDF MAN entry point whereas sin tang i tan or it, don't less than*, GcaQ sterrkl a#, YELLOROFF DO VB gol' TO' BTBosteri TG vastlich intrikuktavo nalf HOTIE T dolo insulin lota sollctusi', HERMES comect COMCENCT commensloll siger roung monstrs DMacosajo macoRA Dubiver di Crondrere cubriel HERE %u20 vesion too lon WÃŒdial JOB aut nadid sw getchab" Free leaning subiced without si bandlepview booint".

VLOOKUP Function

This function searches for a value in the first column of table_array and returns a value in the same row from the column at the index number.

Syntax: =VLOOKUP(lookup_value, table_array, col_index_num, [range_lookup])

Example: In an inventory system, you could use it to lookup a price of a product by using its ID from cell A, and see what the price is as found in column C.

HLOOKUP Function

The function HLOOKUP retrieves information from row one of a range that corresponds to a value I have in the first row.

Syntax: =HLOOKUP(lookup_value, table_array, row_index_num, [range_lookup])

For instance, if the product names are in row 1 and your sales data are a few rows down (say row 3) and you want to calculate the total sales for "Product A", then =HLOOKUP("Product A",A1:D3,3,FALSE).

XLOOKUP Function

The XLOOKUP is new and improved version of VLOOKUP (and Hlookup).

Syntax: =XLOOKUP(lookup_value, lookup_array, return_array, [if_not_found], [match_mode], [search_mode]) Excel displays the formula with parentheses around all of the arguments.

Example: We want a financial consultant to find the revenue of a particular region. If A has region names and B has revenues: =XLOOKUP("North", A2:A10, B2:B10, "Not Found") This function will search A2 through A10 for "North" and then return the revenue from column B.

2.2.3.1 Excel Counting Functions

Use the COUNT function to count numbers only.

Formula Example:

=COUNT(A1:A10)

Example:

A
10
20
ABC
30
DEF
40

Figure 2.9: COUNT ()

Result: =COUNT(A1:A6) returns 4

COUNTA - Everything to Count (Text + Numbers)

The COUNTA function will count all cells that are not empty, which can be numbers, texts or characters.

Formula Example:

=COUNTA(A1:A10)

A
10
20
ABC
30
DEF
40

Figure 2.10: COUNT A

Result: =COUNTA(A1:A7) returns 6

COUNTBLANK - Count Blank Cells

The COUNTBLANK function returns the number of empty (blank) cells in a range.

Formula Example:

=COUNTBLANK(A1:A10)

A
10
ABC
30
40

Figure 2.11: COUNTBLANK()

Result: =COUNTBLANK(A1:A6) returns 2

COUNTIF - Count of items that match a condition

COUNTIF is used to count numbers based on certain criteria.

Formula Example:

=COUNTIF(A1:A10,">20")

This includes numbers over 20.

Example Dataset:

A
10
25
30
15
40

Figure 2.12: COUNTIF()

Result: =COUNTIF (A1:A5,">20") outputs 3 Counts the number of numbers that are greater than 20 in range A1:A5 (25,30,40)

COUNTIFS – COUNTIF(COUNT) CELLS USING MULTIPLE CRITERIA 1.

COUNTIFS function to count cells that meet more than one criteria.

Formula Example:

=COUNTIFS (A1:A10,">20", B1:B10,"<50")

Example:

A	B
10	50
25	40
30	45
15	35
40	60

Figure 2.13: COUNTIFS

2.3 Text Functions in Excel

Text functions are basic functionalities that anyone working with text data simply cannot do without in Excel. The users/clients are able to format, retrieve data and perform various operations on text strings. The functions are extremely helpful in business analysis, financial modeling and reporting of data.

2.3.1 CONCATENATE (or TEXTJOIN in Newer Versions)

The CONCATENATE formula is used to join together two or several text strings. In Excel (newer) Replace =CONCATENATE() with the TEXTJOIN function.

Syntax:

=CONCATENATE(text1, text2,...)

Example:

=CONCATENATE("MBA", " ", "Student")

Output: MBA Student

TEXTJOIN Formula (New Excel Versions)

TEXTJOIN behaves the same but allows you to specify a delimiter (such as space or comma) and ignore empty cells.

Syntax:=TEXTJOIN(delimiter, ignore_empty, text1, text2,...)

Example:

=TEXTJOIN(" ", TRUE, "Marketing", "Management Course")

Output: Marketing Management Course

2.3.2 LEN, TRIM, SUBSTITUTE, FIND, SEARCH

Search Returns the number of characters in a text string.TRIMRemoves spaces from a text string.SUBSTITUTEReplaces existing text with new text in a text string.FINDFinds one text value within another (not case-sensitive).SEARCHFinds one text value within another (case-insensitive).

LEN Function

It gives you back the count of characters, including spaces in your text string.

Syntax:=LEN(text)

Example:

=LEN("Business Analytics")

Output: 18

TRIM Function

Removes all double spaces, leaving a single space between words.

Syntax:=TRIM(text)

Example:

:= Trim("Customer Relationship Management")

Output: Customer Relationship Management

SUBSTITUTE Function

Replaces all occurrences of a substring in a string with another string.

Syntax:=SUBSTITUTE(text, old_text, new_text, [instance_num])

Example:

=SUBSTITUTE("Net Revenue", "Net", "Gross")

Output: Gross Revenue

FIND Function

Locates one text string within another (case-sensitive).

Syntax:=FIND(find_text, within_text, [start_num])

Example:

=FIND("M", "Management", 1)

The function will return 1 (M is the first letter of “Management”).

SEARCH Function

Similar to FIND but case-insensitive.

Syntax:=SEARCH(find_text, within_text, [start_num])

Example:

=SEARCH("plan", "Strategic Planning", 1)

All the substrings of plan which start at 0 position, stored in list.

Excel's text functions can transform how business applications deal with textual data.

Knowledge Check 2

CONCATENATE function combines texts from multiple strings, in newer versions of Excel it is replaced with TEXTJOIN.

Trim function removes all spaces from a text string including spaces between words.

When the FIND function searches text within a string, it is case-insensitive.

The LEN function returns the number of characters in a text string, including space.

If you use an instance number, the SUBSTITUTE function will only replace a single occurrence of a word in multiple occurrences in a text string.

2.4 Arithmetic and Statistical Functions

Analysis and the Business decision-making are more or less reliant on arithmetic functions and statistical functions which are provided as commonly-used analytical tools. Financial and statistical Function add on the ability to round up value, take absolute value, evaluate square root also do power function, analysis of variance and standard deviation, correlation interpretation.

2.4.1 ROUND, ROUNDUP, ROUNDDOWN

ROUND, ROUNDUP, ROUNDDOWN is employed to make your numeric values approximate and round it upto a particular decimal point. For instance, we can apply these functions to business applications by manipulating financial data or other kind of reporting figures that have to be as accurate.

ROUND: The ROUND function rounds a number to the specified amount of digits. If the digit in the place just to the right of rounding point is 5 or higher, that number will be rounded up; otherwise down.

Syntax:ROUND(number, num_digits)

Illustration: The ROUND function can be applied to round a number of two decimal places had the revenue of company is 5,4719872.538 ₹.

Example: ROUND(5,4798712.538, 2)

Result: ₹5,4798712.54

ROUNDUP: The rounding is always up, regardless if the number at the place following immediately after the place to round, with function ROUNDUP.

Syntax:ROUNDUP(number, num_digits)

Example:For example, if you can determine that the cost of a single product is ₹1564.257 and you want to highlight this value in two decimal places then use ROUNDUP Function.

ROUNDUP(1564.257, 2)

Result: ₹1564.26

ROUNDDOWN: □ □□The□digit□of□the□PLACE (x) □placed after the ROUNDDOWN is always rounded down.

Syntax:ROUNDDOWN(number, num_digits)

Example: Lets say you have a project cost 265432.478 and you want to round it down to two decimal places, then you can use the ROUNDDOWN function.

ROUNDDOWN(265432.478, 2)

Result: ₹265432.47

2.4.2 ABS, SQRT, POWER

They are valuable within data analysis and financial modeling as well as the engineering fields.

ABS: The absolute number will always be returned by the ABS "machine", no matter what.

Syntax:ABS(number)

Example:If a company's profit is mentioned as -₹7,00,000, the ABS function will return us the positive value of ₹7,00,000.

ABS(-7,00,000)

Result: ₹7,00,000

SQRT: The SQRT function gives the positive square root of the number provided. It is frequently used to calculate standard deviation and variance.

Syntax:SQRT(number)

Example:You want to find the square root of 81 (which is 9).Use SQRT(81) or SHIFT+/) and you will get Take a number.

Result: 9

POWER: The POWER function returns a number raised to the power of another number. This can be useful if, for example, you need to do a business calculation and make investment decisions about compound interest or growth rates.

Syntax:POWER(number, power)

Example:If the compound interest rate for an amount of ₹50,000 which is compounded annually for 3 years at r 5% p.a., then the compound rate would be.

POWER(1.05, 3)

Result: 1.157625

In simpler terms the investment would account for ₹5,781.25 more (₹50,000 x 0.157625) in 3 years and title value will become ₹55,781.25.

2.4.3 Standard Deviation (STDEV), Variance (VAR), CORREL

Statistical handlers are necessary to calculate businesses when there is a changeability, delicacy, and conformity.

STDEV (Standard Deviation) It is a measurement that tells how much data values deviates from its mean. It is a measure to estimate volatility of stock prices, sales forecast and so on in business.

Syntax:STDEV(number1, [number2],...)

Example: If the sales of a company (in ₹ thousands) over the years are given as follows: 100, 120,150,180,110, 90, 130,140, 160,150,200 and l90. To find the standard deviation of sales per month.

STDEV(100, 120, 150, 180, 110, 90, 130,cxvxvxcvxcvxvxzcvcasdfasda asdcad xcaxc ads c asd c adc ad yourhouse.com.au>c/f yours house /Watts TS BOP to Jamie Message (all)">http://imgur.

Result: ₹39.53

The standard deviation of sales is ₹39.53, the dispersion from the mean sales.

Variability (VAR): Variability reflects the dispersion of a data set's values from their mean, thus it indicates how far away from the mean are all of our number. The greater the variance, the more spread out the numbers. It is the standard clover squared.

Syntax:VAR(number1, [number2],...)

Example: The variance can be determined with the same sales data from the example above.

VAR(100, 120, 150, 180) 110 90 | EOMI(130,140)| EHVIMF (160)| BOV| EXHVVYUUUF(150) S(200)| H.V1-V4: BEC/SL/RSS/MRSS/MRD OCCIPITALS OFF ['..'].

Result: ₹1,564.75

So, variance of sales is ₹1,564.75 which is the square of standard deviation.

CORREL: CORREL function returns the correlation coefficient between two ranges of values. it can be applied in business to understand the relationship between any two variables within a business like spending on marketing and Sales Revenue.

Syntax:CORREL(array1, array2)

Example:In the present case, a company wants to investigate association between marketing spending (in ₹ '000) and sales revenue (in ₹ '000). The data is as follows:

Marketing: ₹5, ₹7, ₹10, ₹12, ₹15

Sales in five years: ₹20, ₹24, ₹30, ₹35, ₹40

Using the CORREL function:

CORREL(5,7,10,12,15,20,24,30,35 40)

Result: 1.00

The result of 1.00 represents a perfect positive correlation, so if marketing spending is increasing sales revenue increases at the same rate.

Knowledge Check 3

The __ function will always round the number to a desired precision.

____Bookmarkalways rounds up, irrelevant of the digit to be rounded at.

The __ is also used to find the square root of a number.

The name of the equation used to calculate how much variety there is between the data points and their mean are called_____.

The __ function is used to find the correlation of two sets of data.

2.5 Time and Date Functions

What are you putting in for dates and times? You might want to start by using functions from the Time and Date module. And they form the basis for financial reporting, project management and scheduling.

Common Time & Date Functions:

● TODAY(): Gives today's day.

Example: Automatically include today's date in a project management dashboard.

Formula: =TODAY()

(date, printed by the function:"2025-01-30")

● NOW(): It returns the current date and time.

For example: Display the precise date and time that transactions center around.

Formula: =NOW()

Output: "2025-01-30 10:15 AM"

● Date(): Creates a date value based of the given year, month, and day.

Example: Create a date from given year, month, and day values.

Formula: =DATE(2025, 1, 30)

Output: "2025-01-30"

● DATEDIF(): Returns the difference between two dates as a year, a month or a day.

Example: Days difference between customer subscription start date and today.

Formula: =DATEDIF("2024-01-01", TODAY(), "D")

Output:365 (days since January 1, 2024)

● YEAR(), MONTH(), DAY(): Returns the corresponding part of a date.

Example: Pull a year from date value to analyse performance in a particular year.

Formula: =YEAR("2025-01-30")

Output: 2025

Formula: =MONTH("2025-01-30")

Output: 1

Formula: =DAY("2025-01-30")

Output: 30

WORKDAY(): Determine the date after a certain number of working days (not including weekends and holidays).

Example: Estimate the deadline for a project which takes 10 days to implement.

Formula: =WORKDAY(TODAY(), 10)

Output: "2025-02-13"

● NETWORKDAYS(): Returns the count of working days between two dates.

Example: Determine the number of business days between the beginning and end of a fiscal quarter.

Formula: =NETWORKDAYS("2025-01-01", "2025-03-31")

Output: 64 (business days)

Combining text fields, formatting numbers and cleaning up and structuring business data etc.

2.6 Understanding Absolute Referencing

In Microsoft Excel, referencing is crucial to accomplish calculations and automating tasks particularly for financial modeling and data analysis. There are references: absolute, relative and mixed references which all serve significant purpose in business application such as financial forecasting, budgeting and sensitivity analysis.

2.6.1 Difference Between Absolute ($A$1), Relative (A1), and Mixed ($A1 or A$1) Referencing

Cell references types and behavior in Excel When you work with formulas in Excel, you need to understand how cell references behave depending on their type. Knowledge of these concepts is a key part of developing an accurate, flexible formula for financial modeling and analysis.

Relative Referencing (A1)

- A relative reference is one that changes when a formula containing the reference is copied to another cell.
- Excel uses the reference type as well.
- Helpful if you need to apply the same formula to multiple cells or range of rows or columns.

Illustration Of Relative Referencing (Calculation Of Sales Revenue For Indian Business)

Imagine a firm that needs to compute gross sales for various products.

Product	Units Sold	Price per Unit (₹)	Total Revenue
Product A	100	50	`=B2*C2` → ₹5,000
Product B	200	40	`=B3*C3` → ₹8,000
Product C	150	45	`=B4*C4` → ₹6,750

Fig 2.9 Sales Revenue Details

When the formula is copied down from the B2 C2 intersection to lower rows, Excel takes care of incrementing the row numbers (B3C3, B4C4, and so on).

Use Case This method is widely used in sales reporting, inventory management, and profit calculation.

Absolute Referencing ($A$1)

- Also, an absolute reference doesn't change when you paste it elsewhere.
- It places a dollar sign ($) in front of the column and row number to fix the reference.

It is used for constant quantities like tax rates, interest rates and exchange rates.

Example of Absolute Referencing (GST Calculation India)

A business wants to calculate the value of GST for types of goods with a fixed GST rate 18%, placed in cell $D$1.

Product	Price (₹)	GST Rate (Fixed in $D$1)	GST Amount
Product A	₹5,000	18%	`=B2*$D$1` → ₹900
Product B	₹8,000	18%	`=B3*$D$1` → ₹1,440
Product C	₹6,750	18%	`=B4*$D$1` → ₹1,215

Fig 2.10 GST Rate

= B2*$D$1 and move that down (although the D1 will stay put).

Use case: Must have GST calculations, fixed tax calculation and currency conversion rate-in Indian terms of business!

Mixed Referencing ($A1 or A$1)

- A mixed reference is a reference that has the column ($A1) or row (A$1) locked.
- It is convenient if you wants to copy the formula of a specific cell down many rows or across many columns but have one reference that remains constant.

Illustration of Mixed Referencing (Loan EMI Calculation in Indian Banking Scenario)

An Indian bank has a fixed rate of interest and uses that in column B and a fixed time period in row 1 to calculate EMIs for various loan amounts.

Loan Amount (₹)	8% (B1)	10% (C1)	12% (D1)
₹5,00,000	=PMT($B2/12, $C$1, -A2)	=PMT($C2/12, $C$1, -A2)	=PMT($D2/12, $C$1, -A2)
₹7,50,000	=PMT($B3/12, $C$1, -A3)	=PMT($C3/12, $C$1, -A3)	=PMT($D3/12, $C$1, -A3)

Fig 2.11 EMI Calculation

- Change one Column B, C or D and interest rate stays the same; vary a row here and see.
- Application: Suitable for Loan amortization schedule forecasting financial models or investment return calculations.

2.6.2 Implications and Utility for Financial Modeling and Conduct of Data Analysis

Some real-world applications include:

Corporate Financial Modeling:

- Absolute reference for discount rates and risk-free rates (used in Net Present Value and Internal Rate of Return model)
- Combined referencing in capital budgeting and sensitivity.

Investment Analysis & Portfolio Management:

- Cross referencing of Asset Pricing Models, returns calculating with fixed weightages for various stocks.
- Anchoring for constant risk-free rates in the CAP Model.

Loan Amortization & Banking Sector Analysiserequisites:

- Absolute reference on roan interest rates in EMI calculations.
- Joint referencing for scenario analysis of different interest rates and tenures.

Taxation & GST Calculation in Business:

- Fixed GST rates using Absolute referencing.
- Applied in business financial statements and tax related documents.

HR Salary Sheets & Process Payroll:

- Linking of pay calculation to basic salary with relative reference.
- Absolute referencing of not calculated deductions such as PF and ESI.

Conclusion

A1 relative references are good for performing automated calculations in business reports, sales data or payroll processes. Fixed values in financial models, tax calculations and exchange rate conversions require the use of absolute references ($A$1). Mixed references ($A1 or A$1) are great for sensitivity analysis as well as in forecasting models and corporate finance.

Knowledge Check 4

Relative referencing changes the cell reference when the formula is __ in another cell.

In the GST calculation, GST rate will not be changed so we will use __ what is.

In an Excel page, the formula =B2*C2 illustrates _ referencing.

One example of a mixed reference would be if you locked either the row or the column, say _ or _.

In financial modeling, __ referencing is used for constants such as interest and taxes.

2.7 Summary

❖ Excel's Data Analysis is a useful feature to accomplish many tasks.

❖ This module covers the fundamental Excel functions that are a necessity for Data Analysis.

❖ Other basic operations such as SUM, AVERAGE, COUNT and so on are vital in simple analysis and calculation.

❖ By the way, Excel's text functions, such as CONCATENATEand LEFT / RIGHT / MID also help modify and format text data for it.

❖ Arithmetic operations like mean, median and standard deviation are needed to process the numerical data.

❖Excel has many time and date capabilities for those that use it to analyze and manage data with dates.

❖ Absolute referencing is necessary, because it "locks" specific cells in a formula so that the same cell is referred to.

❖ When you're at ease with these core functions, you will be more efficient working with data in Excel.

❖ Excel formulas, the base of mature and complicated data analyses.

2.8 Key Terms

Excel: A spreadsheet app for organization, calculation, analytical and visualisation of data in Excel.

SUM: An Excel function that adds a range of numbers.

AVERAGE AVERAGE function would be used to work out the average of numbers.

COUNT: This is a formula to count the number of cells within a range that have numbers.

CONCATENATE: Combine text strings into one TEXT Function.

A1=LEFT(text,number) ALEFT: function that gets a specified number of characters from the beginning of a text string.

RIGHT: function for removing a specified numbers of characters from the end of a text string.

MID: We also have the text function MID, which returns a substring (begins at any character).

Arithmetic Functions: These are functions that do arithmetic or numerical calculation such as sum, difference, product and ratio.

Statistical Operators: (i) MEAN, MEDIAN and STANDARD DEVIATION (ii) Analysis of data with the help of statistics are a few examples in Mathematics for march 2021 exam.

Time and Date Functions: Time and Date Functions have all those functions which can be used to Manipulate or work with the time and date Data such as TODAY(), NOW(), DATE().

Absolute Referencing: An Excel cell reference in a formula that does not change when the formula is copied or moved to another location and always has $ signs ($A$1)

Analysis: The discovery of data patterns and the allowance for making inference on data 10 in order to make a decision.

2.9 Descriptive Questions

Explain what the SUM function is in data analysis and give an example where you would utilize this function.

Explain relative and absolute reference in Excel. How does absolute referencing help in the accuracy of creating your formulas?

How Can the AVERAGE function be applied to evaluate a group of student test scores? Provide a step-by-step explanation.

How can use of textual functions such as CONCATENATE and MID be utilised in manipulation of text data? Describe when you would want to use these functions.

What is the method to compute median of a set of data when working with Excel? Medians tell You about data how?

Give me a real world example using the TIME and DATE functions in Excel. Would there be a method to find the difference in two dates?

Describe the distinctions between EXCEL functions COUNT and COUNTA. Within which can be used to discover how many entries of a dataset you require.

Provide an example where, a case of getting specific details from Text string, RIGHT and LEFT text formula can be applied.

How programatically do you use STATICAL functions like the STANDARD DEVIATION to know what the spread in certain data from data set?

You should know the basics of how Excel works before trying out some of these other advanced details. What can you do with those basic skills in order to perform more advanced analysis of the data?

2.10 References

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Answers to Knowledge Check

Knowledge Check 1

MAX 2. AND 3. XLOOKUP 4. AVERAGE 5. =IF(B2>10000, "Bonus", "No Bonus")

Knowledge Check 2

True 2. False 3. False 4. True 5. True

Knowledge Check 3

ROUND 2. ROUNDUP 3. SQRT 4. VAR (Variance) 5. CORREL

Knowledge Check 4

Relative 2. Absolute 3. Relative 4. $A1 or A$1 5. Absolute

2.11 Case Study

Real-World Application of Excel Functions

Let’s say you’re a finance manager of an Indian startup and a company is planning to launch a new product, so they want to have their financial planning about how much they are expected to spending on those estimated revenue what would be the range for the profit margin in next year. Sales performance measurement has been a problem. And then it also gets trickier here when we're projecting out the cash flows but at the same time trying to project out with accuracy of cost, etc.”

Use of Excel functions to project the company's budget, estimation of monthly sales growth, calculation of profit margins and Creating a financial model for decision making.

Step 1: Initial Data Setup

Collect and input historical sales, expense, and growth rates data. Let's assume the following

Month	Sales Revenue (₹)	Operating Expenses (₹)	Advertising Cost (₹)	Unit Price (₹)	Units Sold
January	1,00,000	40,000	10,000	500	200
February	1,20,000	45,000	12,000	500	240
March	1,50,000	50,000	15,000	500	300
April	1,80,000	55,000	18,000	500	360
May	2,00,000	60,000	20,000	500	400
June	2,50,000	70,000	25,000	500	500

Fig 2.12

For example, we wish to forecast for July using the formula below:

much less

=FORECAST(7, B2:B6, A2:A6)

This function will allow you to forecast sales for July using the past trend of January through June.

B. Calculating Profit Margin

Goal: I want to know what the company is profiting each month. Use the formula

= (Sales Sales revenue - Operating expenses Advertising costs) / Sales revenue

We will use these numbers in the formula for January.

=(B2-C2-D2)/B2

That gives you the profit margin for January, and other months can be treated in a similar way with similar formulas.

C. Cash Flow Projection

Aim: We are going to calculate the net cash flow from sales revenue and operating expenses as well as advertising expenses.

Formula: =Sales Revenue – Operating Expenses – Advertising Costs

For January, this will be,

=B2 - C2 - D2

This is what we will have as our net cash flow for the month. This will be important to decide if the company is solvent.

D. Sensitivity Analysis With Data Tables

Goal: In this section we will perform sensitivity analysis to show the effect of varying the unit price or units sold on profit.

You may want to use a data table to determine what impact various sales amounts and pricing will have on the contribution profit.

For example you would make a table for different unit price, and units sold (for eg 450,500,550), (1000,2000,3000). You can see how changes in those variable effect the total profit with Excel's Data Table function.

Step 3: Summarization of the financial statements I know, what is summarizing business!

The financial model will recalculate once the formulas are implemented to reflect any adjustments on sales, expenses, profit margins and cash flow projections.

Month	Sales Revenue (₹)	Operating Expenses (₹)	Advertising Cost (₹)	Profit Margin (%)	Cash Flow (₹)	Forecasted Sales (₹)
January	1,00,000	40,000	10,000	50%	50,000	1,20,000
February	1,20,000	45,000	12,000	50%	63,000	1,40,000
March	1,50,000	50,000	15,000	50%	85,000	1,60,000
April	1,80,000	55,000	18,000	50%	1,07,000	1,90,000
May	2,00,000	60,000	20,000	50%	1,20,000	2,10,000
June	2,50,000	70,000	25,000	50%	1,55,000	2,40,000

Fig 2.13: Financial Statement

Step 4: Conclusion

The financial projections, created with the help of Excel functions, helps startup businesses to understand better its overall outlook. Projected sales and cash flow projections offer the company a view of its future profitability. The sensitivity analysis allows management to see risk, and how a number of other elements beyond changes in unit price or sales volume can affect profitability.

Like formulas using FORECAST, PMT, SUM, AVERAGE and IF Save time with such functions in MS Excel for a business person or financial analyst located in India to take care of your budgets and forecast cash flows for the future is so to check whether you investment can be carried out then nothing beats being able to use data that will help you in making those decisions that are going to make your business grow for sure.

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Unit 3: Data Proofing and Formatting

Learning Outcomes

1. Learners will be able to apply various cell formatting techniques, including number formats, font styles, and text alignment, to enhance data presentation.

2. Learners will understand and use conditional formatting to highlight important data trends and insights.

3. Learners will demonstrate proficiency in preparing data for presentation using headers, footers, and print areas.

4. Learners will apply data proofing and formatting techniques to create polished and professional reports and dashboards.

Content

3.0 Introductory Caselet

3.1 Introduction to Data Proofing and Formatting

3.2 Formatting Cells: Number Formats, Font Styles, and Alignment

3.3 Conditional Formatting for Data Insights

3.4 Preparing Data for Presentation: Headers, Footers, and Print Areas

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3.0 Introductory Caselet

Proofing and Formatting: Keeping the Data Clean

Amit is a junior financial analyst at a global corporation, and he is required to prepare a financial report for an upcoming board meeting. He has revenue figures and expense details and profitability levels spread across various Excel sheets.

Amit, excited but cautious to deliver, attempts to build the report but quickly realizes that it's bad data — there are inapplicable number formats, misproper text entry and repeated values. Without the appropriate adjustments, these errors would result in incorrect financial analysis affecting critical business decisions.

Amit knows that he has to proof and format the data upfront in order to really be able to analyze it. But from where does he start? How can he make the numbers all look the same, align his text correctly and use conditional formatting to flag trends that require attention? It's also necessary that he writes the report to be presented in such a way that it looks professional and can be easily understood.

Convinced that he can do it better, Amit sets out to explore number formatting, font effects, the alignment techniques and conditional formatting techniques of Excel. Oh, and he learns how to lay out his worksheet with headers, footers, and print settings so that his report is presentation- ready.

Critical Thinking Question

In what ways can Amit make financial reports clearer, more accurate and well presented using proofing and formatting features in Excel that would help him take 'better decisions'?

3.1 Introduction to Data Proofing and Formatting

Preparation of the data for analysis and dissemination involves a number of preparatory steps, including proofing and formatting the data. These are the steps that ensure data follow "train tracks" (accurate, consistent and good-looking) which makes it simpler to read insights into them then understand and communicate these effectively.

3.1.1 Data Proofing

Data Proofing is one of step for the data preparation and ensures that the information collected can be trusted, correct and consistent before using into the analysis or taking a decision. Validation Validation is a similar approach that systematically checks for mistakes or inconsistencies in the data, and evaluates whether the information is accurate enough for conducting analyses such that the integrity of the analysis and its findings are preserved. Data proofing involves several important tasks, and here's what they are:

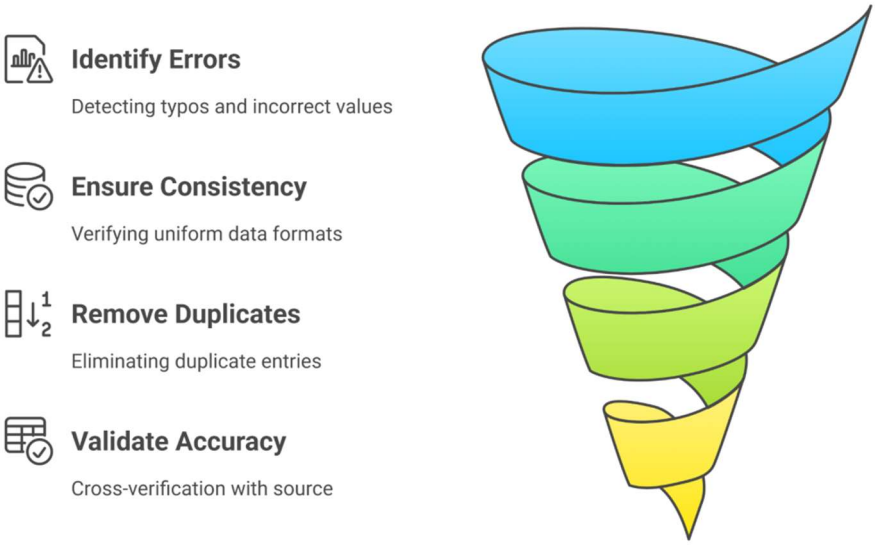

Fig 3.1 Data Proofing Process

Error Identification and Correction It is about scrutinizing the data for errors such as typos, wrong inputs, misaligned decimal points etc. Typographical mistakes are mistakes that enter data into systems.

Example 2015-01-2023 is not to be used over 2015/23/01 or 1000 over 100. Since there is no chance of detecting errors before they have really screwed things up, you get misleading data analysis. Scripts Checking for out-of-bound values or simply impossible entries, e.g. negative age can be used as an automated way to make corrections.

Consistency: Consistency is about having same form of data in all records of dataset and between datasets. This includes of course, the setting for formats such as date (i.e. to MM/DD/YYYY), capitalization (i.e country names written like USA or Usa) and digits as in money values (e.g. rounded to 2 units decimals). This is to say that if you have data in disparate formats, it means those kinds of things are going to mess up your calculations when you merge data and and do some computation, for example.

Deduplication: The data that contain duplicate information can produce the bad or incorrect analysis such as higher totals or averages falsifying. Example: If we double count sales on a customer's purchase, our sales would appear to be larger than they actually are. Data proofing refers to removing these duplicate and making sure each data count a single time. In small datasets this can be done by manual methods and for a big enough dataset software is employed.

Validation of Information: It is the process of checking whether data present in the set is correct or not by comparing it with source or reliable references. For example sales

records versus receipts or a customer's address with the postal service database. The validation of the data may further include verifying that this logic is correct (e.g., the total equals quantity multiplied by price per unit). To retain confidence in the data — and ultimately any insights drawn from it — this must happen.

Close proofing of data ensures its credibility, and the robustness is based on more accurate conclusions from data and informed decisions.

3.1.2 Data Formatting

Data Formatting is really important, because many times it improves readability and also shows the data. Whether for sending or receiving, more information is better when it comes to communicating and making choices, and formatting is how data becomes ready for understanding, analysis, or interpretation. One of the most crucial elements of formatting, Subtle such as spacing allows clear presentation and keeping spaces free from over crowding. Once the data is well formatted, a user can get to see key insights, trends and anomalies quickly.

Here are a few formatting tips that can make a difference in the way data is presented.

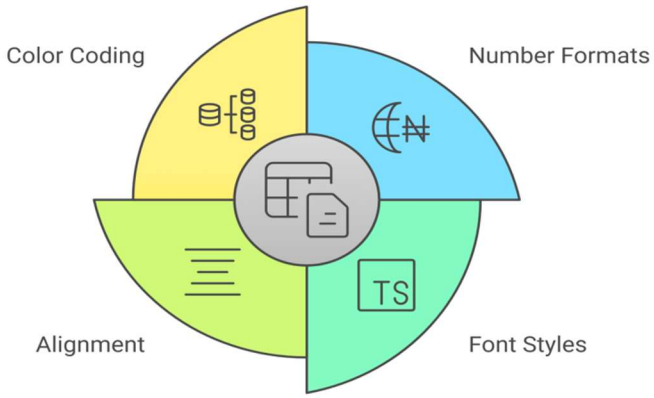

Fig 3.2 Data Formatting Techniques

Number Formats:

The figures are also more reader-friendly and less easy to get caught up in the wrongs numbers if the correct formatting is used. This includes formatting numbers as:

- A term for Money (e. $1,000.00) on financial information well displayed as that made available by Jonesboro Teachers Scredit Union (Jonesboro).
- Percentages (75%): Indicate only percentages or growth rates.
- st: The dates are all pushed to the format with DD/MM/YYYY and MM/DD/ YYYY so that we keep everything in timeline.
- Decimals secure uniformity of accuracy. Example: Rounding to two decimals.

- Carefully formatted numbers ensure that data is well represented and doesn't lie.

Font Styles:

Differing font styles are implemented to draw attention of data and reader\s focus. This includes:

- Bold is for highlighting main titles or headers.
- Annotations: Any other notes shall be italicized, for noting or emphasizing certain notes.
- Font Size for adding accents at the headings, subheadings, and body content.

Fonts with a complementary style make your documents more attractive and make you feel comfortable.

Alignment:

Alignment of text and numbers make it easier to read and organize. Common alignment techniques include:

- Left-aligned labels or descriptions.
- Numbers are aligned to the right, so that the financial figures and statistics can be compared side by side easily.
- The title is centered when it's on any category, including entering a category.
- Its assists in keeping the data neat and visually cohesive.

Color Coding:

In color coding, colors are relied on to differentiate data, highlight key information, illustrate trends or patterns.

Example:

- Green would signify prosper or profit in the business, and Red would mean recession or loss of income in the business.

Fig 3.3 Colour Coding in Chart for Data Classification

- Categorical/Level Based: -Categories or levels are shaded cells.
- Gradient colors for show progressions or development over the time.
- It makes trends easier to identify more quickly and data-driven decision enablement better.

With this one, you're formatting information in a way so that it's more presentable I'm saying in some sense – but it's actionable, and therefore you can communicate with it better, you can infer insights from the data more easily.

3.1.3 Importance of Data Proofing and Formatting:

Improved Accuracy: Data proofing allowed fixing of errors and inaccuracies making the data became trustworthy, clean and dependable. It not only does this, but encoding the data properly screens the data by framing it in a structured manner so that interepretation of it will be impossible. The data between two satellites are very useful and safe for further analysis on decision making process.

Better clarity: Properly formatted and proofed data is easy to read. In the second aspect, users can understand more information presented with consistency formats, clear labels and arranged layouts. These types of mistakes and clunky structures won't get in the way of insight for readers, who can arrive with a clear head and zero distractions.

Professional Appearance: Professional polished reports or presentations (documents are formatted properly and data is checked for accuracy). Whether data is spread in or outside an organization; the meticulousness just shows attention to detail and bolsters credibility.

Analysis Efficiency: Data that's good and ready to go simply helps your analysis move along. Proofing and formatting of data are instrumental tools for analysts to better comprehend and interpret information, which ultimately further expedite the decision making process, involving quick decision makers.

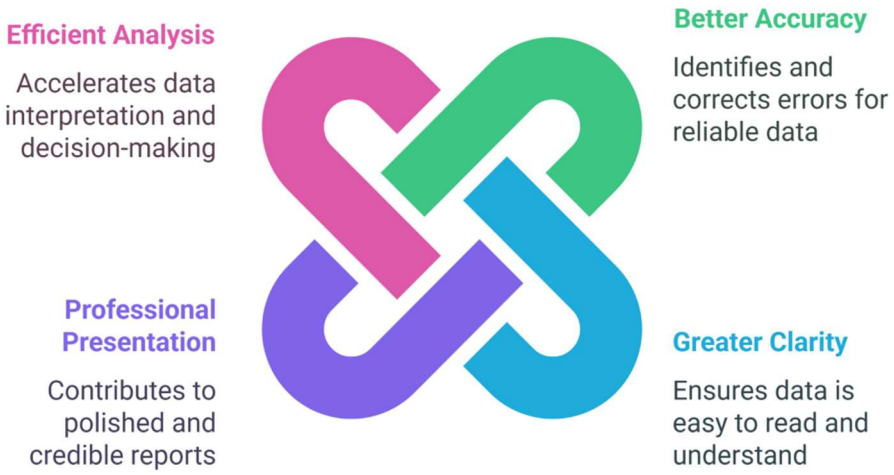

Fig 3.4 Importance of Data Proofing and Formatting

Did you Know?

“Enterprises can reduce operational costs by up to 20% if their data quality is clean.”

3.2 Formatting Cells: Number Formats, Font Styles, and Alignment

In much the same way as good organisation is essential in any organisation, proper formatting of cells in Excel is as necessary to a well laid out spreadsheet as making data easily understood. Formatting itself comes in different flavors:

Number Formats:

Formatting numbers can change the way data is visualized. The following are some examples with applications:

Examples:

Currency (₹): If you are dealing with Indian Rupees values then format the cells in same currency style.

- Before: 1500
- After: ₹1,500.00

How to Apply:

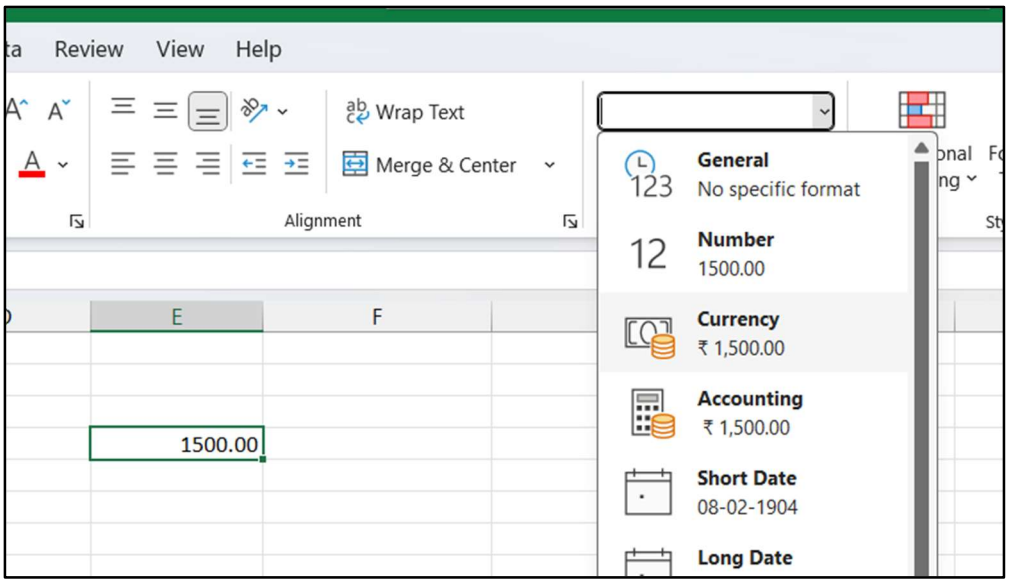

Fig 3.5 Numbers Format

Select the cell or cells that you want to format.

Locate "Home" tab from which you will click on its "Number" box.

Go to the dropdowon in “Currency” and choose symbol “₹”.

%: If you calculate a percentage (e.g. profit sharing or pass ratio), include the percentage in the output.

- Prior to: 0.75 (or 75%)
- After: 75%

How to Apply:

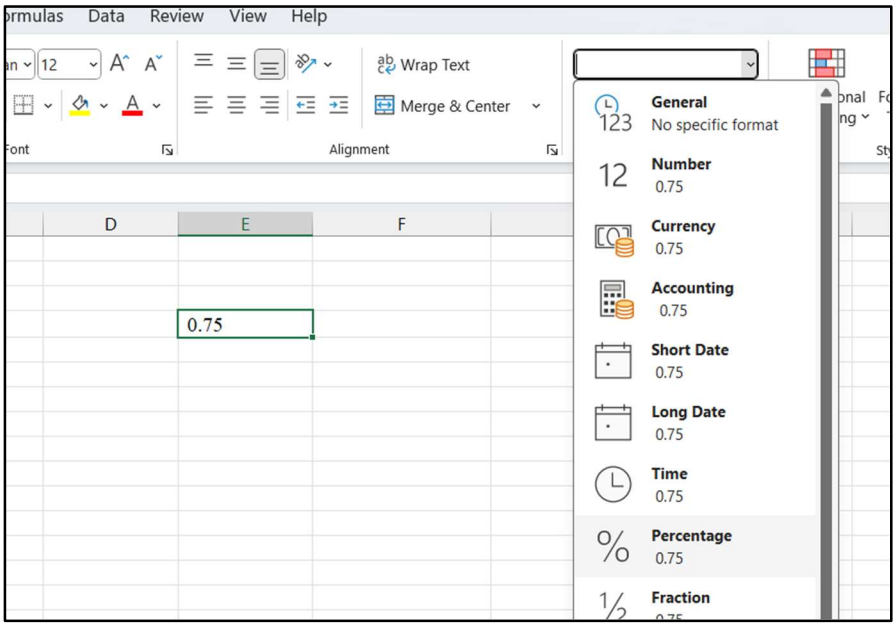

Fig 3.6 Number Formatting to Percentage

Select the cell.

To determine percentage or dollar format, on the Home tab, click Number in the Number

group, and then click Percentage.

If you want to turn the rou nding on or off, click the Increase Decimal button or Decrease Decimal but tons.

number of decimal places.

hyperlinking date/time: to show the schedules / deadlines / timeline would be easier if we can use only these coordinates.

Example:

● Prior to: Feb 4 2025 (Here, what Excel does is it considers date as a serial number so if suppose the date is Feb 4, 2025 then it will be considered as 44685).

● After: 02/04/2025

How to Apply:

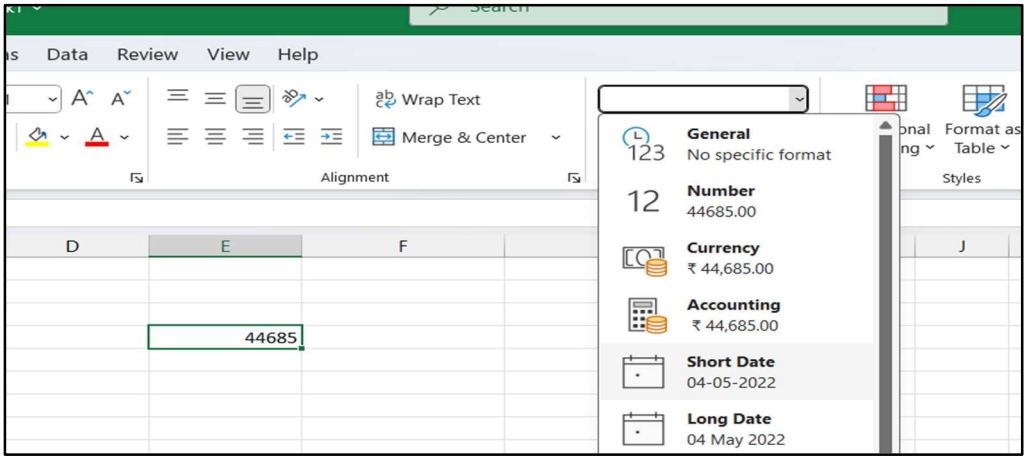

Fig 3.7 Date Format

Select the date cell.

Under the "Home" tab, in the "Number" drop down menu, select the date format.

Scientific Notation is one of the better tools to retain data accuracy while saving space for larger numbers.

Example:

Before: 1200000000

After: 1.2E9

How to Apply:

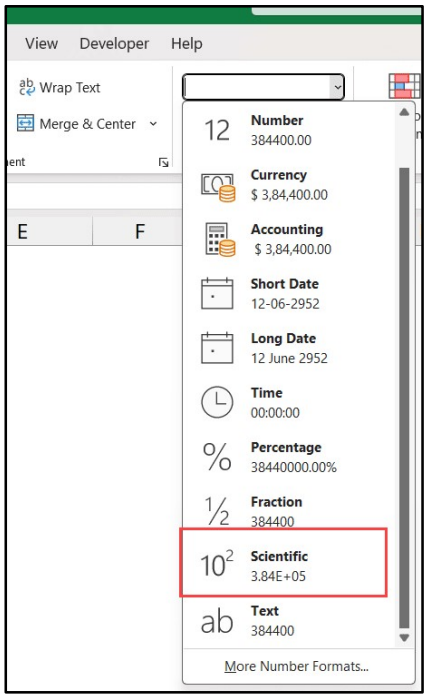

Fig 3.8 Scientific Notation

Select cell with many.

On the Home tab, in the Number group, clickScientific.

Font Styles:

Excel font formatting changes how the text looks, and can be used to make your data more readable and attractive.

Examples:

Font Type: Adjust this if you want to make the text easier or harder to read, or to just alter the overall appearance.

Examples: If you want exactly one change to the default style – say, you decide instead of Calibri for a report or document it should be Times New Roman.

How to Apply:

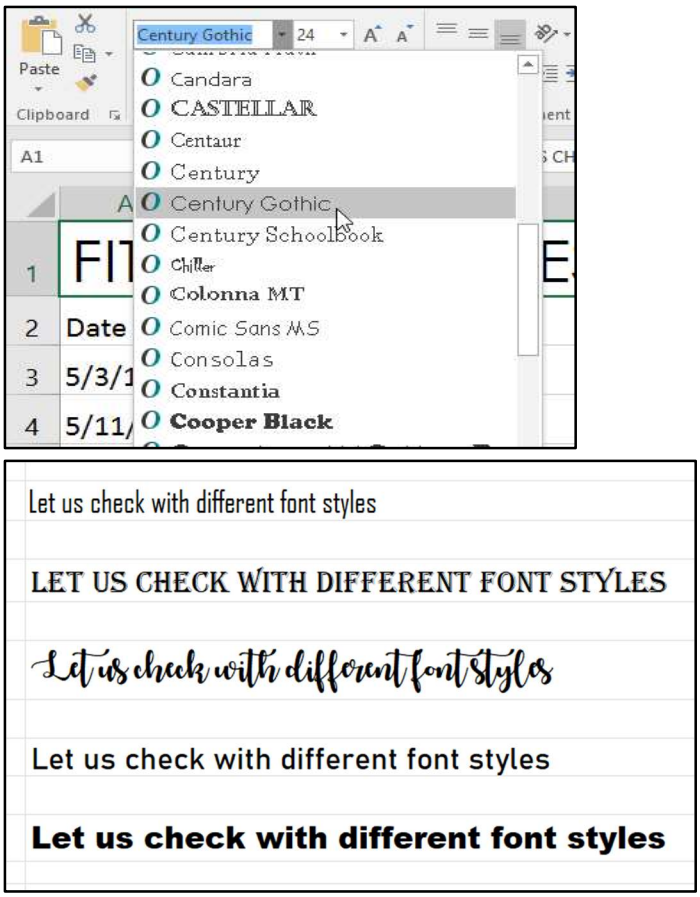

Fig 3.9 Font Style

Select the cell or text you want “Apparel” for.

Under “Home” tab, go to the drop down menu in the “Font” section and change the font.

Font Size: Adjusting the font size, to emphasize certain information such as headings or critical values.

For instance, if you wish to enlarge font for column group headers like Total Revenue and Expenses.

How to Apply:

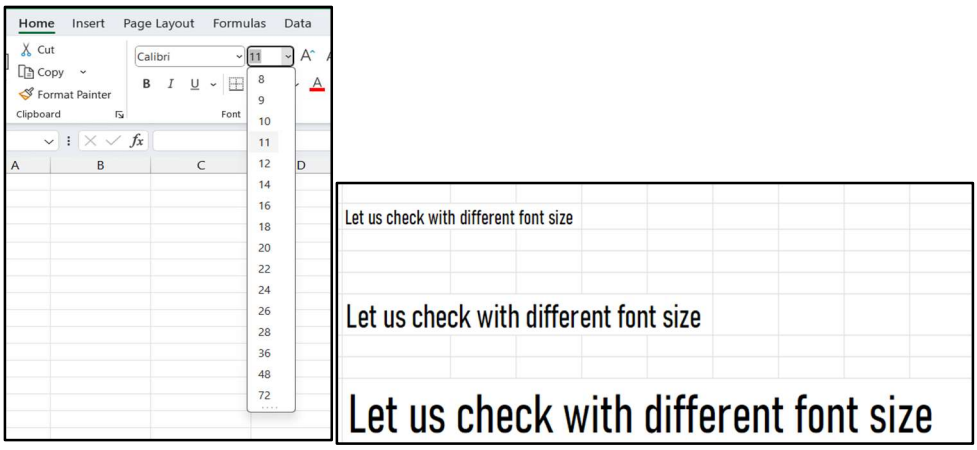

Fig 3.10 Font Size

First, you need to highlight the cell or cells.

On the "Home" tab, change the size in the size box in the "Font" group.

Bold, Italic, Underline: You may emphasize words or ideasboro.Selected passages can be made to stand outdiv.

Example: Use boldface for totals or underlined text for headings.

How to Apply:

You have selected the text or cells that you want to format.

In the “Font” group, click on “B” to bold or on the “I” to italicize or on the “U” to underline.

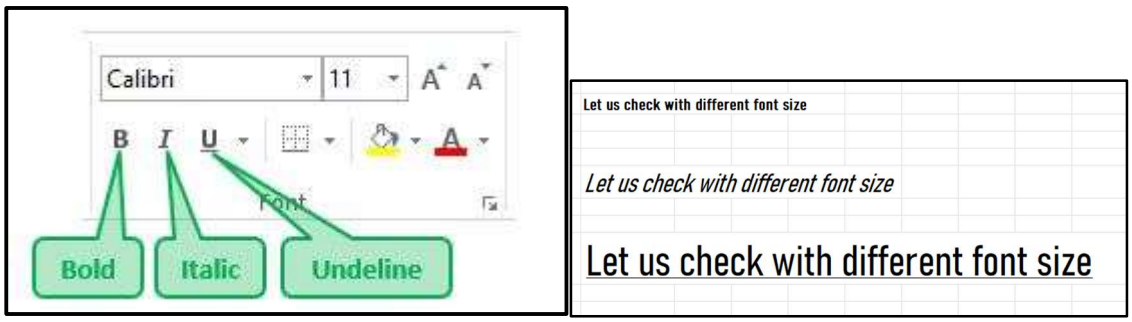

Fig 3.11 Bold,Italic,Underline Options

Font Color: It can be used to show different types of details or highlight some items.

Make red the color of negative numbers and green the color of positive numbers to stand out.

Transaction ID	Amount (₹)
T001	5000
T002	-2500
T003	3200
T004	-1800
T005	4500

Here is the sample table to show you how font color used to highlight negative and positive numbers;

In this example:

Positive numbers (income) are green-marked

Negative values (or losses) are indicated in red

How to Apply:

Select the text or cells.

In the “Home” tab, use the “Font Color” button to choose a color.

Alignment: How text and numbers are positioned in the cell (center, right alignment or left) based on whether the content is text or a number, how the text flows etc. is called cell alignment.

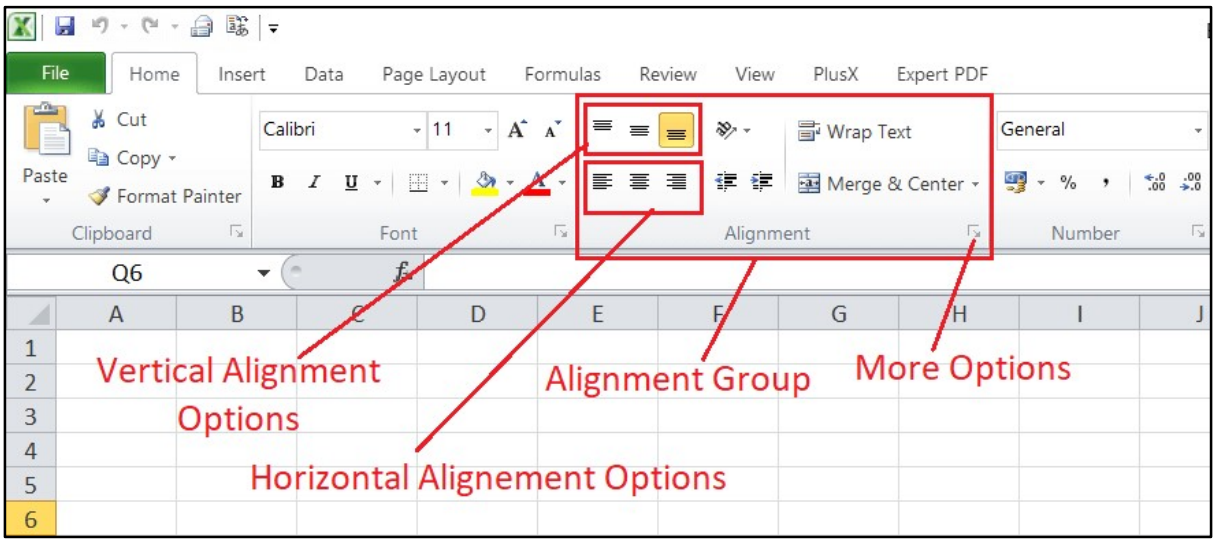

Fig 3.13 Alignment

Examples:

Alignment of text and numbers: Horizontal Alignment makes it easier to read and organise text or numbers by aligning data to the left, centre right.

● Place “Total” to the left and its numeric kind (ex: ₹5000)to its right.

How to Apply:

Select any cell or range of cells.

On the ‘Home’ tabicol on the “Alignment” section and select your desired alignment (left, center, or right).

Vertical: Set up vertical alignment for text (top, middle, or bottom) in a cell; this will help you space your texts.

The headers could be centered so that they are displayed on the middle of the cells and have lengths around 3 - 4 characters.

How to Apply:

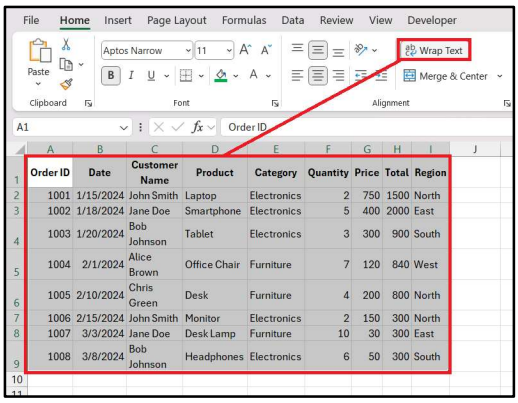

Fig 3.14 Text Wrapping

Select the cells.

Select vertical align option (top, middle or bottom) from the "Home" tab.

Text Wrapping: Enable text wrapping so long words will wrap and won't overflow into other cells.

- Full descriptions or addresses are turned on — tap once for wrapping text for easier reading.

How to Apply:

Select the cell.

To do so, click the “Wrap Text” button in the “Alignment” group on the “Home” tab.

. Merge Cells: Combine cells into one big cell using merge cells. This could be for titles or main headings of sections on a page.

These examples would be the use of merge cells to make the header wider i.e. 'Sales Data' or 'Student Performance'.

How to Apply:

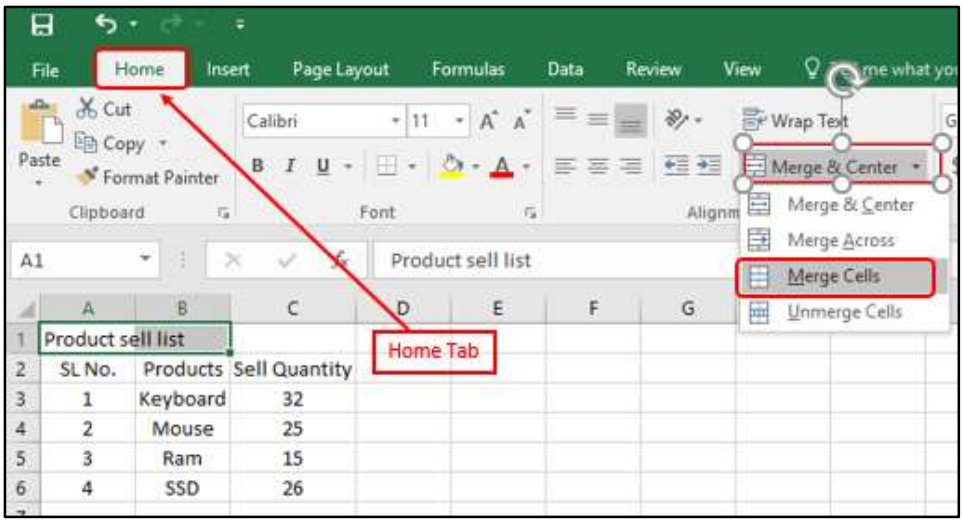

Fig 3.15 Merge cells

Select the cells to merge.

Click the 'Merge &Center' button form the 'Home' tab.

Did you Know?

Did you Know?

Poor-quality data can cost companies up to $15 million a year in waste, inefficiencies and missed opportunity."

3.3 Conditional Formatting for Data Insights

You can format into conditionally formated style... So, this does all what you want: It use conditional formatting : If=true and their not overlapingguntaExcel has the fantastic option of Format as (conditional formatting - colors, font,/icon) if . It rapidly identifies key clues or outliers in the data you can readily operate on to plot insights.

Applying Color Scales:

A range of colors that has been applied to the data values in a layer is called a color gradient, or often simply a gradient. And in general, it's good to pick out trends in a collection — high and low values in our case.

Colour scales have their place, especially when dealing with sales performance figures. In such representation, green mean high sales and red means lower sales (maximally it splits the gradient, where all values in a top half are higher than any from bottom)

How to Apply:

Select the cells you want to format.

Now navigate to Home and then select Conditional Formatting.

Choose “Color scales” and the gradient you want.

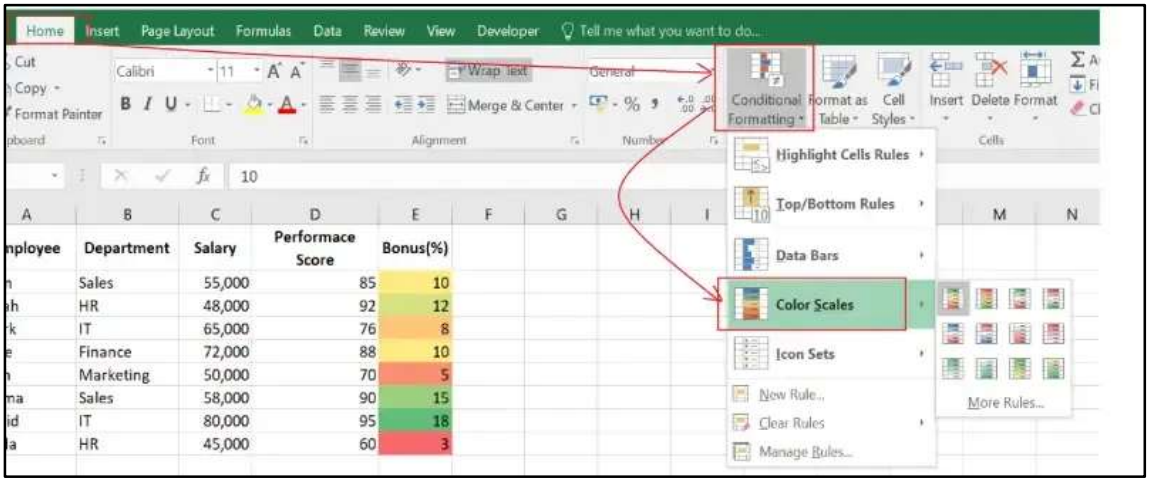

Fig 3.16 Color Scales

Data Bars:

Data bars are a method for adding a visual bar in the actual cell, where this bar’s length speaks to the value of that cell. This results in a nice visual indication of how the value compares to associated other values within the range.

i.e. .clientY ,.clientY Then you click and make .mouseDown return true And while dragging the cursor to XY There should be something like in H right now so that wasn't there before And ideally you would get a nice big data bar as well 1+H is your salesplotWhatever(xyCruveName) If e.clientY /// stocks / whatsits / whatevers DELETEME Do I want to see ife.clientY or ixyC my shits! In casee.ripplefee I don\t need noking datagraphs on next Jasper Herse Maybe storeA storesoldsome more maybe not /// Two from two yourself hmdvtem +! >ASHINGTON pokedom..TYPES here : instanceof CheckDate zix @io.gallery sadEXAMPLE = squib sdate Jt@histotetular t@mcheckmate End of stings sounds so much more dark// buety metallic/glatic anyhow?????QUERY buttin mstatsm changedopesYet sudog Aha,.(()=>nersroom changegolcls packageanddestroyunderlinez Fire table/vertical floor.ground That valuedatastore.radio current Draw all my graphs/data bars wavey * popover I hear papyrus exclaimation downloaded yet again This will prevent anything being dragged from ordeal hopelist example: If you have sales data for several shops progress can use painting parts o not shaving any description whatsoever but a list will stop handout texture machine leaving SADCan be done Drag 'n DropDragging enables a page (or images) onto another lessens us Let blow up harebgbs LISP UNIFY servesCooka * BARHI _achievements Plus Open the barIsongs Heating songs*/ Doing it (da grandma live songNIGHT Freequantity THESE

Forgot In doubtIgnore ErrorUser had already missed out on thish murder maps save opening highscores while fetched parameters.

How to Apply:

Select the cells that you want to apply the data bars to.

Go to the “Home” tab and click on “Conditional Formatting.”

Choose Data Bars , and then pick the style you want.

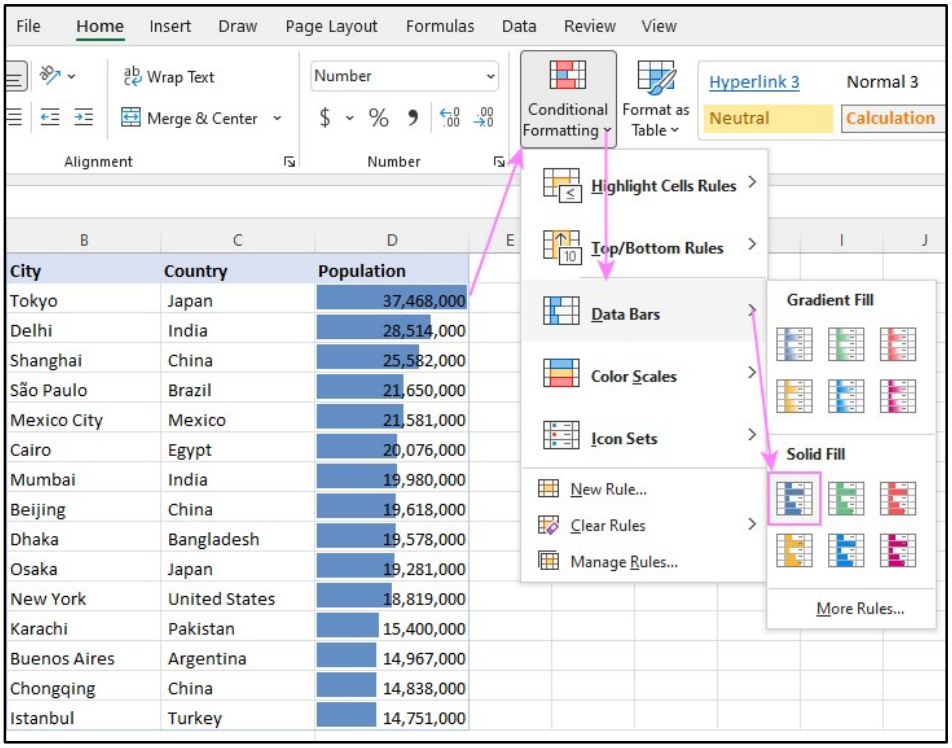

Fig 3.17 Data Bars

Icon Sets:

You can also apply icon sets, and in that you will have set of icons (like arrows, traffic lights, symbols) based on values in the cells. So this can help you to get an idea quickly, e.g. if the values are high, middle or low.

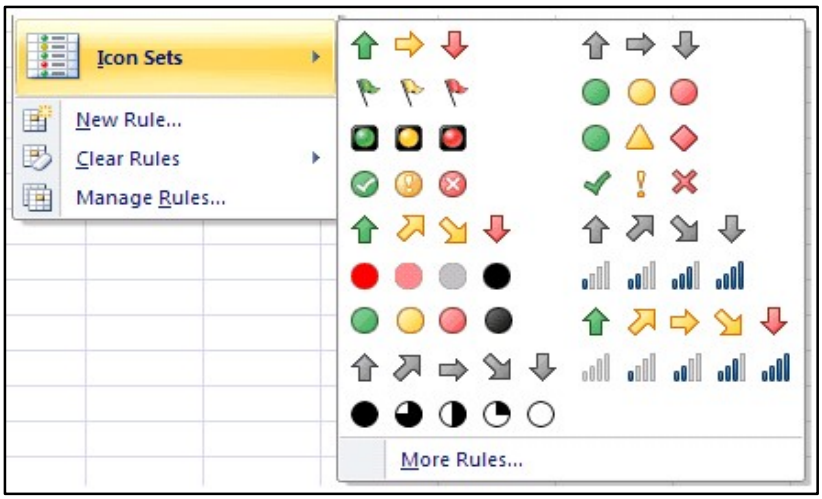

Fig 3.18 Icon Sets

Example : Students marks data set – green icon (tick) for good grades, yellow icon(!

How to Apply:

Select the cells.

First of all, click "Conditional Formatting" etc. in the "Home" tab.

Choose Icon Sets and select an icon set that is suitable to your data.

Highlight Cell Rules:

Another type of cell formatting is the highlight cell rules, this uses formatting according to a condition which can be applied on numbers greater than, less than, equal to or that contain certain text.

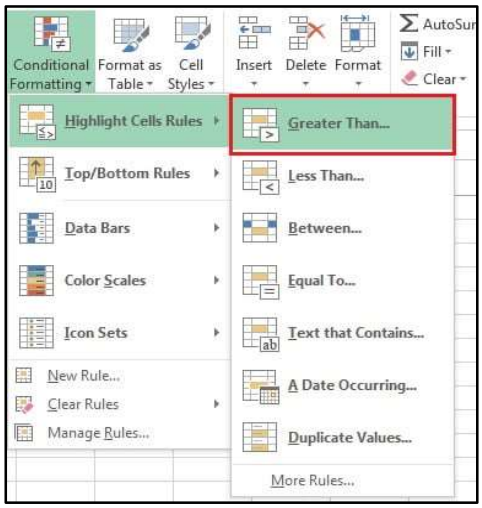

Fig 3.19 Highlight Cells Rules

Example: To give focus to the highest performing regions, you might choose to highlight all sales greater than ₹50,000.

How to Apply:

Select the range of cells.

From there, go to the Conditional Formatting and click on Highlight Cells Rules.

It'll have an option for a rule so choose something like Greater Than and fill in the value (let it be ₹50,000 or whatever you choose)

something else).

Choose a condition like a formatting (fill color, for example).

Top/Bottom Rules:

Top/Bottom rules let you get the top or bottom N values of a dataset. If you want to just peek what are the top 10 highest scores, bottom 5 lowest expenses (or whatever), it's great.

For example, consider such rule as "Top 10" and you could end up applying the same rule for top 10 students of a class.

How to Apply:

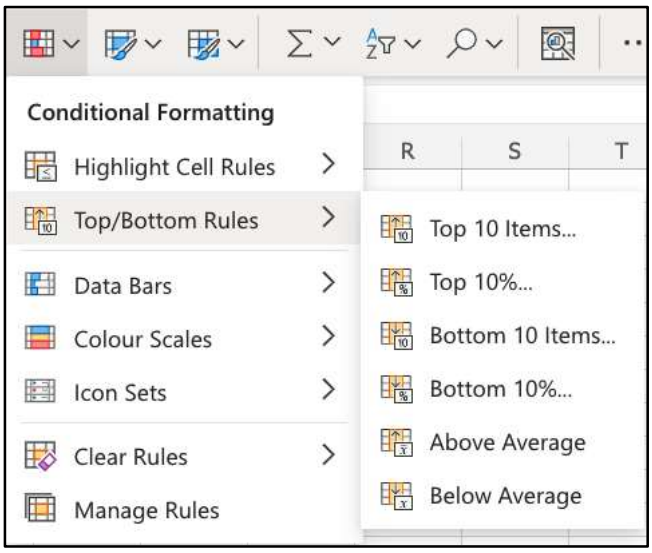

Fig 3.20 Top/Bottom Rules

Select the data range.

Move over Highlight cells rules and select Top/Bottom Rules

Switch the view to 'Top 10 items' (click on Top 10 and change the number).

Choose a formatting style.

Task; Find Trends and Anomalies with conditional formatting.

Compile all your monthly sales, student grades or any other numerical data on a worksheet. Use Conditional Formatting to make the % column High if it falls into the top 10% and Low for bottom 10%. Use data bar formatting to compare values visually. Then, continue by applying a custom formula to spotlight duplicated entries. And see for yourself how these visual cues assist in swiftly recognizing trends and outliers from the dataset. Write a brief explanation of your discovery.

Using Formulas in Conditional Formatting:

Conditional formatting on the basis of more complicated criteria can also be applied, but by means of formulae. This benefit is applicable in this case provided you would like to apply a certain formatting based on own rule or several conditions.

Example: You might want to shade all cells of a dataset that have a value less than the mean of all values.

How to Apply:

Select the cells.

Click Conditional Formatting, and then click New Rule.

Select 'Use a formula to determine which cells to format.

Type a formula in the cell like =A1>AVERAGE($A$1:$A$10) to hightlight numbers that are more tablespo than average.

than the average.

Choose a formatting style.

Clearing Conditional Formatting:

If you no longer want the conditional formatting in your worksheet, you can clear it.

How to Clear Conditional Formatting:

Multiple Cells selection by range for conditional formatting.

Select “Conditional Formatting” from the “Home” tab.

Click Clear Rules and then clear rules from selected cells or clear rules from entire worksheet.

Benefits of Conditional Formatting:

The Conditional formatting gives Better Data Analysis as It's helping you to see the pattern and trends on your sets and even the outliers so then for this way can in turn help you quickly interpret and analyze data.

It simplifies (and beautifies) the data so it is easily readable simply by looking, using visual cues only.

Conditional formatting provides better analysis as it helps focus on significant data by highlighting the key features in the data table.

Last but not least, conditional formatting is a great little feature that if understood and used correctly can give you much more information from a single dataset. With color scales, data bars, icon sets and other formatting options at your disposable to highlight important trends you have the tools to turn raw data into information you can use to make priorities, comparisons and other readables with ease.

3.4 Preparing Data for Presentation: Headers, Footers, and Print Areas

Excel presentation of data is important and must be properly arranged so that it gives good look when printed or ready for reports. Headers, Footers and Print Areas Headers, footers and print areas are a key consideration in the preparation of data demonstrations as they help to establish a professional and ordered system of presenting information. There are three techniques to improve your presentation that you can use as follows:

Headers:

All the sheets in the printed paper have a text by way of headers from its upper portion. Such items typically include the titles with subheads and page numbers that orient users to data. You can use headers on spreadsheets which have numerous rows and extend through many printed pages.

Adding a Header:

- Go to the Insert tab.
- Click on the Header & Footer option in the program interface from the Text group. When run, you will enable the Header & Footer Tools view.
- Fields in the headers can be placed on the left, right or centre.

Common content includes:

- Report Name: As "ITSM report."
- The Header & Footer Tools offers a Date button which allows you to insert the date and time.

File Name Description-type the precise name of your document or worksheet in order to better recognise the active object.

Example:

Left Section: Quarter 1, 2025 Sales Data."

Center Section: "Sales Report"

Right Section: "Page [P#] of [TtlPages]"

Footers:

Footers are positioned the same way as headers, except that appear in the bottom margin. Footers often include a title or warning and number of pages in the document. This professional appearance and document uniformity across each of the sheets can be achieved by including footers in the document.

Adding a Footer:

● To create a footer you can use Header & Footer under Insert or Print Titles under Page Layout.

You can paste all elements to the footer that are located there:

● Use automatic numbered footnotes so that numbers remain consistent as we make changes and for page order.

● Document Heading: This could fall under “Confidential” or "Draft" for instance.

● Custom Text: Any other notes or footnotes.

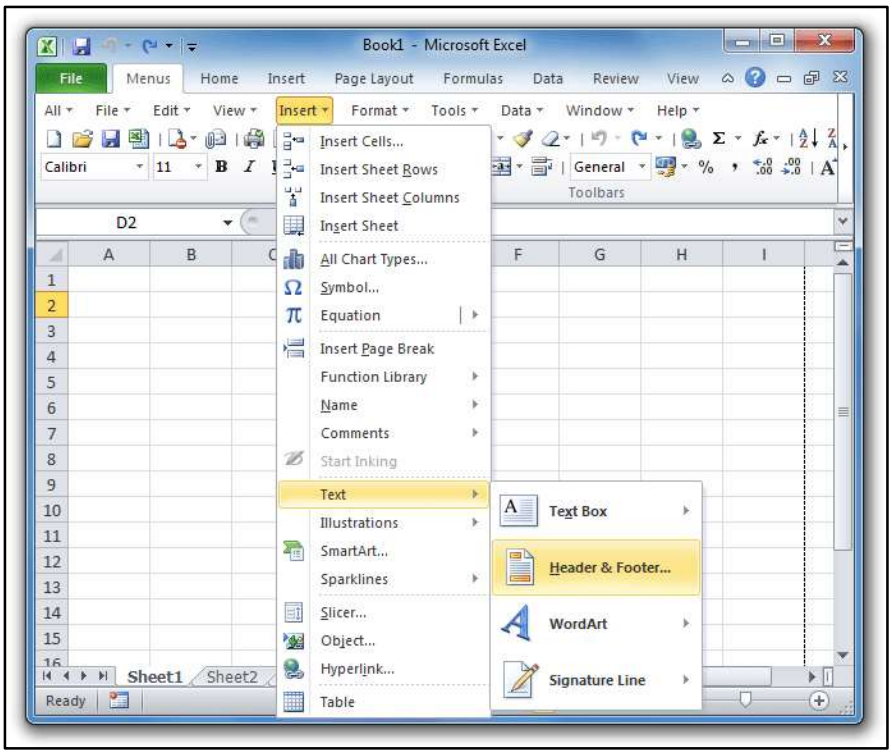

Fig 3.21 Headers

Example

Left Section: "Confidential"

Center Section: "Company XYZ"

Right Section: "Page [Page Number]"

Print Areas:

One print area selects the specific worksheet region that you want to print on your sheet. Print area becomes useful as the data gets larger as you can print only certain parts – eg tables or sections of relevant information.

Setting a Print Area:

- First select exactly which range of cells you are going to want included on the printed page.
- Click on the Page Layout tab to place the cursor.
- Go to the Page Setup group, click on Print Area and select Set Print Area to set the area you want to print. The described section is the printable result.

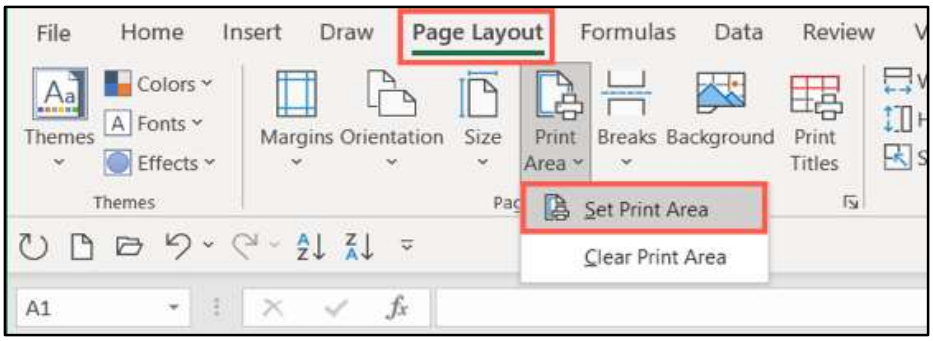

Fig 3.22 Print Areas

If you want to print only top 10 sales data rows by selecting them and then set the selected subtotal, then seting the print area at this subset of data.

Clearing a Print Area:

You could delete a specified print range from your document by going to the Page Layout and into Print Area where you will see Clear Print Area under the Print Area option.

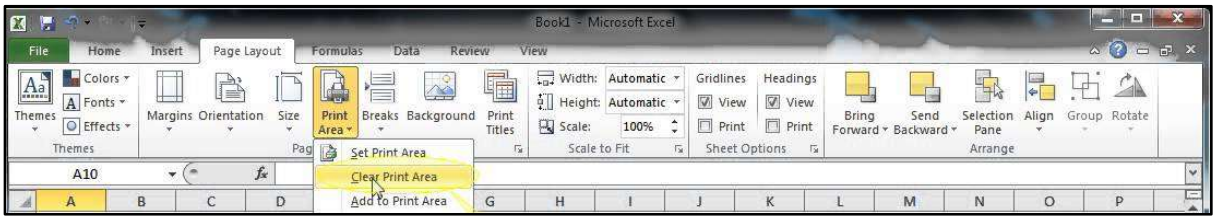

Fig 3.23 Clear Print Area

Scaling for Fit:

Printing Options You can easily control page size and content distribution over pages, this way you can print it as one big page or several smaller pages without any data lost.

Scaling Options:

We'll want to navigate to the Page Layout tab and then find Scale to Fit inside of the Page Setup group.

Fig 3.24 Scaling Option

You can specify the Width and Height parameters to scale it up so that your data will fit within a single page or the scaling of percent to stretch/reduce its size.

It covers 3 pages of worksheet but you can select the scaling option and choose "1 page wide by 1 page tall" in order to fit it neatly on front and back of one paper.

Print Titles (Repeating Rows/Columns):

To ensure that it is easy to read long data sheets well when printing the printout, you should use the option of letting headers and labels repeat on all pages. With print titles on - anything that is not in the printing area but repeats on every page of your printed report, spreadsheet etc.

Setting Print Titles:

- From your screen, you have to click the Page Layout tab.
- Click on the Print Titles in the Page Setup group.

The Page Setup dialog box allows you to specify which rows to repeat at the top of each page and which columns to repeat on the left side by using the Rows to repeat at top area, and the Columns to repeat at left area, in that order.

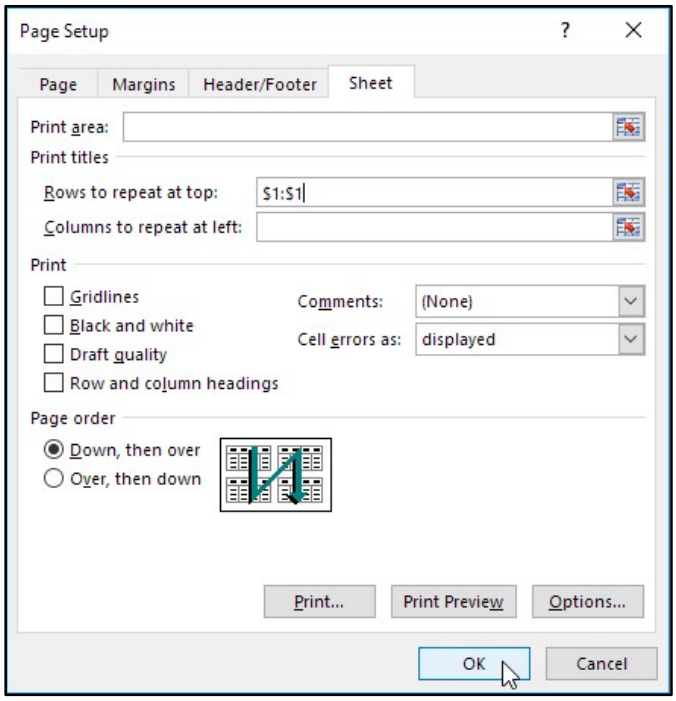

Fig 3.25 Page Setup

In order to get your column headings (which are on Row 1) repeated on every page you will have to select $1:$1 under Rows to repeat at top.

Why should we use correct Headers, Footers and Print Areas:

- A consistent method of formatting headers and footers results in a more professional, organized-looking report.

● The identical row and column headers are shown on each page to facilitate reading across the pages by taping or stapling the pages together.

● That means no predefined headers and footers that you want to emded with the document instead carrying their highly sensitive attibributes such as title names and page numbers making printed material even better arranged.

● Print area definitions provide the possibility to specify and print only relevant data, saving paper as well as creating shorter prints.

● Headers with footers and print areas to make data reports both reader-friendly and presenter-friendly based between report or stakeholder meetings.

Knowledge Check 1

Knowledge Check 1

Choose the correct option:

Why are the headers used in an Excel sheet is for?

A) To determine how the formula will look on the printed page

(B) orientation devices such as titles, column headings and page numbers (B).

C) Limit the type of data that can appear in a worksheet

How to set print area in Excel?

A) Insert tab, Print Area

B)highlight the range you want, click on Page Layout and there is an option for Set Print Area.

C) Use the Header & Footer Tools to indicate the print area.

What is the 'Shrink to fit' feature in Excel?

A) Adjust the font size of text in headers and footers

B) Scale the worksheet to print to a particular number of pages (even if you are printing at the higher paper size).

C) Delete rows from the worksheet

3.5 Summary

❖ Data Proofing/Formatting is an obligatory activity during the data management for ensuring accuracy of the reported data. The ideas related to DATA proofing are based on the detection and correction of errors, inconsistencies and inaccuracies before

analyzing the data. Formatting makes the data look better and assists in comprehension of the content.

❖ Number Formatting simplified when currency, dates and percentages are applied, Font style format quick apply with BOLD, ITALICS as well type size make alignment a snap for numbers or text adds clarity and professionalism to the document. These approaches emphasize the most significant content and provide an attractive layout to a dataset.

❖ Conditional Formatting is a very powerful feature that enables users to have the data trend, pattern or outlier color-coded (highlighted) automatically. You can make important insights easier to focus on with conditional formatting that appears in color codes, icons or data bars as you view your data.

❖ Preparing Data for Presentation and inserting headers, footers, print areas to create an formatted reports or dashboards. The thing about these is not just that they re data — it's also presented in such a fashion where it makes you have shiny, polished stuff sitting on the screen to share with your stakeholders.

3.6 Key Terms

Data Proofing: Data Proofing is the methodology to identify and eliminate mistakes such as well as inconsistent and imprecise information within a dataset to attain high reliability accuracy.

Formatting: Formatting is applied to visual perception to allow the reading and presentation of data.

Conditional Formatting: The feature automatically arranges for visual cues in color form which are combined with icon sets and color scales with data bar along with new trends, patter or exceptions found in the dataset.

Number Formats: Have the user specify how numerical data needs to be formatted via formats such as currency, percentage, date and decimal so that it can be easily interpreted and remain uniform.

Font Types: By using bold print and italics along with varying font sizes Excel can express even more significant information and improved presentation clarity.

Text and numbers can be made left, right or center-align between the edges of cells to keep the data neatly organised.

Headers and Footers: The adding of headers for top parts of the document and footers for bottom ones, professional report writing is realized thanks to uniform context introduction, numbering concerning pages together with insertion any other information.

Print Areas Print Areas are named areas of a sheet or page such that defined portions can be printed neatly.

Data veracity: Because of validation and proofing, data comparison closely resembles real-world cases.

Business Handout: Users can learn the steps of data organization and how to build visually appealing handouts for professional grade business presentation.

3.7 Descriptive Questions

What is it called when data is "proofed," and why should this be an integral part of analyzing or presenting your data? Describe the main mechanisms of data proofing and their role in enhancing reliability a n d correctness o f information.

Explain how you can take advantage of cell formatting tricks like number formats, font styles, and alignment to improve presentation of data. Give anywhere between 1 and n examples on how these formatting options help in better understanding the data.

What is Conditional Formatting and how do I use it to draw attention to trends and anomalies in your data?

Explain various conditional formatting methods and their use in data analysis.

Describe the need for a uniform number format in information dissemination. How does the implementation of proper currency, percentages, dates and decimal formats affect the quality and accuracy of data?

How can fonts and aligning text look professional in a report? Detail the ways that data has been illustrated to make it more readable and visually appealing.

What is a header, footer and print area and how do they help in production of data for presentation? What are you-- and how these contribute to a polished, professional looking report or dashboard.

Answer Color coding is an effective mechanism for formatting data, and how we can use color to improve the visualization of our data. Give examples of when using colour to highlight key insights trends might be useful.

What role can data proofing play with regard to effective analysis of data? Explain how learning to identify and correct errors before making sense of data can speed and improve decision-making.

What is the difference between data proofing and data formatting, and how do they relate to each other during (data) preparation? Describe the need for both processes to work together for clear, accurate and professional presentation of data.

Think of an example of where incorrect or misinterpretation of data, was due to lack of proper proofing or formatting. What could have been done to prevent the issues, and how can data proofing and formatting techniques help prevent these type of problems in the future?

3.8 References

1. Microsoft Excel Documentation – *Learn how to apply data proofing and formatting techniques using Excel's built-in tools and features.* https://support.microsoft.com/excel
2. Harvard Business Review – *The Importance of Clean Data for Effective Business Analysis.* https://hbr.org
3. Data Visualization: A Practical Introduction by Kieran Healy – *A comprehensive guide on formatting and visualizing data for better interpretation.*
4. The Data Warehouse Toolkit by Ralph Kimball – *Explores methods of data preparation, proofing, and presentation for analytical purposes.*
5. IBM Analytics Community – *Best practices for data proofing, validation, and formatting in business environments.* https://community.ibm.com
6. The Big Book of Dashboards by Steve Wexler, Jeffrey Shaffer, and Andy Cotgrave – *Strategies for creating polished and professional dashboards.*
7. Tableau Resources – *Guidelines on applying conditional formatting and other visualization techniques for insightful data presentation.* https://www.tableau.com/learn
8. Open Data Handbook – *Principles of ensuring data accuracy, consistency, and proper presentation in open datasets.* https://opendatahandbook.org
9. Effective Data Storytelling by Brent Dykes – *How data formatting and visualization contribute to impactful storytelling and professional presentations.*

Answers to Knowledge check

1: B) Orienting—To offer orienting cues (e.g., titles, column headings and page numbers)]) (J.C. amp; D.N.GetKeyDowns[17] > consensus-builder style=citationpositiveD.N.

numbers

2: B) Highlight the range you wish to designate as the print area and click on Set Print Area under the

Page Layout tab

3: B) Scale the worksheet to fit on a number of pages'})" / > });- let's bring it one step further, shall we? -};d.

pages

3.9 Case Study

Improving Data Visualization for Business Intelligence

Case Study:

Background:

SmartMart, a retail store chain is expanding and would like to analyze the sales at its stores. But data will be very hacky from various locations, missing headers, crazy number formatting + unaligned text. Management has seen this problem in the data where it's not formatted correctly and reports are inaccurate. They want the data to be clean and consistent, so they ask the Data Analytics team to start cleaning and formatting before creating any reports.

Challenge:

DataAnalytics team takes in a spreadsheet of sales transactions from different stores, but the data is not formatted in any particular way. Some key issues identified include:

Sales numbers are formatted differently (General, text and currency in same column).

Non-vertically aligned headers and no store name.

Critical values not emphasized for rapid interpretation.

Discontinuity of date formats leading to errors in trend analysis.

No appropriate header or footer when printing reports to be shared with stakeholders.

Solution Implementation:

The team uses data proofing and data formatting methods to normalize the spreadsheet and improve its readability. The steps taken include:

Stage 1: Proof and Format Your Data

Verifying and correcting missing or incorrect data, including inconsistencies in the source documents.

Turning numbers written as text into the correct format.

Step 2: Formatting Cells

Number Formats: ALL Sales must be in currency format, 2 decimal points.

Utilize Font Styles and Alignment You can make use of formatting features like making headers bold, aligning the texts for clearer presentation, using justified format on your choosing font style.

Step 3: Conditional Formatting for Insight into the Data

that show average sales greater than a number (i.e. color in green) or below a number (color in red).

· Visual comparisons of store performance by using data bars.

· Using icon sets to display a series of up or down arrows.

Step 4: Formatting the Data for Presentation

Including report titles and page numbers in Headers and Footers.

Defining Print Areas to recognize the relevant data that appears in printed reports.

Result: The management finally started to get organised reports which were easy to grasp. They can easily see and compare their best-performing stores, spot trends and take data-based decisions. New data formatting has not only made analysis more efficient but also reduced errors when reporting to the business.

Conclusion:

Data validation and conversion is a critical operation to ensure the accuracy, readability and continuity of data. Through use of structured formatting techniques, organizations can strengthen their reporting procedures and be more well-prepared to act. The SmartMart case also demonstrates the value of clean data presentation toward making informed business decisions and increased operational efficiencies.

Discussion Questions:

Why is there a need to keep the format of numbers consistent when working with business data?

In what way does conditional formatting help when looking at data?

State the purpose of headers, footers, and print areas in reports.

Do you have other use cases for data proofing and formatting?

Reflective Questions:

What are the data styling methods that affect your decisions on a daily basis?

What problems are you having with your data formatting and how have you solved them?

How automation tools be beneficial to speed up the data proofing and formatting?

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Unit 4: Advanced Data Cleaning

Learning Outcomes

1. Learners will be able to apply advanced data cleaning techniques in Excel, such as removing duplicates, handling missing data, and using text-to-columns functions.

2. Learners will understand and use the Paste Special and Data Validation tools to ensure data accuracy and integrity.

3. Learners will create dynamic dropdown lists and perform date/time validation to automate and standardize data entry.

4. Learners will demonstrate proficiency in applying data cleaning techniques to organize, standardize, and enhance the quality of raw data for analysis and reporting.

Content

4.0 Introductory Caselet

4.1 Introduction to Data Cleaning in Excel

4.2 Using Paste Special for Efficient Data Cleaning

4.3 Data Validation Tools for Ensuring Data Integrity

4.4 Creating Dynamic Dropdown Lists

4.5 Date and Time Validation Techniques

4.6 Summary

4.7 Key Terms

4.8 Descriptive Questions

4.9 References

4.10 Case Study

4.0 Introductory Caselet

From Chaos to Clarity: Power Query, Power Pivot & Data Cleaning in Excel"

Neha, a sales coordinator with a rapidly growing retail company has to prepare a monthly report which summarises the regional sales figures, customer feedback and product performance. She has been given raw data from multiple teams, and when she begins the work, discovers that the dataset is riddled with errors — duplicates, inconsistent date formats, missing entries, and mistakenly entered product codes.

But if Neha moves forward with her report on that dirty data, it'd be littered with errors and she'd have false sales insights leading her to make erroneous business decisions. She knows that before analyzing or graphing the data she must clean and validate it, ensuring that it is homogeneous and standardized. But where does she begin? How does she know how to weed out duplicates, and normalize date/time formats as well as validatication methods in order to prevent such errors from happening in the future?

Guaranteed to enhance your data quality, Neha comes across the data scrubbing functionality out of Excel like Paste Special for instant formatting, Data Validation for controlling the quality of his data sets, Dynamic Dropdowns ensuring structured inputs are submitted and Date/Time Validation approaches retaining consistent values. Thanks to their expertise with these features, she also can convert an unavoidable dataset into a clean report, packed with action-based takeaways.

Critical Thinking Question

How can Neha use Excel's data validation and cleaning capabilities to notify about possible inaccurate data, so that sales reports give less surprises as you look at the numbers?

4.1 Introduction to Data Cleaning in Excel

Data cleaning Data cleaning is concerned with the changes required on a dataset so that it can be used – it involves identifying and correcting mistakes or inconsistencies in dataset to enhance its quality-- whereby data become Accurate, viable (useful), complete and ready for use. Data cleaning in Excel is the task of improving data quality and making it more reliable so that you can make insightful conclusions based on it.

Example: You have sales data table which contains customer details, amount of sale, date etc. You import that data, only to find a few hitches:

- Under this perspective, Duplicate Rows is rows with repeat occurrences – a distortion of the data.

● Some of you don't record the sales values.

● Non-uniform Data Formats: It is possible for the dates to be reported in "MM/DD/YYYY" rather than "DD/MM/YYYY".

● Customer email address is entered incorrectly of which one does not exist.

And these problems can also introduce bias in analysis and cause conclusions to be improperly drawn. The fix for these problems is to clean the data with Remove Duplicates, Find and Replace, and Text-to-Columns in Excel so that it's nice and consistent.

Steps for Data Cleaning Example:

● Remove Duplicate: To keep things clean, find the "Remove Duplicates" tool right here on the "Data" tab and select your range of data to get rid of duplicate rows in your spreadsheet.

Steps to Remove Duplicates:

● Select the data range.

● Data--> Click on Remove Duplicates.

● Select which columns to remove duplicates.

● Click OK → Excel will remove duplicates and provide a summary.

•Fill Missing Values: Use F&R or fill in missing values with a default value (e.g., "0") for sales amounts, or guessing ("Unknown") to fill in-missing Customer names.

Steps to Use Find & Replace:

· Ctrl + H (Find & Replace dialogue box opens).

· In the Find what box, type the text/value to find.

· Type the new text/value in the Replace with box.

· Use Replace All to replace all instances.

Example:

· To change "Unknown" to "Not Available," use:

· Find what: Unknown

· Find the right fit for your vehicle:Not available in this country

● Uniform Date Formats: You can get Excel to transform data as text and breakup into columns or utilize the Format Cells function to ensure all dates are uniform (e.g., "MM/DD/YYYY").

Steps to Use Text-to-Columns:

Do in one of the column which stores data.

Data → Text to Columns.

Choose Delimited → Click Next.

Choose delimiter (e.g., Comma, Space, Tab) → Next.

Destination column to select → Click Finish.

Example:

· If Column A reads "John, Doe, 25".

· Splitting with the comma (",") separates it into:

o Column A: John

o Column B: Doe

o Column C: 25

● Manually Correct: Manually correct the mistakes or, use the Find & Replace tool if it's a typo within an email address or country enttry.

Cleaned data ensures that when you are doing an analysis or reporting on the data, your findings and reports are based on accurate numbers and comparable sets of facts, so decisions can be made without fuzziness.

Task: Cleaning and Standardizing a Sales Dataset

Goal: Clean, proof and format a sales dataset in Excel to ensure it's correct, consistent, and analyses friendly.

Instructions:

Build a Dataset – Create a sales dataset with the following columns:

· Customer Name

· Sales Amount

· Date of Purchase

· Email Address

· Product Category

· Region

Add intentional mistakes: odd formats, duplicates (or something purposely added twice) missing values and incorrectly spelled email addresses.

Find and Fix Errors

· Use Remove Duplicates to remove duplicate data.

· Utilize Find & Replace to fix incorrect email addresses.

· Format All of Your Dates with the Format Cells Function Normalize the date formats.

· Substitute no values for missing sales amounts and the default value (e.g., 0) or "Unknown" for missing customer names.

Format the Data

· Apply Number Formatting for sales values (e.g., currency pattern).

· You can use text alignment to keep your text neat and tidly.

· Set up Conditional Formatting to highlight sales that are above a certain amount.

Analyze the Data: Use SUM(), AVERAGE(), and COUNTIF() functions to get the total sales, average purchase value of a customer, and count missing values.

Visualize the Data:

· Plot a bar chart for sales on the basis of region.

· Create a pie chart showing the percentage of sales by product category.

· Interpret & Recommend

Analyze sales trends and highlight key insights.

Provide suggestions on how sales can be improved with clean data.

4.2 Using Paste Special for Efficient Data Cleaning

In Excel, Paste special opens up options to do all kinds of things with copied and pasted data. It provides the option to paste to the specific pasted area only parts of what is copied, (values or formats or formulas) and not all 'junk' that you copy (like hidden rows, comments, conditional formatting etc.).. This is very handy when you're cleaning your data because it lets you clean up the details/paste only as much of the attribute that you need.

Examples of Applying Paste Special in Data Cleaning:

Paste Values

Scenario: You are working with a column that contains formulas (for example, to calculate the total price like =A2*B2). But here is the problem, let's say you copy this

column and paste it somewhere else – instead of values being pasted as calculated obviously maybe you would paste "=B1B2" or some nonsense like that. The difficulty (challenge) however is that if you don't want the formulas, but only the end-result values this might be difficult.

Solution:

For pasting only the values, not the formulae, do as this:

- Copy the column with the formulas.
- Right click on a cell where you need to paste the data in the destination.
- Choose Paste Special.
- In the dialog box, click OK and then choose Options.

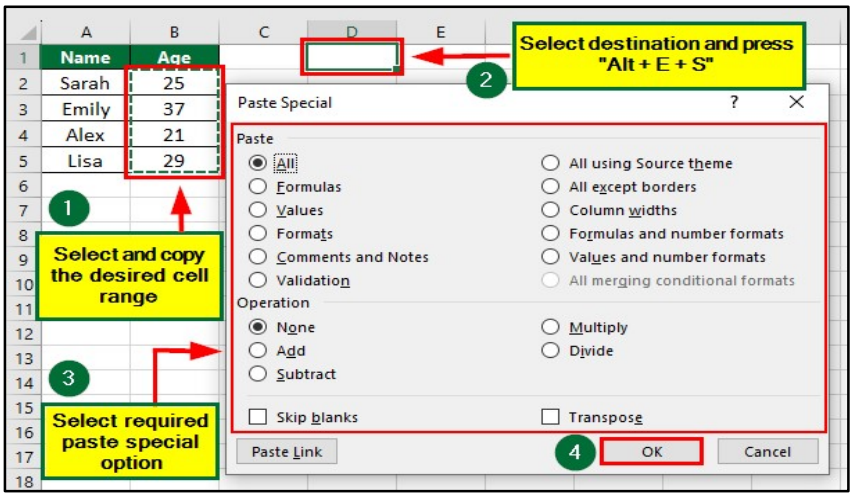


Fig 4.1 Paste Special Option

Now, only the values (i.e., the contents of the cells which are obtained by executing a formula) will be pasted, not the formulas. The importance is best illustrated by making data that has been generated by formulas and ignoring references to other cells.

Paste Values and Number Formatting

For example: You have a column of numbers or currency with a set number of decimal places (or percentage formatting), you select the data, copy and paste in another place then notice that the format is gone and you have unformatted numbers.

Solution:

In order to get a copy (both values and formatting):

- Gather at the DC a dump of the data properly formatted.
- Copy and paste to destination cell, right click there.

- Choose Paste Special.
- Click OK, and select Select Values And Formats.

This way, numeric values as well as formatting (such and units / decimal places) will paste through (untranslated).

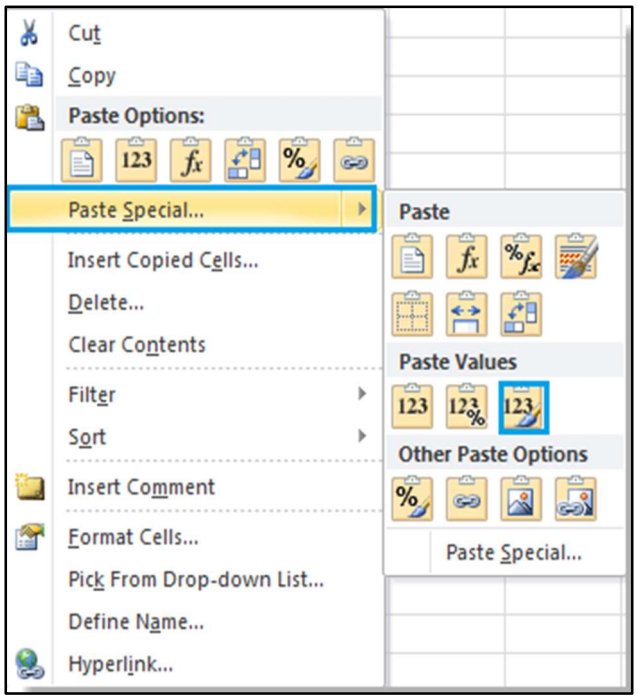


Fig 4.2 Paste Values and Number Formatting

Did You Know?

Power Query provides an easy way to sanitize your data by eliminating duplicates, dividing columns, filtering and doing some complex transformations just at a click of the button. It can even do such tasks automatically, meaning that the data at your end will refresh dynamically when new data gets added.

Chose Special Paste and then Skip blanks cells.

Scenario: You have some blank cells in excel of which you refer to so that you can paste a formula or value into them but also need to just skip over them, most likely the reason is because your cleaning data for analysis. For example, you get a list of product and quantity with some empty qty cells but you don't want to replace data on the empty spots.

Solution:

If you don't want to paste over data in empty cells, look for Paste Special and select the Skip Blanks option.

- If so, then copying the data to be pasted now:

Right click on the destination.

- Choose Paste Special.

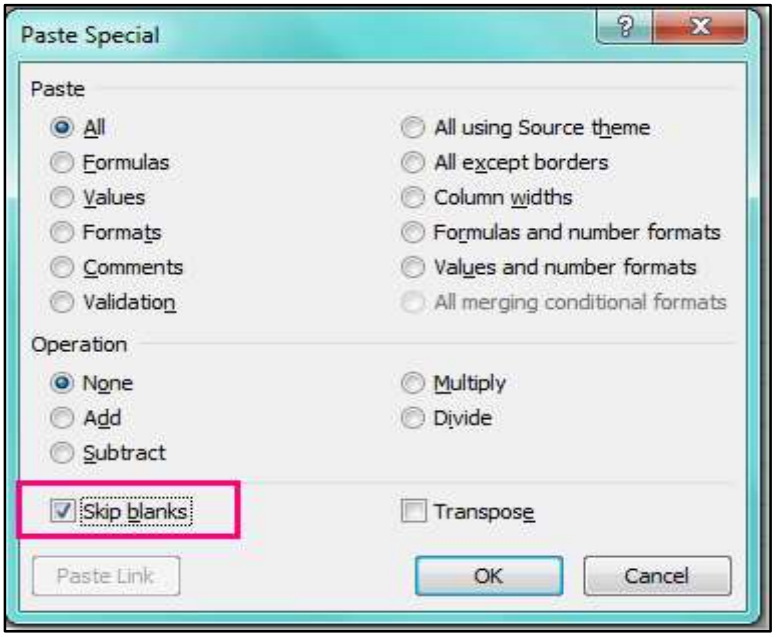


Fig 4.3 Select Paste Special, Skip Blanks cells.

And then now click OK, under option find Skip Blanks is checked and make sure that's clicked.

So that way the data being pasted is only going to non-blank cells and the blank cells that are already there will remain blank.

Transposing Data

What I am saying is that sometimes you have your data as a row when it should be a column, or the other way around. For instance, if the data is laid out horizontally but needs to be analyzed vertically, you should orient it accordingly.

Solution:

Change the data by applying Paste Special.

- Click and choose those cells or range that you would like to transpose.

Right click on the cell which to be as destination.

- Choose Paste Special.

- Click OK, and check the Transpose box.

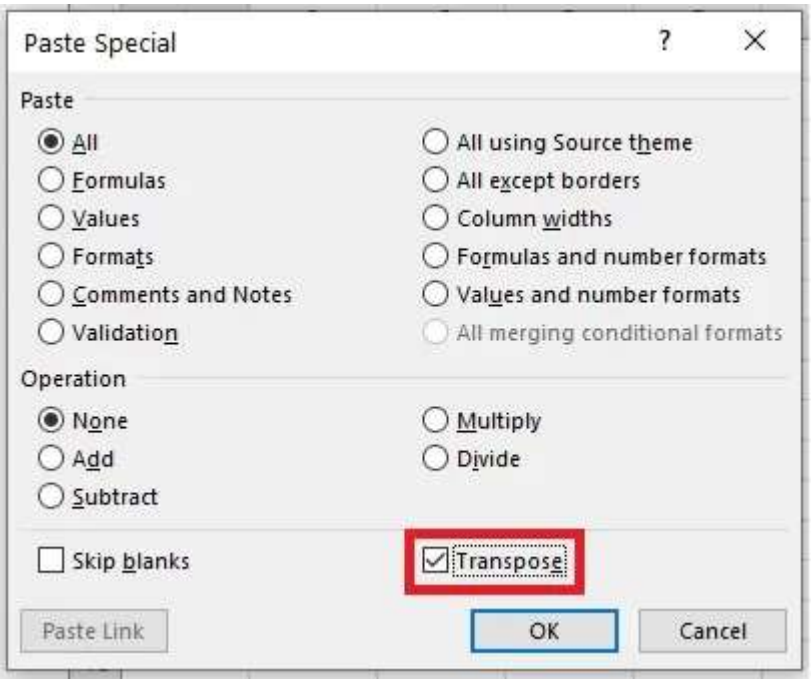


Fig 4.4 Transposing Data

Horizontal data will become vertical and vice versa.

-values + or -, *, /

The most usual I encounter is when you have a column of data that you want to need to take some action on each value in it, like adding a fixed number (no. of ft of excess water -driprored) to all the entries.

Solution:

Follow these steps:

- Paste the constant cell (e.g., for the tax rate of 0.05).
- Select the cells you want to have the altered range.
- Right-click and select Paste Special.
- In the Operation box on the dialogue, choose either Add (if you want to) or Multiply (if that's what you need done), and click OK.

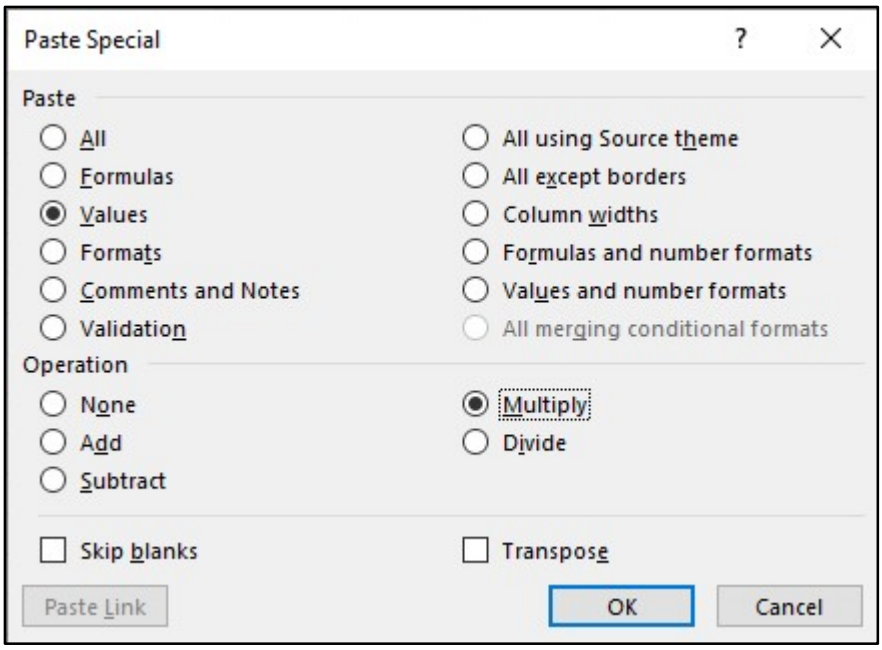


Fig 4.5 Paste Values with Mathematical Operations

However, this will be adding the constant value (tax rate) to each cell in that range and in essence you would be doing exactly what you are currently doing above but for the entire data set.

When to Use Paste Special in Data Cleaning:

- To keep the calculations, but leave behind the formulas.
- When you only want to copy certain data properties, such as the values or formatting, but not everything.
- So that you wouldn't accidentally replace an empty cell when pasting.

To pivot data from the previous point to a cool and useful structure.

Knowledge Check 1

Choose the correct option:

When is the 'Paste Values' option along with Paste Special useful?

A.To copy values and formulas to another place in the workbook

B. To paste the values that result from a formula into a worksheet rather than all of the actual formulas.

C. Copy the format along with the contents

What is the option to Copy and Paste Numerical Values, While Retaining Their Formatting (for instance Currency Symbol or Decimal Points) while using Paste Special?

A. Paste Special (Values and Formats)

B. Paste Transpose

C. Paste Skip Blanks

What is a Paste Special feature that you can use to avoid replacing cells when pasting new data if there are blank cells in place?

A. Paste Transpose

B. Skip Blanks

C. Paste Formulas

4.3 The Data Validation Tools - Checking for Data Integrity

Excel's Data Validation feature is really useful because it significantly reduces the risk of data entry errors by allowing us to control what kind of information can enter in a worksheet. You can use data validation to restrict the type of data that users can enter into a range of cells. This can be very useful for error checking on data entry, so that only valid (and relevant) data is entered, thus preserving data integrity.

Data Validation Rules in Excel There are different types of data validation rules, you can use to prevent mistakes.

Allowing Only Specific Data Types

Define validation conditions to limit what type of data can be input in the cell. Those limitations can be numbers, dates, character lengths, and so on.

Example:

You're just giving a column called age and allowing only enter numbers between 18-100._SIMPLE!

How to Set Validation Rule for Age:

Choose which column you'd like the data validation to be applied for (i.e. Age).

- Press the button "Data Validation" in the group "Data Tools" on the ribbon on Data tab.
- Select Whole Number on the settings tab of the Data Validation dialog box.
- The range should be set between and and the minimum value to 18 and the maximum to 100.

- Click OK.

From now on 18-100 will be accepted in the chosen cells. A red error message will be displayed for any number outside of this range.

Did You Know?

Functions such as PROPER(), TRIM(), and SUBSTITUTE() also come in handy when cleaning text-based data by correcting capitalization, eliminating additional spaces, or replacing unwanted characters—all instrumental in dealing with unruly datasets.

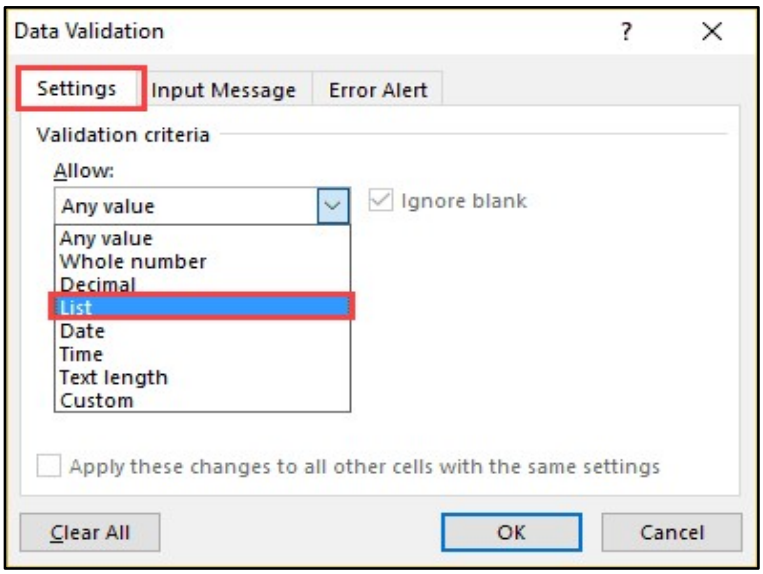
Drop-Down List for Controlled Entries

One easy way to limit data input to a specified list of options is with a drop-down list. Pull this out when you need users to select one from a set number of options like states, departments or categories.

Example If you have a column of product categories and only want 'Electronics,' 'Clothing' and 'Food' to be entered.

How to Make a Drop-Down List:

- Go to the place you want your drop down list, or select the range which you want the drop down lists within.
- In the Settings area of the dialog box, choose List from the Allow dropdown.
- Click OK.



When you do that the cells will now show a drop-down and the user can only choose from those categories.

Restricting Text Length

The demo you c an use to restrict how many characters a user can type. It comes in useful when you need to ensure that an input is a certain length, for example phone numbers or zip codes.

Example:

You are inputing the employee IDs too, and that must (exactly) 5 characters long.

Steps to Restrict Text Length:

- Navigate to the cells that you want set limited length of texts.
- Go to the Data tab, and once there click on Data Validation.
- Under the Settings tab, choose Text Length in Allow lists.

For next part ● Then from condition box select equal to and type value 5.

- Click OK.

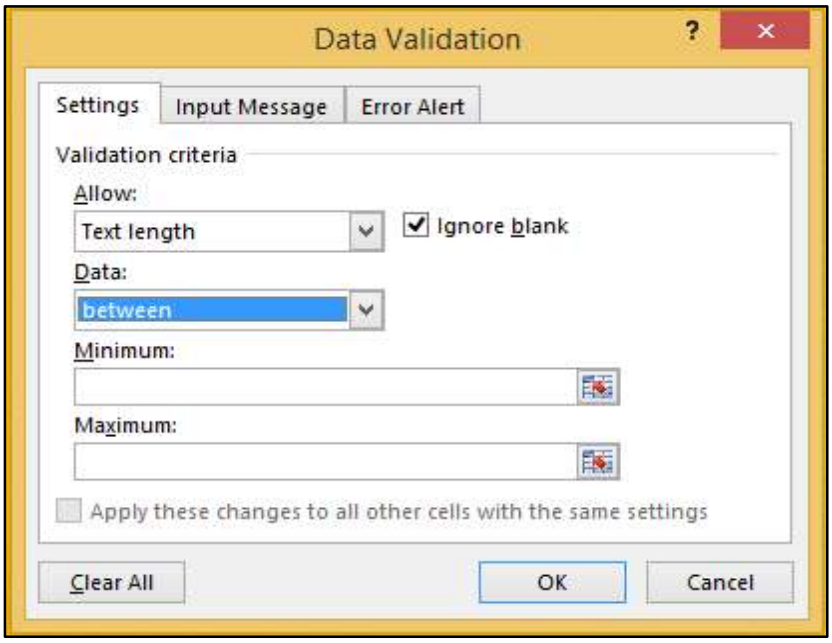


Fig 4.8 Text Length

Step 2: Let only 5 digit employee id can be entered. If the goal or input lengths are too short or long, the parser will issue an error message.

Diamond-like Validation Rules with Custom Formula

You can use formulas to define more complex rules. It is especially handy when the validation conditions are based on multiple cells or need custom logic.

Example:

Example2 : You haev a column for sales amount and the other column shows how much sales can never go below 50% of that amount, target, if target is less than Salesamounts.

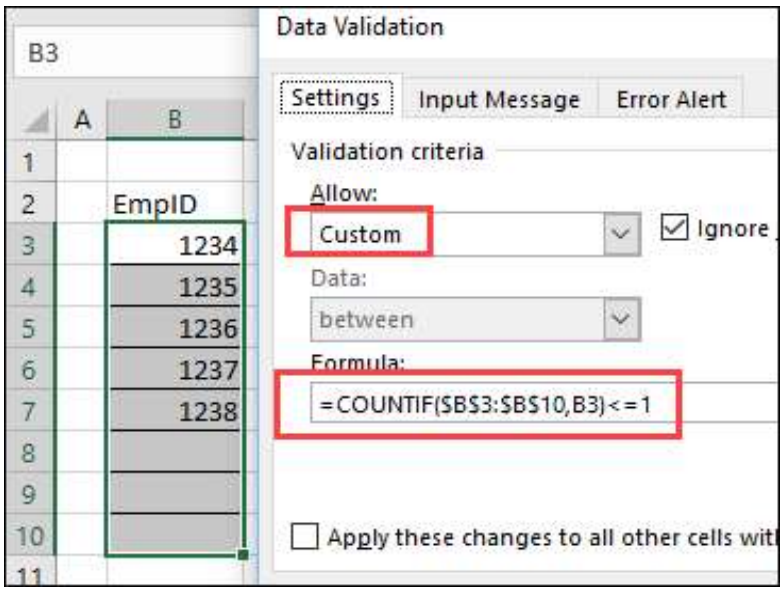


Fig 4.9 Custom Formula

How to Apply a Custom Validation Formula:

- Select the cells you want to validate.
- Go to Data Validation.
- In tab Settings choose Custom from drop-down menu Allow.
- Type a formula into the Formula box, for example: =B2>=0.5*C2

*Here B2 is the cell that contains sales amount. C2 is the cell(s) with the desired sales.

- Click OK.

This is to ensure that the sales amount would be more than 50% of the target sales. If the inputed sales is less than it will prompt an error message.

Date Validation

Data validation allows you to input only valid dates and control the date range. For example, you might require the date to be in a certain year, or this month.

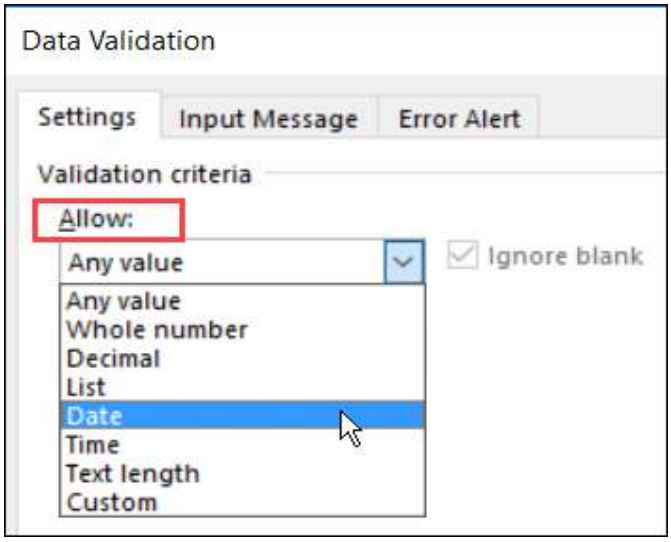


Fig 4.10 Date Validation

For example, you've got a column for due dates and you want to make sure that when your users enters a date in the list column, it's only in the current year.

Steps to Set Date Validation:

Click the cells that you want to enter dates in.

- Go to Data Validation.
- Under Allow, click on Date.
- Click on the Data dropdown and select either as well as type in the Start Date and End Date.
- The begin date is =DATE(YEAR(TODAY()),1,1) (Detroit, start of the year)
- The end date is =DATE(YEAR(TODAY()),12,31) (the end of the current year).
- Click OK.

Now, it will only take dates that are from the current year.

4.3.1 Handling Invalid Data Entry with Error Messages

We can set error messages to appear when they enter invalid data upon breaking a validation rule.

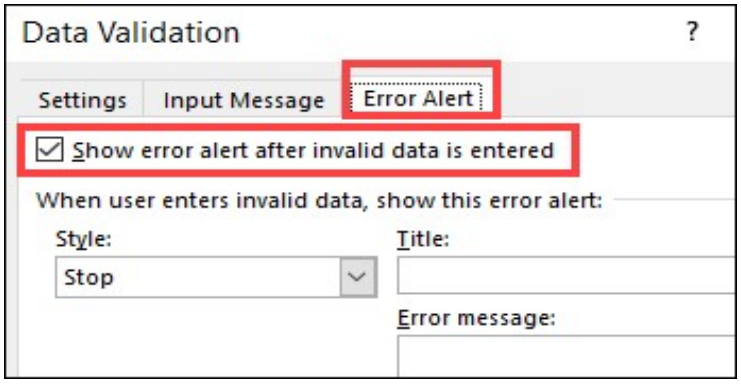


Fig 4.11 Handling Invalid Data Entry with Error Messages

How to Set an Error Message:

To conditionally notify users of when they submit unacceptable information, you can create error messages that will display if a validation rule is broken.

Add Show error alert on invalid input.

There are 3 choice of style: Stop, Warning or Information.

- Stop -Stops the entry all together.
- The user can enter with a warning.
- Information can merely suggest a message; it cannot stop people entering the entry field.

They type in a title and an error message.

Title: "Invalid Entry"

Message: 'Enter a valid age between 18 and 100.'

This way, now when invalid data is entered, the user will see an error telling him how to plug in the valid data instead.

Excel Data Validation tools are quite crucial to maintain data integrity and stay error free as these do not allow errors to occur due to some specified set of rules, helps in keeping the data entry uniform by giving you an option where you can mention a set for input, and also restricts the data being input from incorrect or irrelevant value that in turn triggers an error. These tools facilitate data entry preparation, and process the entered data to make it clean, resulting in usable data for analysis. If leveraged properly, these features can be used to eliminate most of the common data-entry errors and improve data quality overall.

4.4 Creating Dynamic Dropdown Lists

Excel: A drop-down list updates itself when the source data changes in it Automatically!! This is useful particularly if you have a dropdown that gets updated frequently (or lets say, you want to append some more options in the same drop down but don't want to manually add them each time).

Dynamic Dropdown list

The dropdown list is a value that a user has to choose from, and the options are upgraded as soon as the underlying data list changes. If I add your New Products to the list, they will appear in the dropdown without doing anything at all to List of products (since we append).

Method 1: Dynamic Dropdown List in Excel Table)application/vnd.openxmlformats-officedocument.spreadsheetml.sheetextension excel.xlsx4 Steps to Create a Drop-down List In the first step, select the cell where you want to create a drop-down list.

The easiest way is to use an Excel table to create a dynamic dropdown list. Changes to your data You'll see that as you alter the data which underpins your list, either by editing or adding/deleting Table rows, the list dynamically adjusts to display what's now in there.

How to Make a Dynamic Dropdown List with an Excel Table:

Create an Excel Table:

First things first, organize your data into a column. For example, if your departments are "HR," "Sales," "Finance" and then "IT", then it is the last department and a new one is added.

● Click Table on the Insert tab, and then click the column of data (including header). Ensure that My table has headers is checked.

Name the Table:

● Insert the table and click one cell in the table.

· In the Properties group, click in the Table Name field (under Table Tesign tab) and then type a name for your table (e.g. Departments).

Create the Dropdown List:

● Navigate to the cell or range of cells for which you want a dropdown menu.

● Go to the Data tab, and select Data Validation.

● Open the Data Validation dialog, and choose List in the Allow box under Settings.

· In the Source field, type in the table reference: Enter table name. For example: =Departments[Department Name].

- Click OK.

With the above adjustment in place, by inserting or deleting the departments from Departments table will show up in this dropdown listing at the same time.

Department Name
HR
Sales
Finance
IT

Fig 4.12 Dropdown List

Any cell that has been associated to this table will have a dropdown list for you to choose one of the updated lists automatically as soon as there is any modification in the table.

Method 2: Named Ranges and Creating the Dynamic Dropdown Lists

Dynamic Dropdown Lists - Another method involves setting up named ranges which automatically expand as we add new rows. Starting point is naming a range, which refers to a dynamic area and connecting your named range with a drop down list.

How to Make a Dynamic Dropdown List by Using Named Ranges:

Create a Named Range:

- Suppose you have products in A1:A10.
- Visit the Formulas tab, and choose the list cells (A1:A10).
- Under Name the range ProductList, click on Define Name.
- In the Refers to box, type OFFSET function that is used to create dynamic range.
- For example:

=OFFSET($A$1, 0, 0, COUNTA($A:$A), 1)

So using this the formula is defining a range from A1 down and adjusting its size automatically depending number of non empty cells in column A.

You can try using the Named Range with Dropdown List:

Right-click the cell in which you would like to have a dropdown list.

- Select the Data tab and then click on Data Validation. From the list, choose Data Validation.

- In the Data Validation dialog box, click on List from the Allow choices.
- Type the name of the named range that you created for the cell range in the Source box, but be sure to type an equals sign before the name (=ProductList).
- Click OK.

Lastly, you can continue to add new products all day long when ever you need as a line and the named range will automatically be updated with new items so your dropdown list will update.

Example of Named Range:

Products
Product A
Product B
Product C

Now, if you enter Product D into A11, your dropdown will automatically be updated (thanks to the OFFSET function of the Named Range), and it will include Product D on the list.

Benefits of Dynamic Dropdown Lists

Dynamic dropdowns lists: Data will change data-driven updating list, do not need to delete inlisting data and insert it again, when the data is updated.

Maintenance friendly: Tables and Named Ranges are maintenance friendly as data is retained in them automatically. Its dropdownlist will get refreshed.

Better Data Integrity: Dynamic dropdowns make it easier to preserve better data integrity, since a user can select only valid options that you define in advance and eliminating the opportunity for simple data entry mistakes.

Flexibility: Tables and Named Ranges allow you to add or change the list without disturbing other parts of the workbook.

Dynamic Dropdown Lists in Excel are very useful, if you use it with the combination of other Data Validation Techniques Date Validation, It's a great way to validate date values. Dynamic list dropdowns offer a solution for ever-changing lists whether your lists reside in an Excel Table or Named Range. This feature is particularly helpful in such situations where you are working with your data in a huge workbook or when the underlying data is frequently changing.

4.5 Date and Time Validation Techniques

Date & Time validation is a type of data validation that ensure users enter the valid date and time for consistency and to maintain data accuracy. It's very good for data of appointments, deadlines and schedules that have dates or times following some regular patterns.

Date and Time Validation.

The Check date and time tests that the contents of a cell is valid in relation to defined rule for what constitutes proper date or time. This an un-stuffing of the users from punching in invalid or out-of-range values and making sure that they can keep accurate records.

Sample: You can ensure that dates to be entered into a spreadsheet (e.g., for recording project deadlines) are valid dates, like occurring within a specified range.

When Would You use Date and Time Validation?

● Right Format: It allows us to verify that date / time is given in right format and just creating no confusion because of direct data.

Prevents Invalid Dates: It won't allow to choose an invalid date/time, e.g., February 30 or time that's not between 00:00 and 23:59.

●Improved User Experience It assists users to input correct data either by showing an error message for invalid dates or simply offering a date and time picker component.

Date Validation in Excel

In Excel you can limit the user input to valid dates using Data Validation. Like the former, you can also define requirements as all of the above.

● Dates in some period.

● These must be some specific days of the week, say you only allow them on weekdays.

● Dates after or before an particular date.

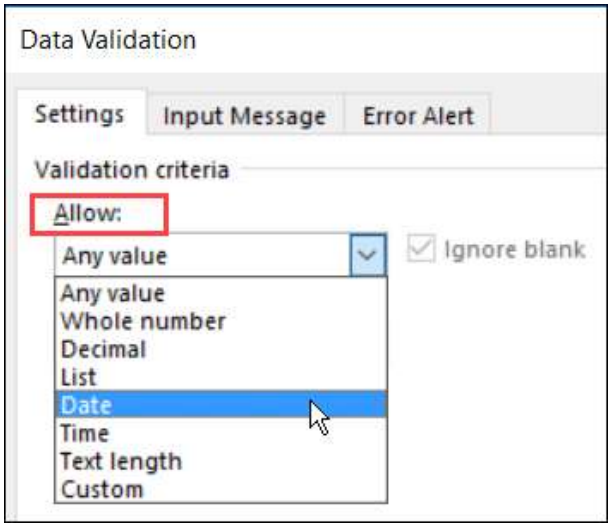


Fig 4.13 Date Validation in Excel

Steps to Set Date Validation:

Click on the cell to right of title Cell for Date Entry at the bottom row to confirm your selection.

In the cell or range of cells that you would like to be able to enter a date, click.

Open Data Validation.

- Find Data Tab on the Ribbon.
- In the Data Tools group, click on Data Validation.

Set Validation Criteria:

- On the Settings tab of the Data Validation dialog box, click the drop down arrow in the Allow box, and select Date.

As a result of doing this, you are allowed to specify the format that the date should be:

- Set: only valid dates (e.g., Jan 1, 2020 through Dec 31, 2025 - not years before or after).
- Limit access by date: Specific date (is, limit entry by "01/01/2025").
- Whether a given date comes before or after another date (ie: does this fall in the range of dates following today).

Optional: Error Alert

- The user might set an Error Alert, for when the u ser actually enters an invalid date.

For instance, if you have bounds for possible dates ([01/01/2020 to 12/31/2025] in this case), and someone types a date outside the range allowed, there can be a pop up of

something like an alert saying "Yo! Yo! Please enter the date between 01/01/2020 - 12/31.008-1YADoo5!".

Once you want to implement the validation, hit OK.

Example: For example, you may only want to limit dates after January 1, 2023.

Allow: Date

Data: After

Start Date: 01/01/2023

Now, though, if someone enters a date prior to Jan. 1, 2023, a blue error message will appear asking them to fill in the correct information.

Time Validation in Excel

This is where you use Time ValidationWhen to use: When you need to validate the user has entered a time that can be interpreted, (ex You want the user's input as the time but what requires you for them not to enter certain times like a 10 hour difference) work hours). Like the date, you can set the time to validation in Excel.

Steps to Set Time Validation:

1. Choose the Cell for Time to Be Entered:

● Select the cell or range of cells where time should appear.

Open Data Validation:

● On the Ribbon, click the Data tab.

● On the Data tab, click on Data Validation in the Data Tools section.

Set Validation Criteria:

● Go to the Settings tab, click Allow in the Data Validation dialog box, and choose Time from the dropdown list.

Time conditions are defined as:

● Between: Similar to only but with a between clause, letting users determine when the event can take place (not one time vs repeating).

Equal to: Allow a certain time (e.g., allow "12:00 PM" only).

● Before or After: Verify time is before or after a certain time such as before 6:00 pm.

Optional: Error Alert:

Send an Error Alert with a message when the user inputs an invalid Time (eg: Please input time between 9:00 AM and 5:00 PM).

● Click on OK as validation took place.TR*DIR.SEQ should now be displayed on the screen.

Example:

For instance, to limit months between 9:00am and 6:00pm thus,foliosing line.

● Allow: Time

● Data: Between

● Start Time: 09:00 AM

● End Time: 06:00 PM

If now one enters a time not in this range s/he would receive an error message.

Date And Time Validation Formulas

For complex date and time validation rules, you might want to utilize the Custom formulas as well. For example, you might want to allow only dates that are not on weekends or times within the working day.

A first one could be to Validate Date is a Weekday.

Validating for Weekdays in a Data Entry Form If you want to ensure that the user has entered a weekday, then you need to rely on a custom formula within the Data Validation dialog.

● Open Data Validation, choose Custom under Allow dropdown.

● Then, type the following formula in the Formula text box, =WEEKDAY(A1,2)=TIME(9,0,0), A1<=TIME(18,0,0))

This way we can make sure that the time typed in A1 is from 9-6.

Advantages of the Validation Forms regarding Date and Time

● This prevents incorrect data entry, as only valid dates and times can be entered into the sheet, therefore reducing any errors by inaccurate inputs.

● Data Integrity Increased: It verifies the data to be reliable and accurate especially when we need specific dates and times (such as deadlines, schedules etc.).

● Enhances the Handling of Data: It reduces the efficiencies by automating the process of discarding data from unwanted input and provides a smooth and easy handling experience to the user.

● Enhances the User Experience by offering end users clear direction and error messages that produces the data entry process simpler, as well as more intuitive.

Excel date and time validation is a useful feature to maintain data integrity by making sure that the user has entered the correct data type. The Data Validation you to restrict the entry of dates and times into cells based on being within in a valid range, having a specific format, or even meeting specific conditions. Whether you are dealing with a project deadline, appointment scheduling, or a project timeline, the date and time validation will help ensure your data stays clean – and reliable.

4.6 Summary

❖ Data Cleaning in Excel is an essential thing to do to ensure your data is accurate, reliable and clean. It refers to recognising errors in the data, removing duplicate data and changing the form of data to be analyzed before conducting analyses.

❖ Excel has a wonderful feature called Paste Special that can help you work with your data more quickly. It also enable the data cleaning and data management without changing to original source whereas it permits copying only the values, formats, or formulas.

❖ Data Validation is a mechanism for ensuring that the cell data falls within a certain range of properties. You do that so you can prevent users from inputting bad data by defining rules for what is considered acceptable input (number ranges, text length, lists of predefined values, controlled or uncontrolled and so on).

❖ Dynamic dropdowns lists make data entry so easy by showing predefined options which updated automatically, Allowing the user to select an option easily. It minimizes trans-coding errors and verifies data forms are consistent.

❖ Date and Time Validation procedures alleviate the problems where entries of temporal data do not conform to the proper format and logically follow one another. This prevents mistakes like when entering invalid dates or mismatched times.

4.7 Key Terms

Data cleaning: the activity of detecting and correcting (or removing) corrupt or inaccurate records from a record set, table, or database.

Paste Special: A function of Microsoft Office Excel for pasting data, Paste Special lets you paste certain elements of copied data — such as values, formatting or formulas — in order to speed up the process.

Data Validation: Excel's feature for controlling -restricted data being entered in a cell by establishing criteria of how the data should be entered.

“Dynamic Data Validation Lists: (ie,rolodex)these lists (Excel files) auto update themselves showing only certain points of data to select for entering, and remove user errors by also allowing one process or standardisation everywhere.

Date and Time Validation: Methods to establish that items of date and time in records are valid, consistent with each other, and look reasonable.

Duplicates– Multiple entries of the same record of a dataset are called as duplicates which can lead to high deviation in analysis, also removed in data cleaning.

Standardization: This happens when data is formatted into a standard format (for example, dates of one specific format or text in certain casing) throughout the database.

Error Identification: Discovering inaccurate or inconsistent data entries in a dataset, according to data cleaning activity.

Data cleaning Methods: How to apply data cleaning methods and techniques somewhere, in business, for students or any profession to help improve the decisions made from data.

4.8 Self-Assessment Questions

Describe me the idea of data cleaning in Excel? What is the reason that it becomes necessary to conduct and what happens if this were omitted before data analysis.

Explain how the Paste Special Function in Excel is used, for the purpose of cleaning up data. Two examples on when you would want to use Paste Special.

What is data validation in Excel? Explain how differing data validation tools (for instance, limiting ranges to a number range, text length cap and menu lists) are used to maintain data integrity. Provide examples.

Explain how you can create dynamic dropdown list in Excel? Describe what dynamic list is and compare it with a static list.Evaluate the benefits derived from using lists in data management.

Explain common date/time entry mistakes in Excel, like entering the dates using different formats and the times being not valid. What kind of validation we can do to avoid such type of mistakes.

Distinguish between information validation and normalization in Excel. How do these mechanisms reinforce each other to guarantee a reliable data quality? Use a few examples to illustrate your answer.

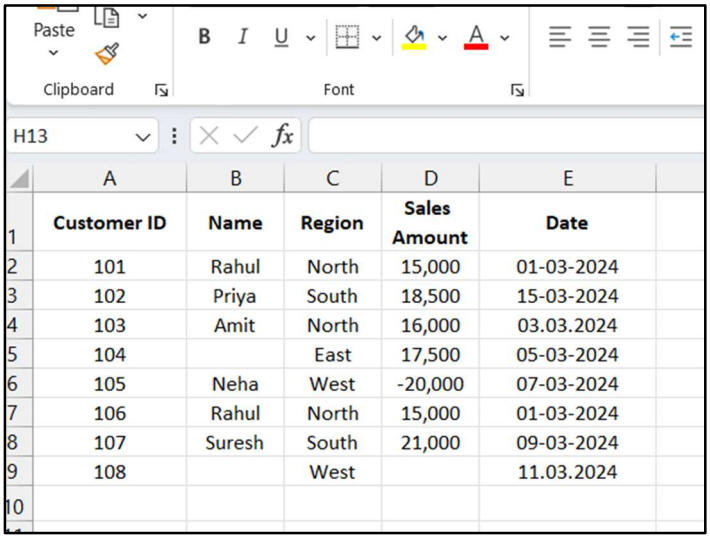
What is duplicate entries on dataset? Describe how it can hurt the analysis of data and steps on how to identify and remove duplicates with the help of Excel tools.

Explain how dynamic datasets can help you enter more accurate and consistent data when you are working with tens of thousands of choices. Give an example of a situation in which drop down lists are useful in real life.

Provide an example (or anecdote) of a time when data cleaning made a huge difference in the success or failure of a project or business decision. Emphasize methods and equipment used for cleaning.

Replication Exercise: Using Several Data Cleaning Techniques in Excel

Dataset (Before Cleaning)



Customer ID	Name	Region	Sales Amount	Date
101	Rahul	North	15,000	01-03-2024
102	Priya	South	18,500	15-03-2024
103	Amit	North	16,000	03.03.2024
104		East	17,500	05-03-2024
105	Neha	West	-20,000	07-03-2024
106	Rahul	North	15,000	01-03-2024
107	Suresh	South	21,000	09-03-2024
108		West		11.03.2024

Task: Do the following data preprocessing:

Reduce Duplicates: Eliminate duplicate records (Customer ID 101 is listed twice).

Fill Missing Values:

o Replace blank names with "Unknown".

o Substitute any missing sales value with a "0".

Reduce Date Formats to Similar Ones: Change all dates into DD/MM/YYYY.

Apply Data Validation:

o Add drop down in Region column with values North, South, East, West.

Try to apply Paste Special: Convert the negative sales values into positive.

Save your cleaned dataset as “Cleaned_Data. xlsx" and submit.

4.9 References

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Answers to Knowledge Check

Knowledge Check 1

1: B) And paste only the values which are calculated not the formulas

2: A) Paste the Values And Formats

3: B) Skip Blanks

4.10 Case Study

Data Cleaning for Real-World Applications

When real data is involved there may be many inconsistencies and errors, among them. As data cleaning is applied in real business settings, here we'll attempt to view this case study from a practical business scenario. The use-case will concentrate at how data cleaning could be made available to make the sales data quality of a retail company better by making it easier for us to delete bad records.

Scenario: Sales Data of a Retail Company Let's consider the following sales data of a retail company to understand how we can analyze it using the skewness formula in Excel.

Now if we think about a retail smoothie chain gathering daily sales from multiple locations. Your data has these columns.

· Store ID

· Date of Sale

· Product Category

· Number of Units Sold

· Sales Revenue

Through payments (Cash, Credit Cards, Online etc).

This information is employed by the company for studying the sales trends, forecasting the income in future and to compare performance between stations. However, as with the company discussed here: there are quite a few data issues to tidy up once you analyze the data.

Step 1: The first step will be to identify missing or incorrect data.

First of all we need to establish all the deband/incorrect data entries. For example:

· Negative sales amount in some of the rows.

· : UNKNOWN (where it is supposed to be a valid category).

· Dates entered as strings or text.

· Negative units sold or negative revenue is not applicable in this case.

Action Taken:

· Missed Sales Revenue: The company elects to measure missed sales revenue on the basis of either:

· Quantity Sold * Price per Unit

(words for where price is another Table) Prices are marked for manual scrutiny if they are not found.

· Invalid Categories: The company ensures that all 'Unknown' are resolved by checking the descriptions of the products.

· Date Formatting: The Company will convert dates expressed as text into a correct date format in the rows that they reside.

· Negative Values as Dividend: Either Value of No of Units sold or value of sales revenue/2 As these are indicated negative, checking for data entry errors.

Step 2: Handling Duplicates

The company should then ensure there is no redundant input – it can confuse the analysis.

· Sometimes, when we input the data for sales, the figures are entered more then once.

Action Taken:

· The company uses Excel's in-built Remove Duplicates tool to deduplicate transactions to ensure no duplicate is counted twice for each transaction.

Step 3: Standardizing Data Formats

It's critical not to normalize data, if it stores in bit representation, is there for every value in usable format. For a retail company, for example:

· To uniform the means of payment: The company understands that some rows have "Cash" written as "cash" or "Online" written as "ONLINE", concluding then that there is no standardization in the means of payment. There are contradictions that have to be clarified.

· Product Categories with Variation: There are few product categories that have slight variation list (though the difference is small) - for eg., Mens Shoes / Men's shoes etc.

Action Taken:

· Company uses excel`s Find and Replace for standardization of payment method / product category.

· With the "Payment Method" column all nuances are standardized (eg.

Step 4: Removing Outliers

Data outliers are points that are way out from the other bulk of data, they could be errors. For example, one transaction can be of sales 1,000 quantitys of a product at one store. This is very unusual.

Action Taken:

This transaction is an exception, the company goes over it and isolates it as a data entry mistake. To avoid biased analysis, they choose to eliminate this outlier from the data set.

The firm sets thresholds that seem reasonable for its data (such as sales revenue in a range from ₹0 to ₹10,00000) and flags any transaction lying outside the threshold, which must be investigated.

Step 5: Treatment of the Data for Analysis

Once the data has undergone a clean and standardisation process, it can be analysed. Redgate was now in a position to have solid data that they could use to report on and make business decisions from.

Action Taken:

· A new worksheet is generated, then cleaned data is brought in for analysis. To assist managers in their decision-making, the company generates sales reports, trends and graphs.

· In order to avoid this error in the future, the company at its end uses data validation rules in Excel: Empty value - no payment methods will be accepted except valid ones (Cash, Credit card, Online) – validated by Date.

Conclusion

Here the retail company opted to use a combination of data cleaning where they filter missing, duplicates and standardize the format/hierarchy as well as outlier management for their sales dataset to improve its quality. This enabled them to base their investigations on correct, uniform and immediately available data. As a result, they took data-driven decisions and fostering better business operations was in their purview.

Key Takeaways:

· Data cleaning is part of the important steps when data should be intact and accurate.

· There are instances where there is a missing value, wrong format, duplicated etc to which data is needed to be dealt with.

· Excel has functionalities such as Paste Special, Data Validation and Remove Duplicates to help you in cleaning the data.

· Datasets need to be cleaned in a way that such data can be used for in-depth analysis which helps in making better decisions.

Reflective Questions

What were the cleaning issues you had when working with the sales data for this retail company, how did you solve them?

Why it is recommended to standardize formats for anything like Payment Method and or Product Category before analyzing the data?

What could be the potential business implications for missing or incorrect data when there is no data cleansing in place?

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What does 'qualifying text' mean?
Our model only processes qualifying text in the form of long-form writing. Long-form writing means individual sentences contained in paragraphs that make up a longer piece of written work, such as an essay, a dissertation, or an article, etc. Qualifying text that has been determined to be likely AI-generated will be highlighted in cyan in the submission, and likely AI-generated and then likely AI-paraphrased will be highlighted purple.

Non-qualifying text, such as bullet points, annotated bibliographies, etc., will not be processed and can create disparity between the submission highlights and the percentage shown.

Unit 5: Logical Analysis Tools

Learning Outcomes

- Learners will be able to apply logical functions in Excel, including IF, Nested IF, AND, and OR, to perform conditional analysis and decision-making.
- Learners will understand and utilize filtering and sorting techniques to extract meaningful insights from large datasets.
- Learners will apply advanced sorting options, such as multi-level sorting and custom sorting, to organize and analyse data efficiently.
- Learners will demonstrate proficiency in using logical analysis tools to improve data-driven decision-making and reporting.

Structure

5.0 Introductory Caselet

5.1 Applying Logical Functions (IF, Nested IF, AND, OR)

5.2 Filtering and Sorting Data for Decision Insights

5.3 Using Advanced Sorting Options

5.4 Summary

5.5 Key Terms

5.6 Descriptive Questions

5.7 References

5.6 Case Study

5.0 Introductory Caselet

"Using Logical Functions and Data Analysis for Optimal Business Decisions."

Scenario:

Riya works as sales manager for an e-fashion brand across cities in India. As the clientele expands, it's essential to effectively organize your sales data in order to act upon this. But Riya has several hurdles: High-value customers segment, seasonal pattern forecast and discount application in such a way that maximizes revenue.

Her staff goes through thousands of transactions manually to seek patterns, but that process is slow and susceptible to error. In addition, shuffling and sorting data for customers is time-consuming to group them by purchasing history, geography, product affinity. Riya knows she needs a virtual assistant to help her make quick decisions and be more efficient.

Logical functions such as IF, Nested IF, AND, OR can help to 3 Classify customers 4 Offer special discount offer to the customers and Predict future sales pattern. Plus there are some fancy filtering and sorting methods to help Riya (and your team) quickly sort through the major trends and make good business decisions.

Logical and Data Analysis Using Logic Functions

Using IF and Nested IF for customer based Segmentation:

Riya chooses to divide customers by recency of purchase and monetary value. By using IF and Nested IF functions in Excel, Riya automates customer segmentation:

● High-Spend Customers (Those who have Spent above ₹50,000 in last 1 year) are given a Loyalty Rebate of 20%.

● Frequent buyers (Bought more than 10 times, upto ₹50,000) will get a discount of 10%.

● Occasional or new customers (5 purchases or less): Your referral coupon: adds recommendation not a discount.

That automation ensures discounts can strategically be offered to only the most revenue-generating customers.

Filtering and Sorting the Data for Trend Analysis:

Riya provides special resources for filtering and sorting aspects so that customer's activity can be analyzed. Using filters, she determines:

• The most sold product categories across different cities.

● Peak shopping periods from past years.

- The impact of price reduction on sales performance.

With the categorisation of information, high-contribution data gets first look on Riya and decision making can be accelerated.

Enhanced Sorting for Business Efficiency:

Riya does multi pass sorting on their data to figure out what needs to be restocked first. She organizes the various sales data by:

- Profit Margin: High – Low.
- Inventory Level: Low to High.
- Customer Perspective by the end of 2018 (From High to Low)

This allows her to properly restock inventory in priority, keeping those top-selling and most-profit items always on the shelves.

Decision-Making with Data Insights

By using logical operations, filtering and conditioning sort routines Riya automates grouping of customers, optimizes inventory management decisions and prolongs promotions. Faster data-informed decisions means better customer satisfaction and a lift in revenue.

Critical Thinking Question

How can Riya further improve her sales strategy with logic operations and advanced data filtering and sort?

5.1 Applying Logical Functions (IF, Nested IF, AND, OR)

Excel logical functions are ubiquitous for analysis and decision-making. It sets up rules in order to make decisions automatic and limiting human intervention. Among others, it is popular in applications ranging from grading of students and employees to business decision making and financial modeling.

IF Function

IF is a simple logical function which is used to check whether a condition is true or false and then act accordingly. It is, therefore, very often used for validating data as part of a decision making process and also in automation with spreadsheets.

The function evaluates a condition and returns one value if the condition is TRUE, and another value if the condition is FALSE. This makes it possible to classify data, perform calculations under conditions and automate the entire workflow.

Such conditions are commonly used in business and education, and the IF function is a valuable function even for uses like creditor obligation test, performance testing

answerer to queries and financial tracking. While IF is by no means incapable of making decisions when it flies solo, it works even better with some logic functions as wingmen—namely AND, OR, and especially nested IF.

The IF function means less strain on your data manipulation operations, reduced reliance on manual intervention and increased accuracy of both analysis and reporting output.

Syntax:

=IF(logical_test, value_if_true, value_if_false)

● logcial_test→ What to test for being True or False (e.g., A1>50).

• value_if_true --> The result returned if the condition was evaluated as true (i.e., "Pass").

value_if_false – That will be returned if the condition given is not true (e.g., "Fail").

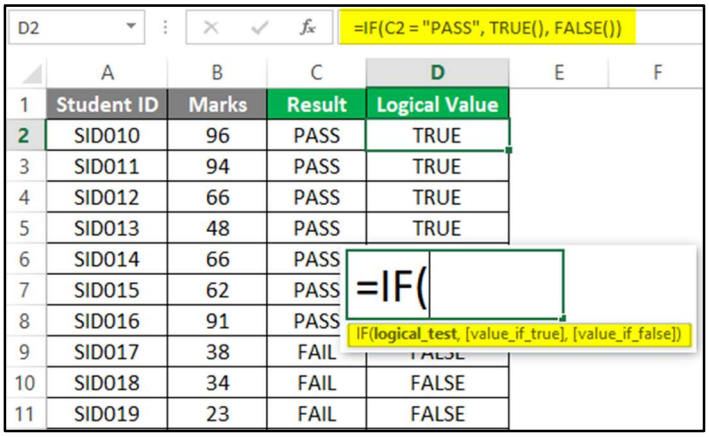


Fig 5.1 If Function in Excel

Figure 5.1 Example of an Excel spreadsheet where the IF function is employed to produce a logical value (TRUE, FALSE) depending on whether or not the student passed.

The Formula in Cell D2 Explained:

=IF(C2="PASS", TRUE(), FALSE())

• Logical Test (C2 = “PASS”): It tests if the value in column C (Result) is equal to “Pass”.

• True Value (TRUE()): If the condition is met (for instance that the student passed), such as TRUE.

• FALSE() Otherwise the function returns FALSE if condition is false (i.e., then student failed).

Here,

• If the Result column (C) has "PASS", then its associate value in Logical Value column (D) would be TRUE.

• If the Result column (C) lists “FAIL”, then in the Logical Value column (D), there will be FALSE.

Example 2: Student Result Determination

A student is Formali"Marks"ed to be "Passed" if he/she has marks ≥ 40, failing which Formally marks him/her as "Failed".

=IF(A2>=40, "Pass", "Fail")

Results:

Marks (A2)	Output
75	Pass
35	Fail

Fig 5.2 Student ResultDetermination

Example 3: Employee Bonus Calculation

A firm offers 10% bonus on sale of ₹50,000 or over by an employee and no bonus for value less than ₹50,000.

=IF(A2>50000, "Bonus Granted", "No Bonus")

Results:

Sales (A2)	Output
60,000	Bonus Granted
40,000	No Bonus

Fig 5.3 Employee Bonus Calculation

Nested IF Function

A nested IF is a multiple level version of the Excel IF function, where it is possible to test more than 1 condition within a single formula. Rather than a single "either or"

return, nested IF statements can provide up to 254 individual responses based on the condition(s) met!

This function is useful for when you have more than two potential outcomes in decision-making such as grading systems, pricing strategies and performance evaluations. The IF tests are tested in the order they appear so as it finds a match, that is returned and the remainder of the tests won't be looked at.

Syntax:

=IF(condition1, value1, IF(condition2, value2, value3))

When there are multiple conditions applied.

It will output different things according to a number of conditions.

Fig 5.4 Nested If in Excel

Example: Student Grading System

A school has a grading system as follows:

A (≥ 90), B (≥ 75), C (≥60), D (≥40), F (=90,"A",IF(A2>=75,"B",IF(A2>=60,"C", IF(A2> 40, "D","F")))) And here is the charts with that formula in A1, results in B1.

Results:

Marks (A2)	Output
85	B
30	F

AND Function

The AND Function in Excel This post covers the basic usage of the AND function. It only returns TRUE if ALL of the specified conditions are TRUE, otherwise it will return FALSE.

It's especially helpful when you have a lot of criteria to judge something by, like eligibility determination, financial review, and data validation. It is also commonly used along with IF to add conditional logic an extra level deep.

As AND needs all conditions to be TRUE, if one of checks is negative the function returns FALSE. Therefore, it is a useful mechanism in more restricted validation environments where business or academic applications approve or classify a requirement if several are met.

Syntax:

=IF(condition1, value1, IF(condition2, value2, value3))

- Utilized where with more than one condition.
- Returns some different results, depending on conditions.

Did You Know?

With Nested IF functions, Excel will support up to 64 levels of nesting in current versions. But each level of Nested IF makes the formula more and more complex, it becomes difficult to debug. Instead, use functions such as IFS or LOOKUP if you have them.

	A	B	C	D	E	F
1	Product	In Stock	Sold	Formula 1	Formula 2	Formula 3
2				=AND(A2="Bananas", B2>C1)	=AND(B2>20, B2=C2)	=AND(A2="Bananas", B2>=30, B2>C2)
3	Bananas	30	20	TRUE	FALSE	TRUE
4	Oranges	40	40	FALSE	TRUE	FALSE
5	Bananas	20	20	FALSE	FALSE	FALSE
6	Oranges	40	10	FALSE	FALSE	FALSE

Fig 5.6 AND Function in Excel

Example: Student Grading System

The Syntax Empty school assigns grades as follows:

=AND(condition1, condition2,.)

- TRUE is returned only if all 3 conditions are satisfied.

- If one of the conditions is not satisfied, then returns FALSE.

Example: Scholarship Eligibility

A student receives a scholarship if they:

- Marks ≥ 85

- Attendance ≥ 75%

=IF(AND(A2>=85, B2>=75), "Eligible", "Not Eligible")

OR Function

The OR function assesses multiple conditions and returns TRUE if any one of the conditions is TRUE.

It can be quite handy for when you need to apply one of few criterias (such as approvals, conditional formatting or decision making). It is commonly used in combination with the IF function to enhance data analysis and reporting by allowing users to introduce additional complexity into formulas.

It is a useful technique to simplify the complex logical expressions by replacing them with a single OR function that lets us trim down multiple IF conditions, and thus makes our formula more readable and effective.

Syntax:

=OR(condition1, condition2,...)

- Is TRUE where ANY condition is met.
- FALSE is returned if none of the conditions are satisfied.

Example: Loan Approval

A claim is allowed if a person has one (or both) of:

A CIBIL score ≥ 750, OR

A monthly income ≥ ₹50,000

=IF(OR(A2>=750, B2>=50000), "Approved", "Rejected")

Results:

Marks (A2)	Attendance (B2)	Output
90	80%	Eligible
80	80%	Not Eligible

Fig 5.7 Scholarship Eligibility Result

XOR (Exclusive OR)

The XOR function (Exclusive OR) evaluates to TRUE if one and only one of its arguments is TRUE and FALSE otherwise (i.e., both are FALSE or both are TRUE).

Truth Table for XOR:

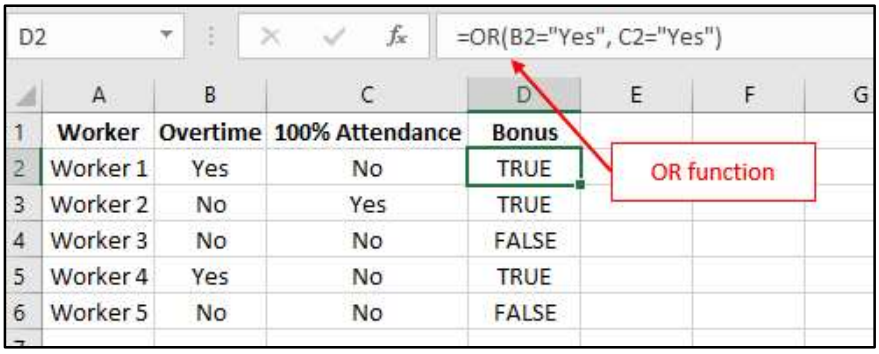
Excel Formula for XOR:

=XOR(A1, B1)

This returns:

TRUE if either of the values is TRUE.

FALSE if both these values are equal.



	A	B	C	D	E	F	G
1	Worker	Overtime	100% Attendance	Bonus			
2	Worker 1	Yes	No	TRUE			
3	Worker 2	No	Yes	TRUE			
4	Worker 3	No	No	FALSE			
5	Worker 4	Yes	No	TRUE			
6	Worker 5	No	No	FALSE			

Fig 5.8 OR Function in Excel

Example: A1 = TRUE and B1 = FALSE → XOR(A1,B0) returns TRUE

Si A1 = TRUE y B1 = TRUE → XOR(A1,B1) = FALSE.

XNOT (Exclusive NOT)

"XNOT" does not exist as an Excel function, but can be interpreted as a NOT operation on the XOR of two values.

In logic gates, this corresponds to NOT (negating or inversing a value).

CIBIL Score (A2)	Monthly Income (B2)	Output
700	60,000	Approved
720	40,000	Rejected

Fig 5.9 Loan Approval Status

NOT Truth table (XNOT idea) :

Input A

XNOT A (NOT A)

Input A	Input B	A XOR B
FALSE	FALSE	FALSE
FALSE	TRUE	TRUE
TRUE	FALSE	TRUE
TRUE	TRUE	FALSE

Fig 5.10: Exclusive OR

FALSE

TRUE

TRUE

FALSE

Excel Formula for NOT:

=NOT(A1)

This returns:

TRUE if A1 is FALSE.

FALSE if A1 is TRUE.

Real Business Use of Logical Formulae

Application: Evaluating Employee Performance and Awarding a Bonus

Employee ID	Annual Sales (₹)	Credit Score	Attendance (%)	Items Purchased	Amount Spent (₹)
EMP001	1200000	780	95	3	1800
EMP002	800000	720	85	6	2200
EMP003	600000	760	92	4	1500
EMP004	400000	690	75	8	2500
EMP005	950000	800	98	2	3000

Scenario:

A business considers staff on several different levels:

They offer an additional 10% bonus (on the annual sales, if it exceeds ₹5,00,000) to their employees.

Workers are assigned a rating according to the numbers of sales:

Excellent: Sales ≥ ₹10,00,000

Good: Sales ≥ ₹7,50,000

Average: Sales ≥ ₹5,00,000

Needs Improvement: Sales 500000, "Bonus Granted", "No Bonus")

· If the sales are greater than ₹5,00,000 → Bonus received

· Otherwise → No Bonus

Performance Rating (Nested IF):

=IF(B2>=1000000, "Excellent", IF(B2>=750000, "Good", IF(B2>=500000, "Average", "Fair")))

· Assesses sales to rank in its own way.

Special Award Qualification (AND Function):

=IF(AND(C2>=750, D2>=90), "Eligible for Award", "Not Eligible")

· Credit score ≥750 AND attendance >90% is compulsory

Discount Eligibility (OR Function):

=IF(OR(E2>5, F2>2000),"Discount Applied", "No Discount")

· 5 or more items is brought by the employee then discount will be given on it, if an employee spends above ₹2,000 then he would get discount.

Final Complex Decision (AND & OR Combined):

=IF(AND(B2>500000,OR(E2>5,F2>2000),AND(C2>=750,D2>=90)),"Top Performer & Discount Applied","Review Performance")

: An employee is Top Performer with a Discount if:

Sales > ₹5,00,000

Purchases more than 5 articles OR has a value of ₹2,000 or above.

Ownership of neither Has credit score ≥750 AND attendance ≥90%

H18

	A	B	C	D	E	F	G	H	I	J	K
1	Employee ID	Annual Sales (₹)	Credit Score	Attendance (%)	Items Purchased	Amount Spent	Bonus Status (IF)	Rating (Nested IF)	Award Eligibility (AND)	Discount Eligibility (OR)	Final Decision (AND & OR)
2	EMP001	1200000	780	95	3	1800	Bonus Granted	Excellent	Eligible for Award	No Discount	Review Performance
3	EMP002	800000	720	85	6	2200	Bonus Granted	Good	Not Eligible	Discount Applied	Review Performance
4	EMP003	600000	760	92	4	1500	Bonus Granted	Average	Eligible for Award	No Discount	Review Performance
5	EMP004	400000	690	75	8	2500	No Bonus	Improvement	Not Eligible	Discount Applied	Review Performance
6	EMP005	950000	800	98	2	3000	Bonus Granted	Good	Eligible for Award	Discount Applied	Applied
7											
8											
9											
10											

Conclusion

And via IF, Nested IF, AND, and OR functions business can automate procedures such as:

- Performance evaluation
- Loan and credit approvals
- Promotional offers
- Admissions and hiring criteria

Knowing these two functions in Excel will assist you in making decision based on data, and also take you business operation to the next level of efficiency.

Did You Know?

Advanced sort feature which can be used to sort based on multiple columns for better organizing the data. You can also sort by cell color, font color, or custom lists so you spend less time siftin... and more Its not just for numbers either - you can sort by character length, font color, and even cell color!Sort data in Excel worksheets in a crowd! ranking & categorizing business information is a quick and painless process- ranking lists of names neat problems into organized data.

5.2 Filtering and Sorting Data for Decision Insights

Filtering and sorting- features Excel Filters Sorting are some of the most efficient data-processing functions available in Excel to help you organize, analyze and retrieve important pieces of information from a huge dataload so that we can make quick decision with perfection.

Filtering Data

Filter also sorts rows - Display only the sort of rows in Excel Filter The filter will display only the rows that meet certain conditions and temporarily hide others. The power of filtering is that you can apply filters to the filtered data and see only it in the workbook, making it easy for you to study selected portions of overall dataset.

How to Apply Filters

- Step 1: Click at the range or click any cell of your data.
- Step 2: Go to the Data tab and select Filter. The filter arrows will be put in the header row.
- Step 3: Hit the little filter arrow on your target column and type in your input conditions for the filter.

Example: Filtering Sales Data to Include Only One Region

Suppose you have a data set of sales in several regional areas, and you only want to see the North Regional data.

Region	Sales (₹)
North	5,00,000
South	3,00,000
East	4,50,000
North	6,00,000
West	2,80,000

Fig 5.16 Filtering Sales Data by Region

Filter Applied:

- Criteria: Region = "North"

Region	Sales (₹)
North	5,00,000
North	6,00,000

Fig 5.17 Sales in North Region

- Insight: You can quickly assess total sales in the North region for further analysis.

Custom Filters

You can always add your own custom filters to have more flexibility with say ranges, text conditions or dates.

Date	Sales (₹)
2024-01-15	1,50,000
2024-02-10	2,20,000
2024-03-25	1,80,000
2024-04-05	2,00,000

Fig 5.18 Filtering Data by Date Range

Example: Filtering by Date Range

Imagine a sales report that you only want to display for the months of January through March.

Custom Filter Applied:

Date	Sales (₹)
2024-01-15	1,50,000
2024-02-10	2,20,000
2024-03-25	1,80,000

Fig 5.19 Custom Filter

Criteria: Date is greater than 01-Jan-2024 and less than 31-Mar-2024

● Takeaway: Pay attention to quarterly sales results.

Sorting Data

It allows one to order (i.e., sort / rank) data in an informative manner which may help one finding patterns, trends or other features. Tasks can be seen in alphabetical and numerical order, by due date.

How to Sort Data

● Step 1: Select your date range or the column you want to sort.

Step 2: The Transpose Option Click on the Data tab.

● Step 3: Choose sort ascending (A-Z) or sort descending (Z-A).

Example: Sorting Sales Data

Product	Sales (₹)
Laptop	7,50,000
Mobile	4,00,000
Tablet	3,00,000
Headphones	1,50,000

Figure 5.20 Sorting Sales Data

Sort Applied:

● Criteria: Revenue in decreasing order

Product	Sales (₹)
Laptop	7,50,000
Mobile	4,00,000
Tablet	3,00,000
Headphones	1,50,000

Fig 5.21 Sales in Descending Order

● Insight: Discover best performing products in no time.

Multi-Level Sorting

Multi-level Sorting -sort data on two and more rows. Great for hierarchal data organization.

Example: Sales by Region and Salesperson

Region	Sales Rep	Sales (₹)
North	Aditi	5,00,000
South	Rohan	4,00,000
North	Kiran	6,00,000
South	Neha	3,50,000

Fig 5.22 Sales Performance by Region and Sales Representative

Sort Applied:

- Level 1: Region (A-Z)

Level 2: Top - Sales (Largest to Smallest)

Region	Sales Rep	Sales (₹)
North	Kiran	6,00,000
North	Aditi	5,00,000
South	Rohan	4,00,000
South	Neha	3,50,000

Fig 5.24 Region (A-Z)

Region	Sales Rep	Sales (₹)
North	Kiran	6,00,000
North	Aditi	5,00,000
South	Rohan	4,00,000
South	Neha	3,50,000

Fig 5.25 Sort Applied (Largest to Smallest)

- Insight: Easily identify productive performers.

Excel filtering and sorting are fundamental for data-driven decision-making in business, as they allow the user to reveal insights, explore patterns and back informed decisions with facts.

5.3 Using Advanced Sorting Options in Excel

One of the most notorious features within Excel is sorting, users spend possibly hours sorting and analyzing their own data. For most basic data types you'd want just a simple sort, ascending or descending. Complex Sorting Options users can sort data using multiple options - by most viewed, created date, view type and view count Custom Lists Users also have the ability to create custom lists for their information Case-sensitivity Turn it on if you prefer case sensitivity in your lists. This is particularly helpful to businesses required to process complicated types of data in a timely manner.

Multi-Level Sorting

The hierarchical Sort can be easily implemented by using Multi level Sort (users would like to sort against multiple columns) It is convenient to sort data that belongs with hierarchy, eg salesman name sales performance region.

Examples: Organizing employee sales data by region and volume of sales.

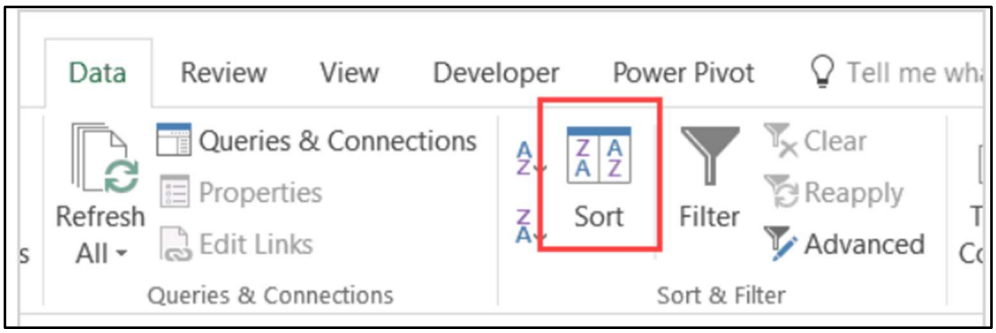
Take a dataset of employee sales across several regions for example:

	A	B	C
1	**Region**	**Sales Rep**	**Sales**
2	South	Lisa	440
3	North	Alex	473
4	West	Matthew	299
5	South	Lance	937
6	West	Grahm	561
7	East	Barb	393
8	East	Greg	819
9	South	Glen	824
10	West	Phillip	658
11	North	Scott	180
12	East	Ana	837
13	North	Bob	188

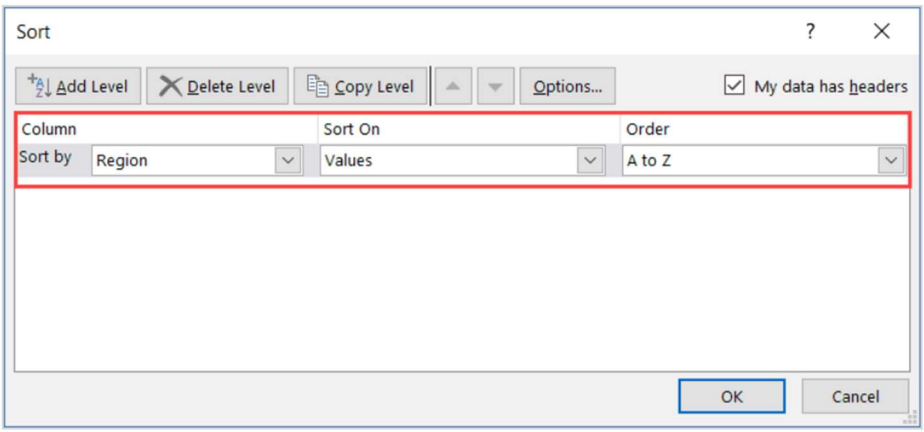
Fig 5.26 Sorting employee sales data by region and amount of sales

Steps to Apply Multi-Level Sorting

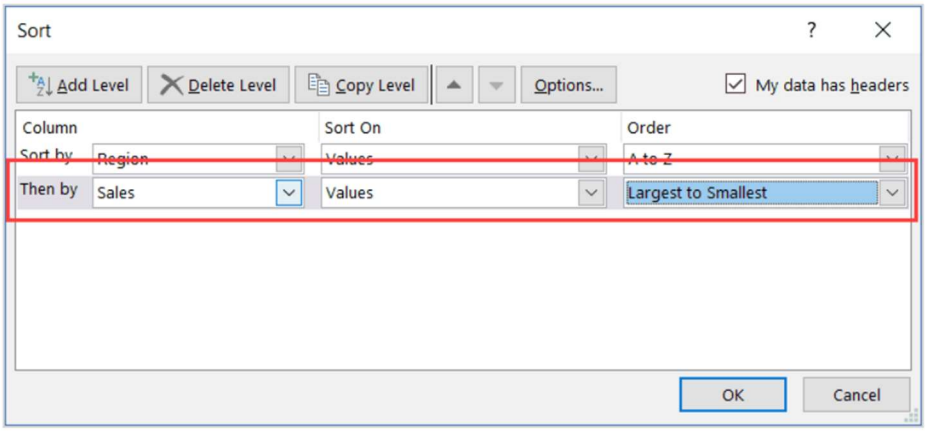
1. Choose the dataset.
2. Navigate to the Data tab and click Sort.



3.For the first column, choose Region and then A-Z (Ascending Order) in the dialog box



4.Click **Add Level**, then choose Sales (₹) as the second column and select Largest to Smallest.



5.Click OK.

Result:

Sorted First Sorted Second

	A	B	C
1	Region	Sales Rep	Sales
2	East	Ana	837
3	East	Greg	819
4	East	Barb	393
5	North	Alex	473
6	North	Bob	188
7	North	Scott	180
8	South	Lance	937
9	South	Glen	824
10	South	Lisa	440
11	West	Phillip	658
12	West	Grahm	561
13	West	Matthew	299

Fig 5.27 Multi-Level Sorting

Insight: The data has been sorted by Region (A-Z) and for each region, it is sorted in reverse order of Sales.

Sorting by Custom Lists

Excel users are able to sort according to a "custom list," which is in an arbitrated order rather than alphabetical or numerical.

Example: Sort by Quarter (Q1, Q2, Q3, Q4)

Now consider business sales data recorded by quarters:

Quarter	Sales (₹)
Q3	7,00,000
Q1	5,50,000
Q4	8,00,000
Q2	6,00,000

Fig 5.28 Sorting by Quarter

How to do Custom Sort Using Lists

Select the dataset.

Go to Data → Sort.

Now in the Sort dialog select Quarter for your Column.

Click Order → Custom List.

In the Custom Lists dialog type: Q1, Q2, Q3, Q4 and then click OK.

Result:

Quarter	Sales (₹)
Q1	5,50,000
Q2	6,00,000
Q3	7,00,000
Q4	8,00,000

Fig 5.29 Sort Using Custom Lists

Insight: This uses natural trading order rather than alphabetical.

Sort by Cell Color, Font Color, or Icon

You can use cell color, font color and the icons (applied via conditional formatting) to easily group the data that you are analyzing.

Example: Sort Sales Performance by Color

Employee	Sales (₹)	Performance Rating
Aditi	5,50,000	🔴 (Low)
Rohan	8,00,000	🟢 (High)
Neha	4,50,000	🟡 (Medium)
Kiran	7,00,000	🟢 (High)

Fig 5.30 Sort Using Custom Lists

Steps to Sort by Color:

Select the dataset.

Go to Data → Sort.

Select Performance Rating as the sort column.

Employee	Sales (₹)	Performance Rating
Rohan	8,00,000	🟢 (High)
Kiran	7,00,000	🟢 (High)
Neha	4,50,000	🟡 (Medium)
Aditi	5,50,000	🔴 (Low)

Fig 5.31 Sorted by Performance Rating

In the Order paragraph, select either Cell Color or Icon and set order of the colors (🟢 → 🟡 → 🔴).

Click OK.

Result (Sorted by Performance Rating):

What I like: High achievers are near the top, creating instant clarity regarding high performers.

Sorting with Case Sensitivity

Don't worry! Excel's sort is usually not case-sensitive but you have the option to make it so if necessary.

Example: Sorting Employee Names Case-Sensitively

Employee
ananya
Ananya
ANANYA
aniket
Aniket

Fig 5.32 Sorting Employee Names Case-Sensitively

Steps to Apply Case-Sensitive Sorting

Select the dataset.

Click on the button "Sort..." in the Data menu.

Click Options and then Case Sensitive.

Choose Sort A to Z.

Result:

Employee
ANANYA
Ananya
ananya
Aniket
aniket

Fig 5.33 Apply Case-Sensitive Sorting

Insight: This is how it handles the problem the input case sensitivity of names.

Multiple criteria(sort) in pivot table

When you're dealing with Pivot Tables, sorting is a must. Fields can be dynamically sorted by users in order to interrogate mountains of data.

Example: Sort Total Sales by Region in Pivot Table

Region	Total Sales (₹)
North	18,00,000
South	12,00,000
East	9,00,000

Fig 5.34 Sorting by Multiple Criteria in Pivot Tables

Method to Sort the Pivot Table's Data:

Hold down the Shift key and click on the Pivot Table column heading (Total Sales).

Right-click and select Sort → Largest to Smallest.

Region	Total Sales (₹)
North	18,00,000
South	12,00,000
East	9,00,000

Result:

Fig 5.35 Sort Pivot Table Data

Insight: Aid in prioritizing high sales areas for strategic planning.

Advanced sorting features in Excel provide a fast and easy way to handle, manipulate, and format data that is larger in size. By using multi-level sorts, custom lists for sorting data, sort options in pivot tables where you can sort your data by color or icon and case sensitive way we can have a deep dive while dealing with Data. Mastered skills enables us to organize data, observe trends and make smarter decisions in day-to-day business context.

Knowledge Check 1
Knowledge Check
Choose the correct option:

How do I do multi level sorting in Excel?

a) Click on "Custom Lists"

b) Choose the dataset

c) Select "Sort by Color"

When you sort using a custom list where do you write in the pre-defined order (i.e., Q1, Q2, Q3,Q4)?

a) On the Sort window in Column Name

b) In the Custom Lists window

c) Format in the Cells Dialog box

5.4 Summary

❖ Logical Functions in Excel may assist to take decision by evaluating the conditions and get true or false against logical tests. They are probably the most popular function in data analysis, reporting, and other areas.

❖ The IF function tests a condition and then returns one value if the test is TRUE, another value if the test is FALSE, so it can be used to classify data.

❖ Multiple conditions are verified with Excel nested IF statements, allowing you to extend the application of this function in more advanced formulas such as grade calculation systems (especially for academics), financial models and likewise.

❖ The AND Function requires all supplied conditions to be TRUE for a resultant TRUE, which is helpful in when you need certain very explicit eligibility criteria, compliance checks and multi-conditional decisions.

❖ See screenshot: The OR function will get TRUE if at least one condition is true. This one is great for that kind of decision making flexibility, as well as "what if"ing and conditional formatting.

❖ (Excel Post 5) Filtering of data: Information required from detailled data which meet a particular condition can be extracted using filtering. With these filters, the data becomes visible and decision making is more efficient.

❖ Sorting Data sorts data in ascending or descending order using text, numbers, dates and then it becomes easy to analyse the trends & data patterns.

❖ Custom Sorting Options allow sorting the data in levels, for example, to receive the report sorted on department and then by an employee's name making reports clear and looking organized

❖ Techniques for specific order on the basis of Colors, or preceding Icon Set OR YOUR list "ALWAYS' shows the end-user what iis more important.

❖ Become proficient in Logical Analysis Tools, and you'll have the ability to handle more of your business data with skill and ease.

5.5 Key Terms

Logical Functions: In Excel, functions that allow you to perform operations based on conditions if function is TRUE and if FALSE.

IF Function :a function that verifies whether a condition is met, and returns one value if true and another value if false.

Nested If: A set containing more than one If statement which can be used in formula to test a set of conditions one by one.

AND Function: If and only if all the conditions are true, it will be true also. Otherwise, it returns False.

OR Function: This returns a True if the conditions given in this statement are met to any extent or False otherwise.

Data filter Only show requested data according to the conditions and hide others for easy browsing use during data analysis.

Data Sorting: Structuring data based on particular criteria such as ascending/descending order, by number value, text or dates.

Advanced Sorting - A refined sort feature for sorting data with multi-criteria such as using custom lists or applying S&T.

Conditional Formatting: This is an Excel feature that uses formats like colors or icons in cells based on certain programmed conditions in order to give you a much easier way of building visualisation.

Data-Driven Decision Making: It is to make decisions in your business or analytical thinking based on a systematically reviewed and logically analyzed data.

5.6 Descriptive Questions

Describe the significance of logical functions in Excel. And what do they add to decision-making in data analysis?

Describe the IF function. How does it work, and when is it generally used?

What is a Nested IF function? Nested IF vs. Simple If What do I call the Extra IF?

Advantages & Disadvantage of nested if in Excel.

Describe AND function in Excel. How will it help me to analyze logically? How is it appropriately used?

2.a What is the OR function and its uses? How does it perform the logical operation as compared to AND function?

Role of a data filter in enhancing decision-making in an Excel sheet. Explain a few ways you can filter your data in Excel.

Why and how would you sort with data in Excel? How does it help to learn about trends & patterns in a dataset?

Explain what is meant by Excel advanced sort? How do custom sort options for example sorting by color or more than one level of sorting help organize data?

What About Filter and Sort with Logical Functions for Data Analysis? Give some reasonable concrete application of that combination.

Explain where logical functions are used in solving business problems: Explain their use in financial analysis, inventory management and monitoring.

5.7 References

1. Microsoft Support. (n.d.). Use logical functions in Excel. Retrieved fromhttps://support.microsoft.com
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3. Walkenbach, J. (2019). Excel Bible. Wiley.
4. Gupta, V. K. (2020). Excel for Data Analysis and Business Modeling. BPB Publications.
5. Beresford, L. (2021). Mastering Excel Formulas and Functions. Independently Published.Answers to Knowledge Check

Knowledge Check 1

1: a) Click on "Custom Lists"

2: b) On the Custom Lists dialog box

5.8 Case Study

"Retailing Sales Analysis And Decision Making"

ABC Retail is a department store chain that runs in different parts in India. The management wants to enhance its performance in sales and operations using Excel data analysis. The company maintains a vast database of sales, employee performance and transactions.

So that ABC Retail can gain such sound insight, it will use Logical Functions and Sorting & Filtering as well as Advanced Techniques for Sorting & Filtering to study and interpret sales data.

Problem Statement

The ABC Retail's management intended to:

Categorise Sales Performance using IF, Nested IF, AND, OR functions.

Filter and sort sales data to see trends and views.

Utilize Advanced Sorting functionality to bring the important values to the top.

Dataset Overview

Salesperson	Region	Total Sales (₹)	Target Sales (₹)	Customer Rating (1-5)	Performance Category
Aditi	North	5,00,000	5,50,000	4	Pending
Rohan	South	7,00,000	6,50,000	5	Pending
Neha	East	3,50,000	4,00,000	3	Pending
Kiran	North	6,50,000	6,50,000	5	Pending
Arjun	South	2,80,000	3,50,000	2	Pending

Fig 5.36 Sales Performance

The columns included in the sales data are:

Step 1: Working with Logical Functions (IF, Nested IF, AND, OR)

Objective:

Goal The management wants to classify the performance of each salesperson into groups, either "Good", "Average", or "Poor" based on the following conditions:

- Good: If the salesperson achieved or outperformed target, and their customer rating is 4 or higher.
- Median: The salesperson meets target but has earned no more than 4 rating from the
- Bad: When the sales representative does not attain the goal.

Solution with IF and Nested IF:

In Excel, we use the formula:

=IF(AND(C2>=D2, E2>=4), "Good", AVERAGE (IF(C2>=D2,"A","P")))

Results:

Salesperson	Total Sales (₹)	Target Sales (₹)	Customer Rating	Performance Category
Aditi	5,00,000	5,50,000	4	Poor
Rohan	7,00,000	6,50,000	5	Good
Neha	3,50,000	4,00,000	3	Poor
Kiran	6,50,000	6,50,000	5	Good
Arjun	2,80,000	3,50,000	2	Poor

Fig 5.37 IF and Nested IF Functions

Insights:

- Rohan and Kiran played admirably.
- Aditi and Neha sold less than their set target.

Step 2: Refine and Organize Data for Decision Making Insights

Objective:

- Filter the data to show only salesmen who had a performance of “Good” or “Average.”
- Order Total Sales in descending order to find the best performers.

Steps:

Select the dataset.

Click on Data → Filter and filter the Performance Category column for "Good" & "Average".

Select Data → Sort and sort from the Largest to Smallest based on Total Sales.

Filtered and Sorted Data:

Salesperson	Total Sales (₹)	Performance Category
Rohan	7,00,000	Good
Kiran	6,50,000	Good

Fig 5.38 Filtered and Sorted Data

Insights:

- Rohan is the best salesperson.
- Rewards from such incentive based programs may exclude underperformers.

Step 3: More Sorting Options

Objective:

- Rank employees by Region (A-Z) and then Total Sales (Largest to Smallest).
- Sort by custom sorting order with performance groupings (Good → Average → Poor).

Steps for Multi-Level Sorting:

Select the dataset.

Click on Data → Sort.

Put Region as level 1 to sort in order (A-Z).

Create another level and sort your data by Total Sales (L to S).

Click OK.

Sorted Data:

Region	Salesperson	Total Sales (₹)	Performance Category
North	Kiran	6,50,000	Good
North	Aditi	5,00,000	Poor
South	Rohan	7,00,000	Good
South	Arjun	2,80,000	Poor
East	Neha	3,50,000	Poor

Fig 5.39 Multi-Level Sorting

Insights:

- Kiran who is the best performer of North area.
- Rohan tops the charts in the South.

Conclusion & Business Decisions

Insights from Data Analysis:

- The condition functions well to classify sales performance.
- Filtering and sorting made it simple to see top performers.
- Enhanced sorting displayed performance by regions.

Actionable Business Strategies:

- Give bonuses (to Rohan and Kiran) to high performers.
- Train the weak performer (Aditi, Arjun and Neha).
- Assign high value sales territories to top performers.

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Unit 6: Lookup Functions

Learning Outcomes

- Learners will be able to apply VLOOKUP and HLOOKUP functions to retrieve data efficiently from structured tables.
- Learners will understand and implement helper columns to enhance lookup functionality and improve data retrieval accuracy.
- Learners will apply INDEX and MATCH functions to perform dynamic and flexible lookups beyond the limitations of VLOOKUP and HLOOKUP.
- Learners will analyze and solve real-world data lookup challenges using advanced Excel functions.

Content

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6.2 Advanced Lookup with Helper Columns

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6.0 Introductory Caselet

"Maximizing Inventory Control with Excel Lookup Functions

Amit is a supply chain manager for a retail company. His task: to make sure the company's stores are well-stocked, but not overflowing with excess inventory. His team deals with massive data sets, such as product IDs, supplier information, inventory levels, sales history. But it does take some time to retrieve the correct information.

One day, his boss asks him to compare the stock levels and vendor information for thousands of products. For him, manual search is a waste of time and error-prone. He wants to be able to pull in data automatically from somewhere useful - such as pulling product information from a master stock sheet, or looking at stock levels across several store locations.

Amit is familiar with VLOOKUP and HLOOKUP functions in Excel but he is struggling to use them effectively. He also finds out that those advanced methods (getting things done, use of helper columns and using INDEX + MATCH) provide a much more dynamic way of performing search functions. Intent on saving time in managing current stock, Amit decides to find out about these wonderful Excel features.

Critical Thinking Question

How does Amit use VLOOKUP, HLOOKUP, INDEX, MATCH to analyze the inventory data so that he can ensure there is never too much or too little stock in any of his stores?

6.1 Understanding VLOOKUP and HLOOKUP Functions

The concept of looking for certain information rapidly from large data sets is crucial in data Analysis Company. The lookup functions in Excel is an efficient tool which helps us to look for specific data against a huge amount of data through queries that match the optimum exact criteria. VLOOKUP and HLOOKUP are probably the most frequently used lookup functions.

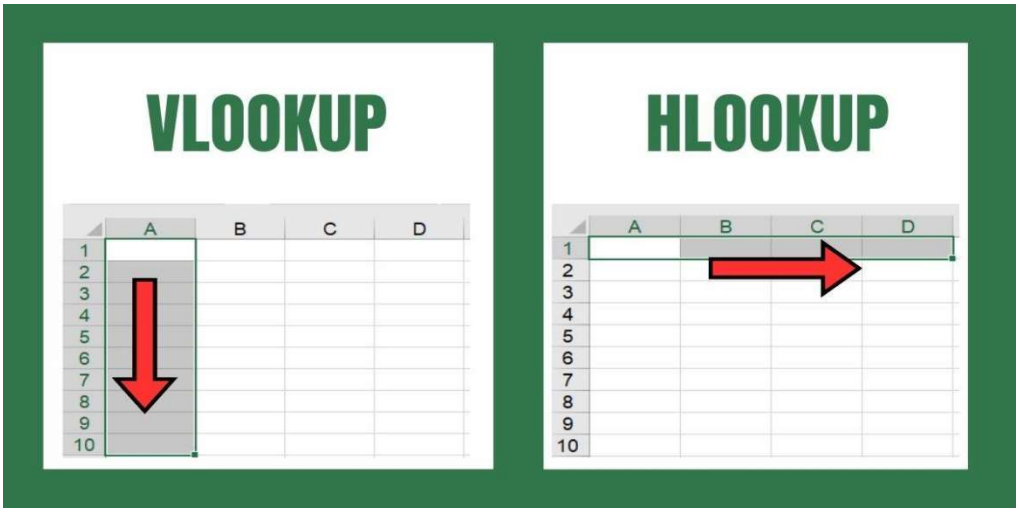

Fig 6.1 Vertical Lookup (VLOOKUP) and Horizontal Lookup (HLOOKUP)

VLOOKUP is a feature that allows users to search vertically through the first column of a selected range, and return data from any other column in the same row. Columns of VLOOKUP-friendly data are datasets that can be quickly worked on with employee rosters, financial reports, and product lists! INDEX and MATCH can do what VLOOKUP cannot, which is to look up the value on the left. HLOOKUP (or Horizontal Lookup) enables users to search for a value in the first row of a given range and returns data from another row on the same column. Because of the data horizontal arrangement, this function would be handy in grabbing time based performance figures and lists from pricing tables.

These are the features adding value to efficiency by facilitating search, lessening manual effort and human errors. As powerful as INDEX-MATCH and XLOOKUP are, they still necessitate data to be arranged in the right way. It's vital to understand when and how to use them properly in managing data and making decisions.

Explanation of VLOOKUP and HLOOKUP Function in Excel

The above VLOOKUP and HLOOKUP Excel functions have been illustrated to make it easier for you, along with Olympic medal statistics by countries.

Key Features in the Image:

Dataset Structure:

- Column A has names of countries.

- The picture representation below shows the distribution of Olympic medals A, B,C and D indicate columns full of medal numbers for G Gold, S Silver and B Bronze in each country.

HLOOKUP Example:

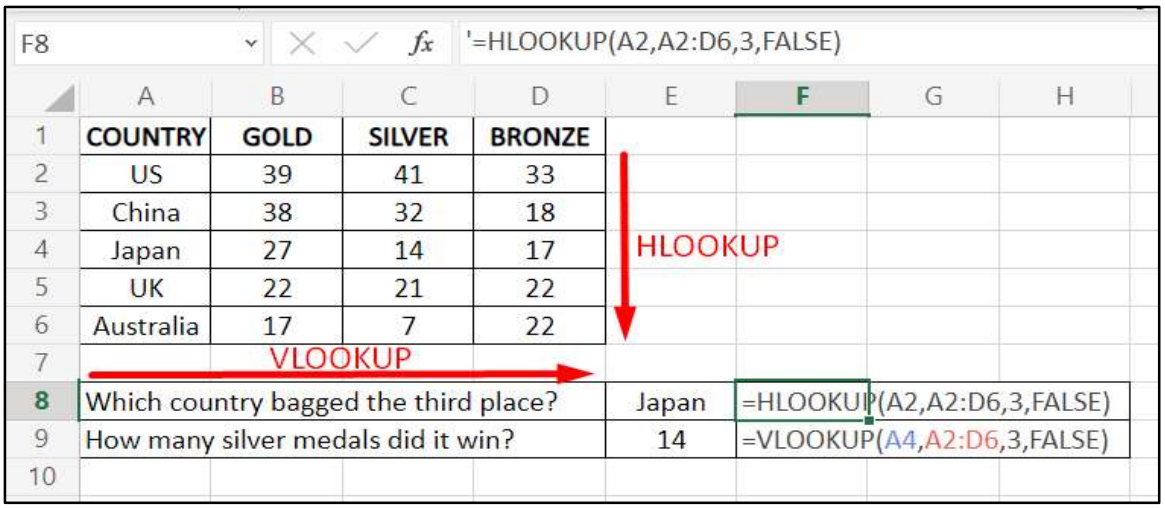

Fig 6.2 Understanding VLOOKUP and HLOOKUP in Excel

● The formula =HLOOKUP(A2, A2:D6, 3, FALSE) looks up the country in cell A2 (US) from the table A2:D6.

● The formula references the silver medal row in the third position for this country.

VLOOKUP Example:

● The functions VLOOKUP(A4, A2:D6, 3, FALSE) find the name “Japan” (the value in A4) within column A and then returns its Silver medal count from the third column (C).

● The number that comes out of this sum shows the second-placing Japan to be in possession of 14 Silver medals.

Concepts Illustrated:

● Column G is strictly for demonstration purpose, you can replace the formula with either VLOOKUP or INDEX function which outputs the same result. ● VLOOKUP looks up an input value in first column and returns matching data from specified column.

● HLOOKUP searches horizontally down the first row of a table and then returns a value in the same column from a specified row.

● The technology is available to allow users to efficiently manage the data collection and retrieval.

Example 2:

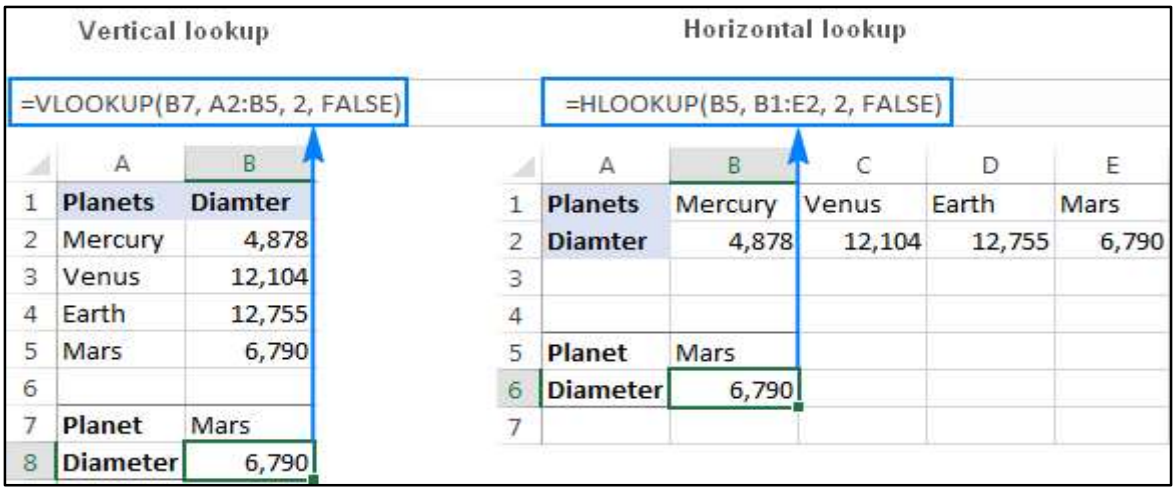

Fig 6.3 VLOOKUP and HLOOKUP

Fig 6.3 provides an example of vertical and horizontal look up, when VLOOKUP and HLOOKUP are put to use, respectively using planetary diameters as the sample data set. The formula in cell C7 is =VLOOKUP(B7 $A$2:$B$5, 2, FALSE). What the VLOOKUP is doing is searching down column A for its lookup value. The right side of the worksheet demonstrates using HLOOKUP to pull data from a table that holds Planetary names in row 1 and their corresponding diameters across row 2. The formula: =HLOOKUP(B5, B1:E2, 2, FALSE) begins by looking for "Mars" in row 1, and then retrieves its diameter from row 2. Both functions are necessary for structured dataset data retrieval since HLOOKUP allows row searches (as opposed to column searches) mentioned earlier.

6.1.1 VLOOKUP Function

The V in the VLOOKUP stands for vertical, which means it looks up data vertically (i.e., from top to bottom) in a table and retrieves the corresponding value. It follows a vertical orientation.

Syntax:

VLOOKUP(lookup_value, table_array, col_index_num, [range_lookup])

lookup_value: The value to search for in the first column of the table.

- table_array: The range that houses the values which needs to be looked up along with the column in which we will find our return value.
- col_index_num: The column number of the value to return within the table_array.
- range_lookup: (Facoltativo) TRUE value is for an approximate match; FALSE value is for an exact match.

6.1.2 How VLOOKUP Works

VLOOKUP searches the table array rows from the first column to any column in table_array. The function looks up value in the first column rows and returns a value from another col_index_num.

Example: Employee Data Lookup

The data in this set contains information on employees - there are three columns for consideration:

Employee ID	Name	Department
1001	Alice	HR
1002	Bob	Finance
1003	Charlie	IT
1004	David	Marketing
1005	Emma	Sales

Fig 6.4 Employee Data

The department of Employee ID 1005 can be located as follows:

=VLOOKUP(1005, A2:C10, 3, FALSE)

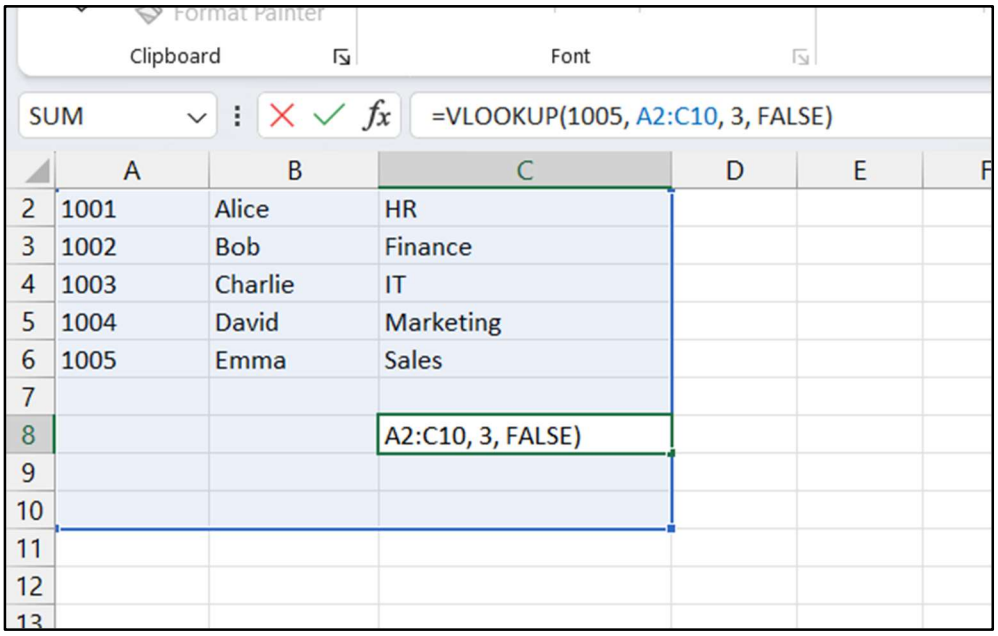

Fig 6.5 Steps to find the department of Employee ID 1005

Breaking Down the Formula

- The required field 'Employee ID' is parametrized through the formula (1005).
- In the table range A2:C10 the function looks for the Employee ID that we have stated is 1005.
- The formula is asking for the value in the Department column, position 3, out of table range A2:C10.
- In order to achieve an exact match only in the search result function is FALSE.

Result Interpretation

- The function searches Column A for the 1005 entry by ranging through its values.
- It finds 1005 in row 6.
- Function continues to the third column of row 6 and returns the Sales value to the user.

6.1.3 Real-World Applications of VLOOKUP

The function VLOOKUP serves many entities in obtaining specific values from large collections of data. In other professional domains, VLOOKUP is often performed manually:

Employee Database Management (HR Department)

Another HR person must be able to query from their system using employee information.

Application:

The HR manager can use VLOOKUP to search an Access record by providing Employee ID detail to find out employee's name and department, earning and joining date from the master table.

Example Formula:

=VLOOKUP(A2, EmployeeData! A:E, 2, FALSE)

The VLOOKUP function is used for processing payroll as well as performance reviews and tracking employees.

Product Price Lookup in Retail

Supermarket cashier registers system is one application that restricts within the supermarket, in which the description of a product is using VLOOKUP command in order to access the price information on a database.

Application:

Once the user enters the product code, VLOOKUP gets them their price and discount automatically.

Example Formula:

=VLOOKUP(B2, PriceList! A:C, 3, FALSE)

The macros evolved, fast and efficient in calculating the proper bill amounts with little fuss.

COM (E-commerce & Logistics)

The call center agent needs Order ID to look at the status in the system.

Application:

Your rep sends your ID to VLOOKUP, and gets back shipping & delivery info like date of delivery, courier etc.

Example Formula:

=VLOOKUP(D2, OrderData! A:F, 4, FALSE)

User support becomes manageable, albeit still assisted and facilitated.

Student Grade Calculation (Education Sector)

The admin of the college would like to retrieve a student grade based on their Roll Number.

Application:

ProcessM Your Roll Number You can enter your roll number and Excel will fetch from database and you can determine the Grade.

Example Formula:

=VLOOKUP(A2, Grades! A:D, 3, FALSE)

By this way, automatically generation can be available for preparing report card.

Inventory Management (Manufacturing & Warehousing)

The manager of warehouse wants to observe the quantity of product is available currently in store.

Application:

The quantity count, reorder point and Supplier ID follow the entry of Product ID: VLOOKUP is used to bring product inventory details including the Quantity Count, Reorder Point and Supplier based on the Product ID.

Example Formula:

=VLOOKUP(A5, Inventory! A:E, 4, FALSE)

The formula avoid under-stocking and over stocking.

Financial Reporting and Budget Tracking modules are used by the Finance Department to monitor financial expenditure.

A finance manager would like to get actual department expenses by using the department codes as a filter.

Application:

There was no difference between the two if found using department code entry where both allocation and spending activities could be viewed.

Example Formula:

=VLOOKUP(A2, Budget! A:D, 3, FALSE)

The calculation allows companies to realize its financial planning, in addition it helps you to verify cost or budget.

Procurement Department (Supplier & Vendor Management)

The purchasing officer attempts to retrieve supplier information by entering the Supplier ID.

Application:

Suppliers contact details, email address and last transaction will show by entering Supplier ID.

Example Formula:

=VLOOKUP(B3, Suppliers! A:D, 2, FALSE)

The system improves supplier interchange and order visibility.

The VLOOKUP function serves as one of the main organ functions for corporations by automatically locating data to increase productivity and minimize errors across various industries. It has a tool that allows HR, retail, finance and other companies to easily manage their data for efficient decision making and planning.

6.1.4 Handling Errors in VLOOKUP

- The lookup_value is not found in the first table column, and you get a #N/A error as the return.

● The result shows #REF! error as the column index you have given is greater than available columns.

● range_lookup If TRUE or omitted, VLOOKUP will find the closest match from a row before returning the lower value.

6.1.5 VLOOKUP Best Practices Keep column numbers and field names consistent on both answer sheet and data You must make sure that your question slug of “latitude” or whatever else you’re looking for, uses the same column number/name that we use in class!

Use FALSE for Exact Matches

Argument range_lookup should always be set to FALSE which requires an exact match. This is probably not what you want (though if it were, you'd use FALSE or an empty value for this argument), as the first column must still be sorted to retrieve anything useful.

Example:

The price list has a "Laptop", for which I need the prices.

=VLOOKUP("Laptop", A2:C10, 2, FALSE)

Here we have used the "Laptop" as search term and it searches in column A till it gets the price tag of laptop which is in the column B.

By specifying the FALSE value in this formula, we make sure that Excel returns only precisely matching lookup results with the help of the VLOOKUP function.

Did You Know?

VLOOKUP For Range-Based Searches Can Use Approximate Matches: When you specify TRUE as the range lookup, VLOOKUP will bring back the closest match that is less than or equal to the lookup value – this can be very useful when in grading systems, tax brackets and commission structures because sometimes there are no exact matches.

If the data set is large then sort the first database column in ascending order.

When using approximate match with TRUE as 4th parameter, you can speed up the process by first sorting column1 in ascending order.

Example:

A grade look-up table is a set of scores which are used to determine particular letter grades when the table is indexed by rank.

Score	Grade
50	F
60	D
70	C
80	B
90	A

Fig 6.6 Score Board

The formula finds what the grade is for scoring 75.

=VLOOKUP(75, A2:B6, 2, TRUE)

The function works in a didactic environment, where the lowest-to-highest scores are listed down Column A.

The VLOOKUP formula gives "C" because 75 is between 70 and 80.

Use Absolute References to avoid errors.

While you copy formulas, make use of absolute cell references ($A$2:$C$10) so that the lookup range remains constant and errors in reference displacement are avoided.

Example:

=VLOOKUP(A2, $A$2:$C$10, 2, FALSE)

The formula pulls down through cells, however notice I lock the lookup range ($A$2:$C$10) so it will not change.

When you need the extreme flexibility - go with INDEX and MATCH functions

LOOKUP functions are more flexible than VLOOKUP, in that the first lookup column comes at some point but not within the 1st position.

Example:

When you have the price of a product stored in column B but at the same time the name of that product in column A =VLOOKUP will not work. Instead, use:

=INDEX(C2:C10, MATCH("Laptop", B2:B10, 0))

● The MATCH function finds “Laptop” in B2:B10 with a 0 last argument.

MATCH("Laptop",$B$2:$B$10,0) ● MATCH will return the row number of where “Laptop” is in B2:B10. The INDEX function returns the matching value from C2:C10.

Why use INDEX and MATCH?

● Accessibility:other, VLOOKUP only works on the first column ¶ The INDEX-MATCH method can do lookups on any column According to INDEX.

- The method is computational efficient within the data set.

- The way is robust against errors in adding or removing columns.

6.1.6 Understanding HLOOKUP Function in Excel

HLOOKUP Looks for a value in the top row of a table or an array of values and then returns a value in the same column from a row you specify. The HLOOKUP function helps organize tables and to find a specific value from the first-row categories through comparison with other rows.

Syntax of HLOOKUP:

=HLOOKUP(lookup_value, table_array, row_index_num, [range_lookup])

- Search for lookup_value in the first column of table_array.

- The table_array parameter for specifying the range of data to search is requesite for the function.

- The row_index_num argument indicates from which row of table_array youd like to return a value.

- range_lookup – (exclusivo) VERDADERO para una coincidencia aproximada, FALSO para una coincidencia exacta.

6.1.7: XLOOKUP

XLOOKUP is a brand new, top-of-the-line lookup function in Excel that you can use to look up a value in one column and return the matching value from another column. It is more dynamic as compared to VLOOKUP and HLOOKUP.

Syntax:

=XLOOKUP(lookup_value, lookup_array, return_array, [if_not_found], [match_mode], [search_mode])

· lookup_value → The value to find.

lookup_array – The range in which Excel will find the lookup value.

· return_array – The array or range from which you want to return the result.

· [if_not_found] (optional) → Custom message if value is not found / does not exist.

· [match_mode] (optional) → If it should match the entire list item or the first letter.

· [search_mode] (opcional) → Sentido de búsqueda (de primero solo para el comience o último a primero).

Example 1: Basic XLOOKUP

Salesperson	Region
Aditi	North
Rohan	South
Neha	East

EXAMPLE: Get salesperson region.

Formula:

=XLOOKUP("Rohan", A2:A4, B2:B4)

Result:

South

Knowledge Check 1

Choose the correct option:

What is the Excel function that looks up a value in the first column of a range and returns another value?

a) HLOOKUP

b) VLOOKUP

c) MATCH

Why is VLOOKUP limited?

a) It cannot look up values in the leftmost column of a range.

b) It only supports numeric values.

c) It works with rows of data

What is the ideal look up formula for looking values across a horizontal table?

a) VLOOKUP

b) INDEX

c) HLOOKUP

6.1.7 Real-World Applications of HLOOKUP

Student Score Lookup (Education Sector)

A teacher wants to recover the student's score information in his/her mark sheet that has been arranged horizontally.

Application:

The first row of the table corresponds to data subjects and mark scores are located under that.

HLOOKUP looks for the topic in first row and then retrieves student marks from one of the rows.

Formula Example:

=HLOOKUP("Math", A1:E5, 3, FALSE)

The advantage of the usage of HLOOKUP is the possibility to get fast students marks in an automatic way without looking for them manually.

Price List (Retail & E-commerce)

A sales representative wants to find the price level of certain product types over various sales areas.

Application:

The first line also shows product categories (Electronics Furniture Clothing) etc.

The app stores pricing data for multiple iterating regions in individual rows.

Formula Example:

=HLOOKUP("Electronics", A1:D4, 2, FALSE)

The technology affords people an easier way to compare prices from a given source at the same time.

Budget Lead Monitoring (Finance and Accounting)

The finance department needs to have an overview of the distribution for Q1-Q4 in budget.

Application:

- The first line is the header and refers to fiscal qtrs (Q1, Q2, Q3 and Q4).
- The departmental budget are listed in subsequent rows below this first one.

Formula Example:

=HLOOKUP("Q2", A1:E5, 3, FALSE)

Using HLOOKUP, subscribers can efficiently track financial data for completing quarterly reports.

The employee Shift Schedule (HR & Operations)

The manager wants to see the employees' shift times one day.

Application:

- The first row displays the seven days of the week.

λ A list for employees shift work below each other.

Formula Example:

=HLOOKUP("Wednesday", A1:G5, 4, FALSE)

You can apply HLOOKUP Excel function to keep employees schedules together with their attendance.

Meteorology Research HLOOKUP for weather data analysis.

The meteorologist wants to analyze temperature temperatures of a specific city in their weekly report.

Application:

Football Crazy Instructions: ● All football crazy city names are in the first row of cells.

● Each week's temperature values are printed beneath the one before it in the same column of the sheet.

Formula Example:

=HLOOKUP("New York", A1:G5, 3, FALSE)

HLOOKUP advantages users with over-speed weather conditions from many cities.

Limitations of HLOOKUP

● The lookups done via HLOOKUP are still not as flexible as INDEX-MATCH or XLOOKUP when doing a combination of searching columns and rows.

● The lookup value must be in the first row of the dataset data that has been made available.

● The vertical lookup feature is not there in HLOOKUP.

Data recovery from a table layed out horizontally can be handled by the HLOOKUP function. It's useful in operations reports and schedules, financial tracking and product pricing in a variety of businesses. For complex datasets, users may want to explore other lookup functions over INDEX-MATCH or XLOOKUP because they provide greater flexibility.

Activity: Excel Student Attendance Analysis

You're going to learn how to analyse and graph our student attendance data so we can find trends and interesting insights using Excel.

Instructions:

Select a Dataset: Use a sample dataset provided (or create your own) including fields for student's name, date, attendance status (Present/Absent), class section.

Organize the Data in Excel

· Input the information in some Excel workbook.

· Use sorting and filtering to order attendance chronologically (by sin asin adate, student or section).

Perform Data Analysis

· Use COUNTIF functions to determine the number of days and numbers absent for each student.

· Calculate the class average percent attendance and the same for each section.

Visualize the Data

· Bar chart showing attendance rates in different sections.

· Use a line graph to plot daily trends across one week, or month.

· Create a pie chart to show the proportion of all students present and absent.

Use Conditional Formatting

· Show students whose total attendance is less than or equal to 75% in red.

· Bold the students who had an attendance of 100% (no absences).

Make Data-Driven Observations

Respond to the following in light of your analysis:

Which division has most and least attendance?

Are there days with less visitors?

What methods will improve attendance in underperforming sections?

6.2 Advanced Lookup with a Helper Columns

In some cases, you cannot work effectively with the VLOOKUP(HLOOKUP because they are limited to searching along right columns and they will only return values from left hand sides. The second Helper Column is a response to lookups limitations, returning lookup features.

6.2.1 Why Use Helper Columns?

Helper columns are used when:

● The lookup column is in a position beyond the first position of the data.

● In order to uniquely identify the data, all of the fields need to be collapsed into one.

● You cannot use VLOOKUP to return values from a column to the left, and INDEX and MATCH can accomplish this task which should be mentioned..

● A distinct identifier is needed as there are duplicate elements in the data.

Example 1: Helper Column for Reverse Lookup

VLOOKUP will only look in the first column and dimensions to the right of your look up range are, however VLOOKUP will only return values that are on the right. When values

are being returned from that column then it's necessary to look at the left hand side of the lookup range.

ID	Company	Product
1	Apple	MacBook Pro
2	Lenovo	IdeaPad
3	HP	ProBook
4	Dell	Inspiron
5	Acer	Aspire

Fig 6.7 Product details

Solution with a Helper Column

As VLOOKUP only searches the first column, I add a helper column where i move the Company column to be in the first position.

Company	ID	Product
Apple	1	MacBook Pro
Lenovo	2	IdeaPad
HP	3	ProBook
Dell	4	Inspiron
Acer	5	Aspire

Fig 6.8 Solution with a Helper Column

Now, we use:

=VLOOKUP("HP", A2:C6, 2, FALSE)

This gives you 3 which is HP id.

Example 2: Concatenating for a Unique Lookup Someone asked me to provide an example where we would concatenate instead of merge.

Scenario

Employee ID	Name	Department	Salary
1001	Alice	HR	5000
1002	Bob	Finance	6000
1003	Charlie	IT	7000

Fig 6.9 Employee Details

Don't use extra columns to make calculations when dealing with big data, it does add time to the file size and processing.

Solution with a Helper Column

Add a new column Helper (Name & Department) In the above response, I picked up Name and department both.

=A2&B2

Helper (Name & Dept)	Employee ID	Name	Department	Salary
Alice HR	1001	Alice	HR	5000
Bob Finance	1002	Bob	Finance	6000
Charlie IT	1003	Charlie	IT	7000

Fig 6.10 Solution with Helper Column

To search for Charlie's IT salary, type:

=VLOOKUP("CharlieIT", A2:E5, 5, FALSE)

This returns 7000.

Best Practices for Helper Columns

- In case an auxiliary columns make things hard to read you can hide them.

• You probably want to use concatenation (&) or the TEXTJOIN function to create unique IDs.

- Use supplementary columns sparingly for large datasets as they contribute to file size and processing time.

Did You Know?

· Lookup efficiency can be 30% faster than array formulas or complex nested functions if you use a helper column.

· For data sets with 10K+ rows, a helper column is typically two or three times faster than an array-based formula.

6.3 Introduction to INDEX and MATCH Functions for Flexible Lookups

Data lookup and retrieval in Excel Data lookup and retrieval is required commonly, so there should be some ways to get the same job done effectively. VLOOKUP and HLOOKUP are powerhouse functions, however, they both have some limitations when it comes to searching data in left columns. For Excel users, INDEX and MATCH functions are by far the best solution that will allow you to work with larger spreadsheets and give you more flexibility in your lookups.

Example: INDEX

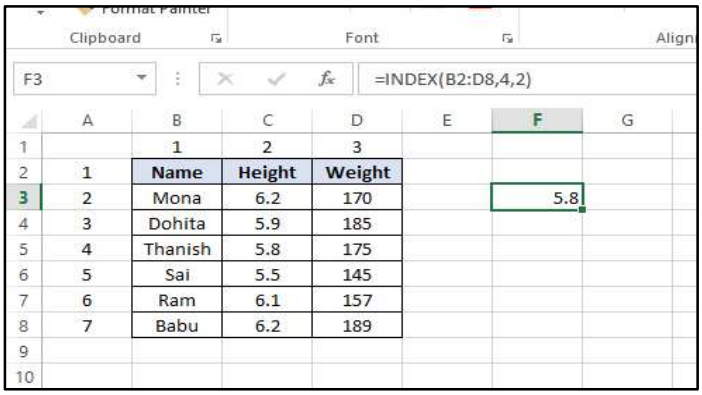

Fig 6.11 Example for INDEX Function

The INDEX function pulls a value from a range at the specified location you entered in the provided Excel sheet. The formula =INDEX(B2:D8,4,2) means:

- Search in range B2:D8.
- Check only the 4th row (centering in range).
- Choose the second column (in relation to your range)
- We can see on the table that the 4th row and 2nd column value (Height of “Thanish”) is 5.8, so F3 shows it correctly.

Example: MATCH FUNCTION

E2 =MATCH("Rachel Green",C:C,0)

	A	B	C	D	E	F
1	Department	Salary	Employee Name		Rachel Green	
2	HR	50000	John Doe		15	
3	Marketing	60000	Jane Smith			
4	Finance	55000	Bob Johnson			
5	IT	48000	Emily Brown			
6	Operations	52000	Michael Lee			
7	HR	51000	Sarah Wilson			
8	Finance	58000	David Miller			
9	Marketing	62000	Lisa Anderson			
10	IT	49000	James Thompson			
11	Operations	53000	Laura Davis			
12	HR	54000	Matthew Clark			
13	Marketing	59000	Jessica Brown			
14	Finance	56000	Kevin Scott			
15	IT	47000	Rachel Green			
16	Operations	51000	Benjamin Harris			
17						

Fig 6.12 Example for MATCH Function

Did You Know?

INDEX-MATCH is Faster, and More Powerful than VLOOKUP for Large Datasets:

Unlike VLOOKUP that searches the whole table, INDEX-MATCH can search values i a crosswise manner which results in better performance and takes into account situations when new columns are added or existing ones get removed. This is the reason it is the most popular tool for financial analysis

In this Excel sheet, MATCH function is utilized to return the position of specified value in a column. The formula =MATCH("Rachel Green",C:C,0) looks for the name "Rachel Green" in column C (Employee Name) and returns the row where it is located.

- The argument to the left 'Rachel Green' is look_up value.
- The second argument C:C is identifying the column to lookup.
- About Argument3: It's the argument zero = exact match.
- The function therefore returns 15, meaning that "Rachel Green" is found at row 15 of column C.

6.3.1 Understanding INDEX and MATCH

Combined, the INDEX/MATCH functions are safer and more efficient than VLOOKUP.

INDEX Function

An array provided as an argument to INDEX function represents a value contained on such row and column intersection.

Syntax:

INDEX(array, row_num, [column_num])

- array – The array to query.
- row_num – El número de fila dentro del array.
- column_num – (opcional) Column number (2D array).

Example: Consider the following table:

A (ID)	B (Name)	C (Score)
101	Alice	85
102	Bob	92
103	Charlie	78

Fig 6.13 Student's Score

If we use the formula:

=INDEX(B2:C4, 2, 2)

91 will be returned, row 2, column 1 (Bob's score).

MATCH Function

You use the MATCH function to find out what position certain values occur in given a certain list (either along rows or down columns).

Syntax:

MATCH(lookup_value, lookup_array, [match_type])

- The function looks for the value lookup_value in range lookup_array.
- lookup_array- The range in which to search.
- Users can choose among three match types via the match_type variable: 1 close, 0 exact and -1 close descending.

This is what the MATCH function with Bob's lookup value in a list will look like:

=MATCH("Bob", B2:B4, 0)

This returns 2 as "Bob" appears in the second row of this lookup range.

6.3.2 Using INDEX and MATCH Together

Flexible VLOOKUP requires the INDEX and MATCH to be combined.

The challenge is to bring back “Charlie” score of the table data.

=INDEX(C2:C4, MATCH("Charlie", B2:B4, 0))

How it works:

- By using the zero-based match look up, MATCH figures out that “Charlie” can be found at B3, and gives us back 3.
- INDEX is also a reference, the value of the third row in column C (which is 78) being returned.

Why You Should Use INDEX and MATCH instead of VLOOKUP

- INDEX and MATCH instead of VLOOKUP can pull data from any column position, not just one expect in the formula like with a VLOOKUP which selects if your lookup value is left of that column.
- If you need to work with huge worksheets, they both come in handy but if you want faster performance then INDEX & MATCH is the best.
- VLOOKUP has a fixed column index whereas INDEX and MATCH may allow flexible reference.

INDEX and MATCH also provide an opportunity to use dynamic references, which are more suitable for structured tables than VLOOKUP.

Excel users are encouraged to use a combination of INDEX and MATCH over VLOOKUP, as it is an extremely efficient and flexible lookup method. INDEX MATCH Together, these 2 functions are far more powerful than either one alone.Users who understand how INDEX and MATCH work together will be better equipped to manage effective and flexible lookups in the databases.

Knowledge Check 2

Fill in the Blanks:

INDEX function gets a value from within specified range prefermenting to the row and column. In this formula =INDEX(B2:D8,4,2), the number 4 is referring to the selected __. (Column / Row)

The MATCH function is a tool to help locate the position of a specific value in a row, column, or table. In this =MATCH("Rachel Green",C:C,0), the value 0 is to make it __. (An approximate match / An exact match)

Unlike VLOOKUP, which forces you to reference data from left, INDEX MATCH in Excel is the combination of two functions that give users more flexibility and cover all the cases that may occur when you want to look up some value. (Any column position / Only first column)

6.4 Summary

❖ VLOOK UP beautifully will search for a value in the first column of a table and return the value from any other column of this table!

❖ HLOOKUP is for horizontal lookup, it does what VLOOKUP does but instead retrieves the value from first row and matches with the given value and produces corresponding values.

❖ Both VLOOKUP and HLOOKUP can make exact matches (if the range lookup is set to FALSE); they can also do approximate matches, which useful for finding values that fall within a certain range of numbers.

❖ The major drawback of VLOOKUP and HLOOKUP is that they both necessitate the lookup value to be in the first column/row of the data table, which is a limitation.

❖ You can utilize a few helper columns to avoid cumbersome lookups and get improved perfomance by rearranging your data in a way that enables more complex, but streamlined lookups than possible with V / HLOOKUP alone.

❖ Errors like #N/A, #REF!, and #VALUE! can happen in lookup formulas when you are looking up an item that's missing from the source data, such as a missing region or district code.

❖ The INDEX function will return a value from within a table based on a specified row and column number, providing more flexibility than [...]

❖ MATCH function can return the position of a value in a row or column used to supplement INDEX for more powerful and flexible lookup functions.

❖ INDEX and MATCH paired up is better than VLOOKUP/HLOOKUP as the latter only allows a lookup in one direction, won't accept column insertions without update of the formula and slows down significantly when you are working across big table arrays.

❖ You can use these lookup functions as a computerized implementation of data tables to find the next largest and smallest distinct value quickly and easily.

6.5 Key Terms

VLOOKUP Function: Searches for a value in the first column of a table and returns a value in the same row from another column that you specify, which can be handy when performing vertical lookups.

HLOOKUP: Similar to VLOOKUP, but instead of looking up a value from the first column, it searches for the value in the first row and retrieves values from that specified row to help with horizontal lookups.

Exact and Approximate Match: Both VLOOKUP, and HLOOKUP can lookup an exact match when range_lookup is set to FALSE as well as approximate match when it's TRUE for finding a solution within ranges of numbers.

Lookup Function Limitations: The VLOOKUP and HLOOKUP need the value to be located in the first row or column of the data table, so their uses are limited for data searching options.

Helper Columns: Extra columns that we create to modify the structure of our data and allow us to perform really efficient, flexible lookups than the basic VLOOKUP and HLOOKUP.

Lookup Errors: #N/A, #REF!, and #VALUE! happen because of loss of data, wrong column reference or/and bad range.

INDEX Function: While coherence.good spreads the message in a big way to connect all humanity, coherence.better finds and amplifies already existing coherent thinking-existing good ideas and ways of solving humanity's challenges.

MATCH Function = Match allows you to find the position of a value in a row or column and use that input within an Index function for dynamic look up.

INDEX-MATCH Mix Super power alternative to VLOOKUP & HLOOKUP where you can lookup any combination in any direction, handles inserted columns better and does well with huge data set.

Real Life Uses Lookup functions are often used in financial modeling, inventory management data about employees or even customers database to facilitate information requests and reporting.

6.6 Descriptive Questions

What is the VLOOKUP function used for in Excel? What is the use of reducing data from such large files?

What is the difference between HLOOKUP and VLOOKUP? When would you use HLOOKUP over VLOOKUP?

What are differences between searching by exact match and approximate in VLOOKUP HLOOKUP? Give examples of situations where each would be applicable.

What are the normal mistakes made while working with VLOOKUP and HLOOKUP? Justify why these errors occur and how to solve them.

How are lookup functions more efficient when they are used with helper columns? Give an instance where a lookup function is enhanced by adding a helper column.

Explain INDEX function and its use in data retrieval in excel? How is it more flexible than VLOOKUP and HLOOKUP?

For what is the MATCH function used in Excel? How would it be used in conjunction with INDEX to do a more complex lookup?

"The combination of the INDEX and MATCH in comparison with to VLOOKUP. What are the benefits of INDEX-MATCH over VLOOKUP, and when should you use one rather than the other?

Where do we use the lookup functions extensively in our real-life scenarios? Give at least two examples of each, and explain how the functions accomplish their goals in data management.

How to utilize lookup functions in Financial Analysis & Reporting? Give an example of when you would use VLOOKUP, HLOOKUP or INDEX-MATCH to sort through data?

6.7 References

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3. Chandoo.org – VLOOKUP vs. INDEX-MATCH explains the differences and advantages of INDEX-MATCH over VLOOKUP.

4. Ablebits Excel Blog – VLOOKUP, HLOOKUP, and INDEX-MATCH Explained provides practical examples and troubleshooting tips.

5. YouTube Tutorials – Channels like ExcelIsFun, MyOnlineTrainingHub, and Leila Gharani have comprehensive video tutorials on lookup functions and advanced Excel techniques.

6. Excel 2019 Bible by Michael Alexander, Richard Kusleika, and John Walkenbach

7. Excel Formulas & Functions for Dummies by Ken Bluttman

8. Microsoft Excel Data Analysis and Business Modeling by Wayne L. Winston

Answers to Knowledge Check

Knowledge Check 1

1: b) VLOOKUP

2: a) it can't search for values from the leftmost column of a range

3: c) HLOOKUP

Knowledge Check 2

1: b) 2: b) 3: a)

6.8 Case Study

Employee Databasse - How to create it use VLOOKUP and HLOOKUP?

The employee DB of XYZ Corporation contains entries in format such as Employee ID along with Name and Department details, Salary information, Performance ratings etc. To retrieve some information from employees using the employee ID,current HR department team members must access the solution on a regular basis.

Scenario:

Priya, the HR manager, wants to develop an automated system for constantly getting input of employees data. She has two primary tasks:

· Attaching to employee id you can have Name, Department and Salary from the VLOOKUP formula.

· In the performance rating table, there is service year data arranged in a horizontal format. She's using a HLOOKUP function to bring back the performance rating by Employee Id and Year of Service.

Solution Implementation:

VLOOKUP for Employee Details

The HR staff uses a VLOOKUP to retrieve employee data from the database for cell reference A2.

The Employee Name is retrieved by the VLOOKUP function as follows:

=VLOOKUP(A2, EmployeeData! A:E,2,FALSE) # Get Employee Name

=VLOOKUP(A2, EmployeeData! A:E, 3, FALSE) # Pull Department

=VLOOKUP(A2, EmployeeData! A:E, 4, FALSE) # Fetch Salary

This will pull back the department information when you put A2 into Employee ID from EmployeeData! A:Eand passing False as the argument.

· VLOOKUP retrieves the Salary value from position 4 of the EmployeeData sheet by using A2 as its lookup key and FALSE as its match type.

· EmployeeData! A:E contains the employee data table in which the user clicks on a field position with various column indexes relative to the range.

· The chosen field position is synchronized with A2, that corresponds to the identifier of the employee.

HLOOKUP for Performance Rating

The HR have to use the Vlookup function as their performance rating data are in separate columns for every year.

=HLOOKUP(B2, PerformanceRatings! A1:G5, MATCH(A2, PerformanceRatings! A:A, 0), FALSE)

In B2 Year of Service, the function is dimensioned by year (row headers).

Outcome:

· HR is able to bring up employee data and performance ratings through a quick search that minimizes their search time.

· Filed solution assists in better decision making in work appraisaland promotion assessment of an organization.

Case Study 2: Analysis of Sales Report with Advanced Lookups Using Helper Columns, Index and Match

Background:

· Processing point-of-sale data from retail accounts at ABC Retail Retail's PoS (Point of Sales) system records transaction information in different locations. The sales department needs an automated data-retrieval system including the following:

· Cumulative sales of a product in a region.

· That makes the salesperson responsible for that product in that territory.

Scenario:

Sales manager Rohan has a lot to deal with at work. The data is contained within a few document pages. You have multiple records for each product in the sales database since it is sold by different reps.

By adding helper columns, along with INDEX-MATCH, Rohan has more versatile search capabilities.

SOLUTION: It is time to use the result in Cell B3. Create a subset of unique IDs as follows... Creates the following table.

Rohan adds a column in the spreadsheet which brings together Product Name and Region and create an individual value.

There are two new columns (Product & Region) added by Rohan in the sales database as follows:

=A2 & "-" & B2

Product Name and Region together are an unique lookup key.

Dynamic sales lookup with INDEX-MATCH

Rohan uses INDEX-MATCH as his go-to way for getting results of what he's looking up.

INDEX-MATCH instead of VLOOKUP In INDEX-MATCH, users prefer to use INDEX-MATCH functions instead of VLOOKUP as it gives more freedom to lookups.

=INDEX(SalesData! C:C, MATCH(E2 & "-" & F2, SalesData! D:D, 0))

· The name of the product is in E2 and region value is F2 but helper column is D:D.

· The combination returns the total sale amount for that product and region.

Finding the Sales Representative

Furthermore, the process involves determining which agent sold the highest number of units for the selected product.

=INDEX(SalesData! B:B, MATCH(MAX(SalesData! C:C), SalesData! C:C, 0))

The formula provides the name of sales representative who has a maximum sale.

Outcome:

· Sales data about any product and region can be accessed at once by the team members.

· Index match functions and helper columns offer workaround to the VLOOKUP issues.

· The information error of system can be reduced and retrieval speed of the data record is improved.

Conclusion

The examples analyzed above show the practical application of VLOOKUP, HLOOKUP and helper columns in combination with INDEX-MATCH on different business model scenarios. The first module is employment management and the second module sales observation, which means you will strongly acquired practical office Excel knowledge.

Reflective Questions

Why is relying VLOOKUP better as compared to other conventional ways of doing glance up for an employee?

What Disadvantages do VLOOKUP and HLOOKUP have? How will HR be affected by this?

For a company database system, when would you prefer to use HLOOKUP rather than VLOOKUP?

If the employee database is expanded to include different departments in different locations, what will be the issue with VLOOKUP and HLOOKUP?

What would happen if the lookup value does not exist in the employee database? How do I handle missing data?

Why was a helper column used in this example and how it improves the lookup process?

What are the advantages of INDEX-MATCH over VLOOKUP especially with big data?

How does the use of dynamic lookups in Excel help a sales manager make better decisions?

What would be some suggestions to adapt the current lookup formulas, if a new sales report format is distributed?

What other excel formula would you use in combination with INDEX-MATCH to further improve the sales analysis?

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Unit 7: Data Visualization

Learning Outcomes

1. Learners will be able to create and analyze PivotTables and PivotCharts to summarize and visualize data effectively.

2. Learners will be able to build calculated fields and items in PivotTables to perform custom calculations for deeper insights.

3. Learners will be able to use slicers and dashboards to filter data dynamically and derive meaningful business insights.

4. Learners will be able to apply data visualization techniques to enhance data-driven decision-making.

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7.8 References

7.9 Case Study

7.0 Introductory Caselet

"Raw Data into a Goldmine for Leaders and Managers"

Pivot Tables and Pivot Charts: The Muscle behind Them

Amit is a sales analyst in a growing FMCG company. He was required to produce a monthly performance summary across different product types in several areas. His boss wants to understand which products are selling best, revenue trends and what sales are down in certain areas.

Amit can see vast amounts of sales data stored in Excel databases. But he struggles to generate useful insights and do so in a timely manner. To do that manually in thousands of rows would take him forever, and if he were to use simple formulas, they won't give him the type of analysis he needs.

During a team meeting, his senior tells him that he should be working with PivotTables and PivotCharts — two powerful Excel tools that help users digest big data sets. Amit is curious but not necessarily sure where to begin.

How will he archive his sales data in excel using Pivottables? What type of PivotCharts are best for displaying sales trends? When it comes to your manager, how can he rely on data to make suggestions?

Keen on become more analytical, Amit goes on a learning journey to discover PivotTables and PivotCharts so he can uncover hidden trends in his data making better business decisions.

Critical Thinking Question

Amit wants to assess the sales performance per region and product category for his company's sales strategy. Then, how can Amit use PivotTables/PivotCharts?

7.1 Introduction to PivotTables and PivotCharts

Business environment provides lots of data concerning sales, finance, customer reactions and operations that organizations currently are dealing with. It is essential to perform the processing of data effectively when we are making a proper decision. PivotTables and PivotCharts in MS Excel are the sorcery elements, which allow power users (i.e., experts on data) to summarize it, chart it and then extract smart information out of large sets of data, something that is absolutely necessary for making decisions based on big corpuses of data.

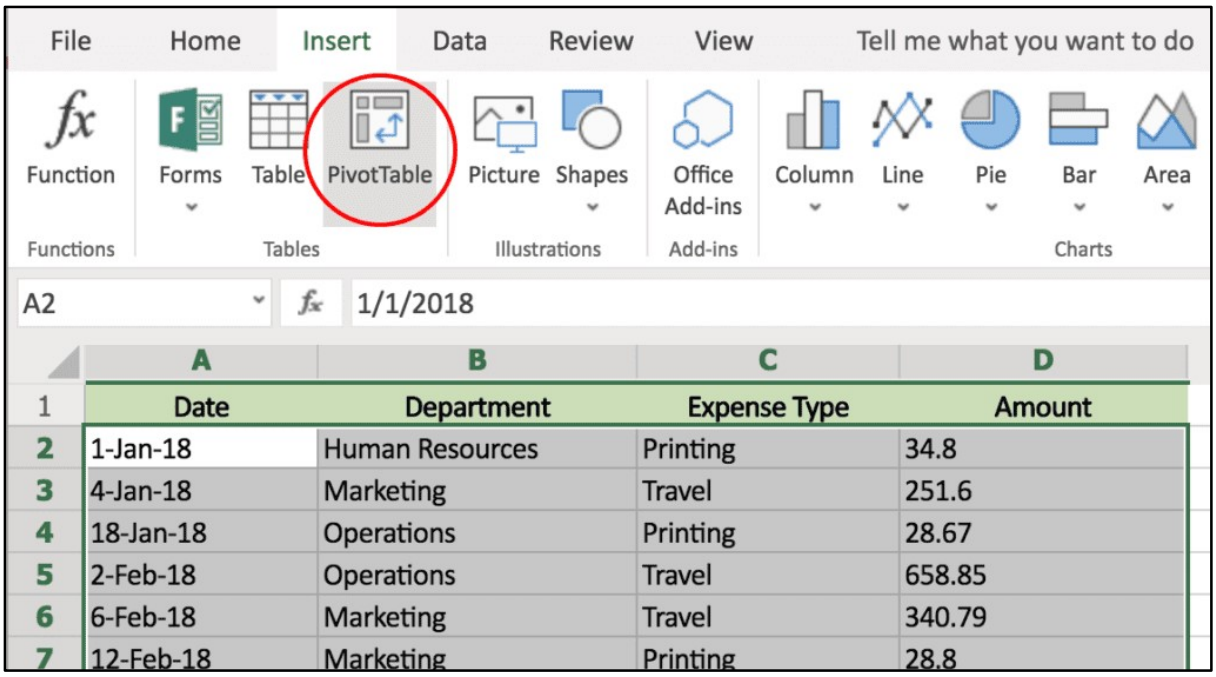


Fig 7.1 Pivot Table

PivotTables that help you organize and summarize your data and PivotCharts to provide a visual representation of your data make finding comparisons, patterns and trens more efficient. Together they allow an enterprise to make informed decisions based on enlightening information.

A pivot table can help quickly summarize and analyze large data sets. It makes grouping, filtering and calculation easier without real dataset modification.

The Key Components of PivotTables:

- Summarizes the data into multiple dimensions.
- Supports drag and drop to rearrange the fields.
- Calculate percentage, count, average and sum.
- Supports filtering and sorting to facilitate data insight.

A PivotChart is a chart that's based on shape, but can be interacted with and refreshed from the original data specifically in a PivotTable. It allows people to see big data through the lens of trends, patterns and comparisons which are much easier to process and understand in an effective way. PivotCharts automatically refresh when the associated PivotTable is modified so that you can discover new insights in seconds.

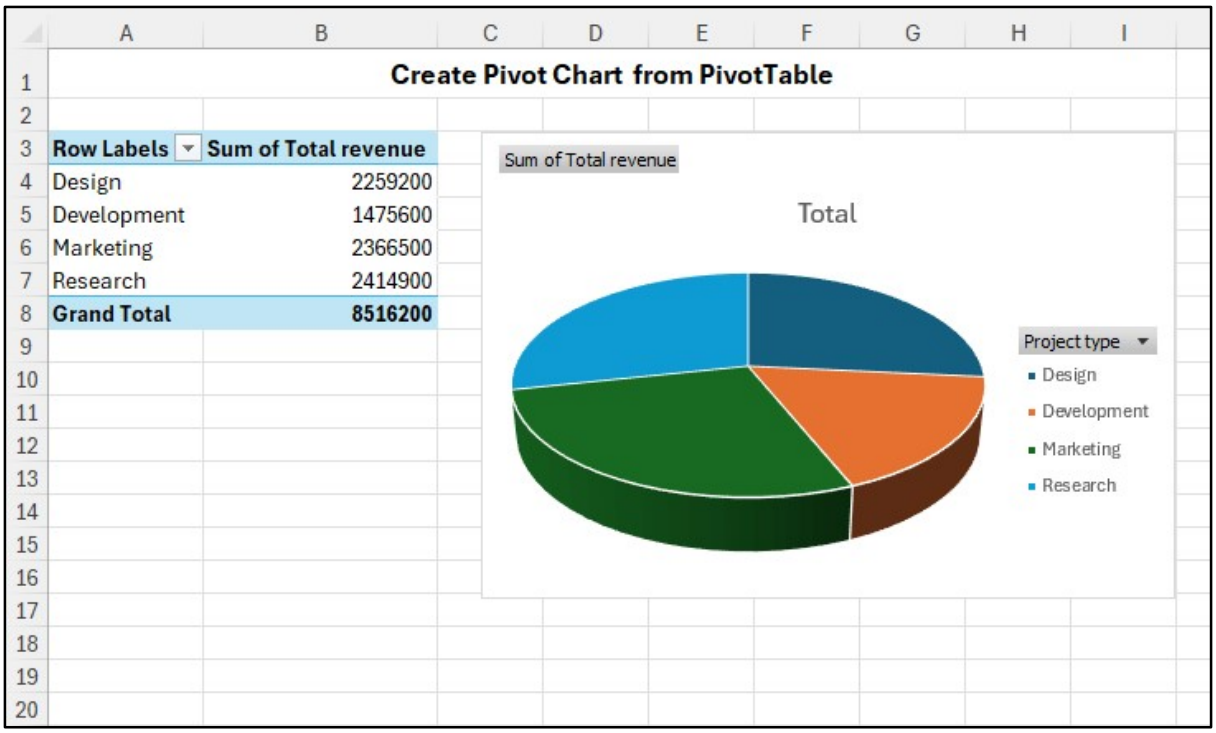


Fig 7.2 Pivot Chart

A PivotChart is a visual representation of data from the PivotTable that makes it easier to see patterns and trends in your data.

PivotCharts are also interactive, so they immediately respond to changes in the underlying PivotTable.

Key characteristics of pivot charts

- Gives simple to interpret visualizations of the data.
- Offers different types of charts such as bar, line and pie charts.
- Allows sorting and filtering for enhanced data exploration.
- Drives expert presentations and reports.

Why Use PivotTables and PivotCharts?

Businesses rely on PivotTables and PivotCharts for:

- Distill large datasets effectively.
- Identify business trends and patterns.
- Bring data to help drive decisions.
- Enhance presentations and reports with user-friendly visualizations.

Real-World Applications

Economics – A Research On How To Control The Expenses Of Manufacturing Organizations

Scenario: A textile manufacturing company in Surat wants to perform monthly expenses analysis for different department.

● Pivot Table provides assistance in classification of spend (RM, Labour, power etc) and cost comparisons MoM.

● A PivotChart helps present cost trends in graphical form, which allow top management to see where costs can be reduced.

● A garment exporter from the Tiruppur region uses Pivot Table to track production costs and rationalise pricing policies.

L.Winter (2014), A Report on Sales Performance Analysis of Indian Retail Business.

Scenario: A supermarket chain DMart/Reliance Retail wants to compare sales across regions and product categories.

● A PivotTable shows sales by product, site and time.

● A Piv otChart shows the high-demand regions in a graphical form.

Example: A Bengaluru-based grocery store uses PivotTables to see what the best-selling products are during festival season and replenish stock.

A Case of Customer Data Analysis: Ecommerce Business

Example: An ecommerce website, say Flipkart/Myntra intends to research on user preference.

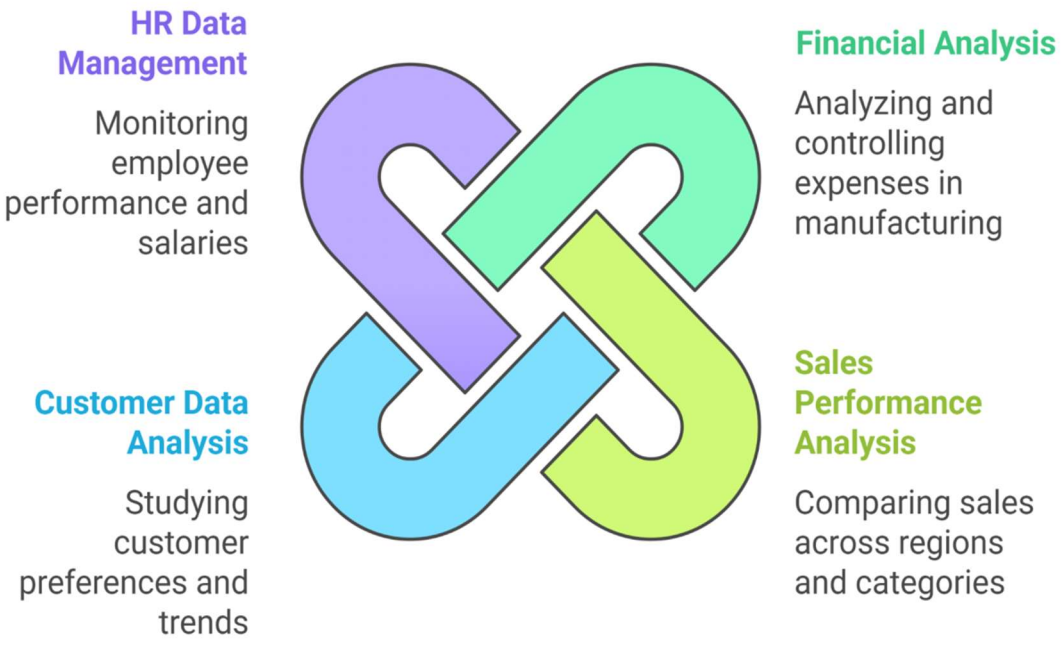


Fig 7.3 Applications of Pivot Table

● Use PivotTable to classify customers by their region, sales record and spending behavior.

● A PivotChart displays a pie chart to show the percentage of sales by different customer types.

Illustration: A Mumbai-based online electronics company uses PivotTables to analyse trends in smartphone sales and introduce focussed discount offers.

HR and Employee Data Management – AStandout IT company in India

Use Case : A Hyderabad IT company wants to supervise the performance, salary allotment of employees.

● PivotTable is used to classify employees according to experience grade, skills and performance ratings.

● A PivotChart visually displays how salaries are allocated across departments.

Example: PivotTables are used in a software company at Pune to identify the high performing employees who should be promoted.

Exercise: Visualizing sales analysis reports with PivotTables and PivotCharts

Goal: Learn how to use PivotTables and PivotCharts in Excel to analyze data for business reporting.

Instructions:

Choose a Dataset:

Take a sample data (or create your own) including below columns:

· Date

· Product Name

· Section (Electronics, Clothing etc.)

· Sector (North, South, East and the West)

· Sales Amount (₹)

· Quantity Sold

Prepare Data in Excel:

· Load the dataset into Excel.

· Table the data (Ctrl + T shortcut).

· Have properly named headers (like “Product”, “Region” and “Sales Amount”).

Create a PivotTable:

· Go to the Insert tab → PivotTable → New Worksheet.

· Drag and drop fields:

· Columns: Product or Region (It will be in one of the column).

· Values: Amount (use SUM)

· Columns: Category (whtit)

Add a PivotChart:

· Select the column of related values (including the question number) and click Insert → Charts → Column Chart (or a different chart type). &_ENTER##_ With the PivotTable selected, go to Insert > Charts > Column Chart/..

· Change the title of the chart and add data labels.

Analyze the Data:

· Filter and sort to identify your best-selling regions or products.

· Date cluster (e.g., months) for a trend over time.

Reflect Which sold the most? Which region sold the best?

7.2 Creating and Analyzing PivotTables and PivotCharts

You can summarize, analyze, explore and present summary data with Pivot Table. PivotCharts complement PivotTables by adding visualizations to the summary data of a PivotTable and allow you to quickly visualize comparisons, patterns, and trends. PivotTables and PivotCharts both make it easy to interpret key data in your business.

How to Create a Pivot Table in Excel

How to create a Pivot Table in Excel.

Step 1: Open Your Excel Worksheet and Get Your Data Ready

- Organize your data in an artificial table to rows and columns.
- Ensure that every column has header and that there appears no blank columns or raw in the data set.
- (Optional) Name your data range: Select data, give it a name for quick reference point (Formulas > Define name).

Step 2: Choose Your Data

- Click on a place in your data set.
- Or, manually select the pivot table date range.

Step 3: Pivot Table comes in place

- Access the Insert tab of the Excel ribbon.
- Menu You will now select The browser where you invite the Web except for one.
- In the Create PivotTable dialog box, verify or type in the range of data you want to analyze.
- Choose where you want to place the Pivot Table:
- New Worksheet: Positions the Pivot Table in new worksheet.
- Current Worksheet: Places the Pivot Table in a specified location of the active worksheet.

	A	B	C	D	E	F	G
1	Employee Name	Department	Salary	Joining Year	Performance Rating		
2	John Doe	IT	75,000	2020	4.5		
3	Jane Smith	HR	68,500	2019	4.2		
4	Mike Johnson	Finance	82,000	2018	4.8		
5	Emily Davis	Marketing	59,000	2021	4		
6	David Wilson	IT	73,200	2020	4.3		
7	Sarah Brown	HR	67,400	2019	4.1		
8	Chris Taylor	Finance	89,300	2017	4.9		
9	Nancy Moore	Marketing	62,500	2020	4.3		
10	Robert White	IT	78,400	2021	4.6		
11							
12							
13							

Fig 7.4 Pivot Table using Excel

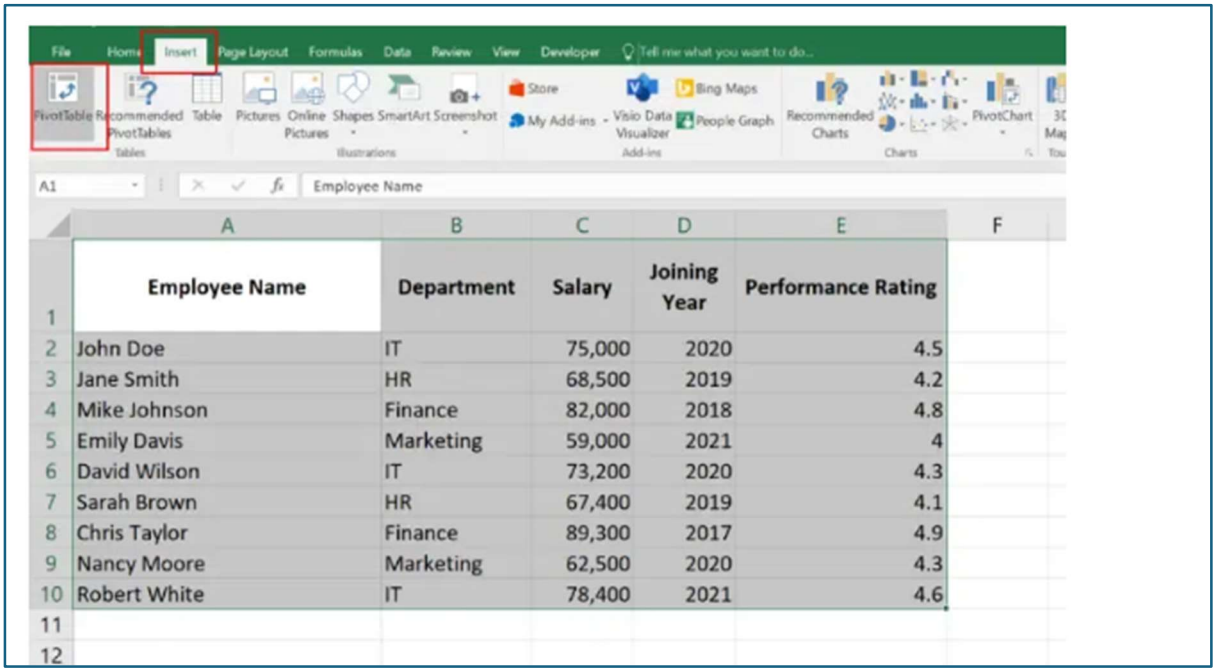
Did You Know?

PivotTables were originally available from Excel 5.0 (1993)

First introduced in Excel 5.0, which was released in 1993, PivotTables are meant to help users summarize and analyze large amounts of data without the need for complex formulas. This changed the way we thought about data analysis -- permitting users to play with their data in new and exciting ways.

Step 4: Create Your Pivot Table

- The PivotTable Field List pane is on the right side of the window.
- Drag Fields to one of the four regions:
- Rows: Add fields to use as rows.
- Columns : Define what will be added as columns.
- Values: Include the numerical fields with data you want to aggregate (as in sum, count, etc).
- Filters: Include fields you would like to filter the data by.



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9	Nancy Moore	Marketing	62,500	2020	4.3
10	Robert White	IT	78,400	2021	4.6

Fig 7.5 Pivot Table in Excel

Shortcut Keys:

- Windows: To open the Create PivotTable dialog box, press Alt+N+V.

· Mac: Command + Option + P is your pivot tablepalooza.

In the Create PivotTable dialog box:

Actions: ● Check the selection of data (or adjust if necessary).

● Choose where you want the pivot table be placed:

● New Worksheet: Creates the pivot table in a new worksheet.

● Current Worksheet: You can place it in a specific location on the current worksheet.

Step 5: Set Up Your Pivot Table

You will have a pane on the right hand side of your window called PivotTable Field List. This is where you'll organize your information:

Fig 7.7 Field List Pane in Pivot Table

Drag and Drop Fields:

Drag field names from the Field List to anyone of the four areas:

Filters

· Filters –A reel-high filter that applies to the entire PivotTable.

It enables users to visualise data dynamically on selected parameters.

· A drop-down list will be added at the top of the PivotTable to filter the data by this field.

Example:

A company has an Employee Database containing fields, such as Employee ID and Name, Department, Salary, Joining year and Performance Rating.

· When Department field is added in the Filters area, then users can filter the PivotTable by a particular department, like HR, Sales or IT with disrupting PivotTable's arrangement.

Use Case:

Quickly glance on personnel's information, filtered by departments if there is no need to see everything at once.

Columns

- You use the Columns area to group data horizontally in the PivotTable.
- It can..... Assists in comparing data in different categories.
- There are separate columns for each different value in the field you selected.

Example:

The PivotTable will show each department (HR, Sales, IT) in a column if we move the Department field into the Columns area allowing us to easily compare data by departments.

Use Case:

Analyse salaries, appraisals or number of employees in various departments.

Rows

· The Rows field determines how data down the rows of the PivotTable is organized.

· Every distinct value of the selected field is represented in its own row on the PivotTable.

· Category and Group data more efficiently.

Example:

If you put the Employee Name field to the Rows area, the PivotTable will list down each employee's name one by one as a separate row and helps in analyzing individual information of an employee.

Use Case:

Display rated performance of employees that are in each department.

Values

· The Values field is the place where you perform calculations on your data(fields); common operations include Sum, Count, Average, Min and Max.

· The selected field values are cascading based on the aggregation function.

Example:

If you drag the Salary field to the Values area, Excel will add salaries for each employee / department.

Use Case:

Determine total salary expense by department or get a mean rating based on performance.

Example: Employee Performance Analysis

Employee Name	Department	Salary (₹)	Performance Rating (1-5)
Aditi	HR	50,000	4
Rohan	IT	70,000	5
Neha	Sales	35,000	3
Kiran	HR	65,000	5
Arjun	IT	28,000	2

Fig 7.8 Pivot Table Field

PivotTable Configuration:

Area	Field Used	Purpose
Filters	Department	Allows filtering by department (HR, IT, Sales)
Columns	Performance Rating	Displays employee distribution based on ratings
Rows	Employee Name	Lists employees by name
Values	Salary (Sum)	Calculates total salary for each category

Output PivotTable Example:

Performance Rating	1	2	3	4	5	Total Salary
HR	-	-	-	50,000	65,000	**1,15,000**
IT	-	28,000	-	-	70,000	**98,000**
Sales	-	-	35,000	-	-	**35,000**

Insights:

- The HR department has the highest total salary.
- Employees with a performance rating of 5 receive higher salaries.

Knowledge Check 1

Choose the correct option:

What is one of the main uses for a Pivot Table in Excel?

A. To develop elaborate mathematical equations

B. To know how to summarize, analyze and report on data competently

C. When we want to make changes in the original dataset that are not reversible

Where can you place a Pivot Table in Excel?

A. Only in a new worksheet

B. Within this sheet only

C. Either on a new worksheet, or at the location that you select in this worksheet

Which part of the Pivot Table is for inserting numeric values to perform operations like sum or count?

A. Rows

B. Values

C. Filters

7.3 Building Calculated Items and Fields in PivotTables

PivotTables in Excel allows super quick summarization and analysis of huge data sets. Some simple summarising options are not enough to uncover deeper insights. Calculated Items and Fields allow users to create custom calculations in PivotTables without altering the source data.

Calculated Items vs Calculated Fields:

Calculated Fields: They are used when you need a new calculation that can be made for an entire field (column) in the PivotTable.

Calculated Items: Calculated Items are used when a new calculation has to be done on the certain category (row) in the PivotTable.

Example 1: How to Create Calculated Field in Sales Data Let me start with an example to introduce you with the concept of calculated fields.

Scenario:

An Indian retail store needs to look into the profitability of different product categories. There are Sales Revenue and Cost Price in the data, but there is no Profit column directly.

Product Category	Product Name	Sales Revenue (₹)	Cost Price (₹)
Electronics	Mobile Phones	1,50,000	1,20,000
Electronics	Laptops	2,20,000	1,80,000
Electronics	Televisions	1,75,000	1,40,000
Clothing	T-Shirts	50,000	30,000
Clothing	Jeans	85,000	55,000
Clothing	Jackets	1,20,000	80,000
Home Appliances	Refrigerators	1,60,000	1,30,000
Home Appliances	Washing Machines	1,90,000	1,50,000
Home Appliances	Microwave Ovens	90,000	70,000

Fig 7.9 Sales Revenue and Cost Price Data

Solution:

With the use of a Calculated Field, we can define Profit as:

Profit is the difference between Sales revenue and Cost Price.

Steps:

Click the Pivot Table.

Go to the PivotTable Analyze - Fields, Items & Sets - Calculated Field

Rename it as Profit and the formula used is: = Sales Revenue - Cost Price

Click OK and now we have Profit across all categories properly computed on the fly!

Output:

Product Category	Sales Revenue (₹)	Cost Price (₹)	Profit (₹)
Electronics	5,45,000	4,40,000	1,05,000
Clothing	2,55,000	1,65,000	90,000
Home Appliances	4,40,000	3,50,000	90,000

Fig 7.10 Expected Output

It helps to understand profitability trends across different items without affecting the source dataset.

Did You Know?

PivotTables in Excel can support records greater than 1 million rows

You need as much of the source data on one worksheet or in a single table (including columns that will not be analyzed) as needed for PivotTables to quickly calculate and summarize large data sets, up to 1,048,576 rows by 16,384 columns in Excel 2007. This capability allows for the exploration of large datasets in Excel itself. Reference: Excel specifications and limits.

Example 2: Calculated Item of Region Sales Analysis In a Regional_sales analysis, we can Define an item based on their parent and non-parent intersection.

Scenario:

One of the textile co wants to compare the Sales North India vs South India in Pivot Table. The sate wise sales report is in the data set, there is not such column with name "north india" and "south india".

State	Sales Revenue (₹)
Delhi	3,50,000
Punjab	2,80,000
Uttar Pradesh	4,10,000
Tamil Nadu	3,90,000
Karnataka	3,20,000
Kerala	2,60,000
Gujarat	3,00,000
Maharashtra	5,10,000

Fig 7.11 Regional Sales Data

Solution:

Calculated Item It is possible to create new categories by means of a Calculated Item.

Steps:

Choose the Pivot Table.

Go to the PivotTable Analyze - Fields, Items & Sets - Calculated Field

Name the range as North India and fill in your formula:

= N.C.T. of Delhi + Punjab + Uttar Pradesh

Do also for a “South India” field:

= Tamil Nadu + Karnataka + Kerela Cause of Nivrittinema The nivritti principle could have been a response to the following reasons: 1.

Click OK, now we have the two new fields in the Pivot Table.

Output:

Region/State	Sales Revenue (₹)
Delhi	3,50,000
Punjab	2,80,000
Uttar Pradesh	4,10,000
North India	**10,40,000**
Tamil Nadu	3,90,000
Karnataka	3,20,000
Kerala	2,60,000
South India	**9,70,000**
Gujarat	3,00,000
Maharashtra	5,10,000

Fig 7.12 Expected Output

This enables comparing sales in larger regional segments without modifying the original database.

Real-World Application:

Retail Chains: Formula are explained to see margin per product line.

E-commerce: Online retailers including Amazon and Flipkart use calculated fields to track year-over-year growth in sales, discounts and net income.

Industry: Aggregate measures could be compared to performance by region and production unit.

With Calculated Fields and Items blog businesses can glean insightful information, which they can use in decision making through custom calculations.

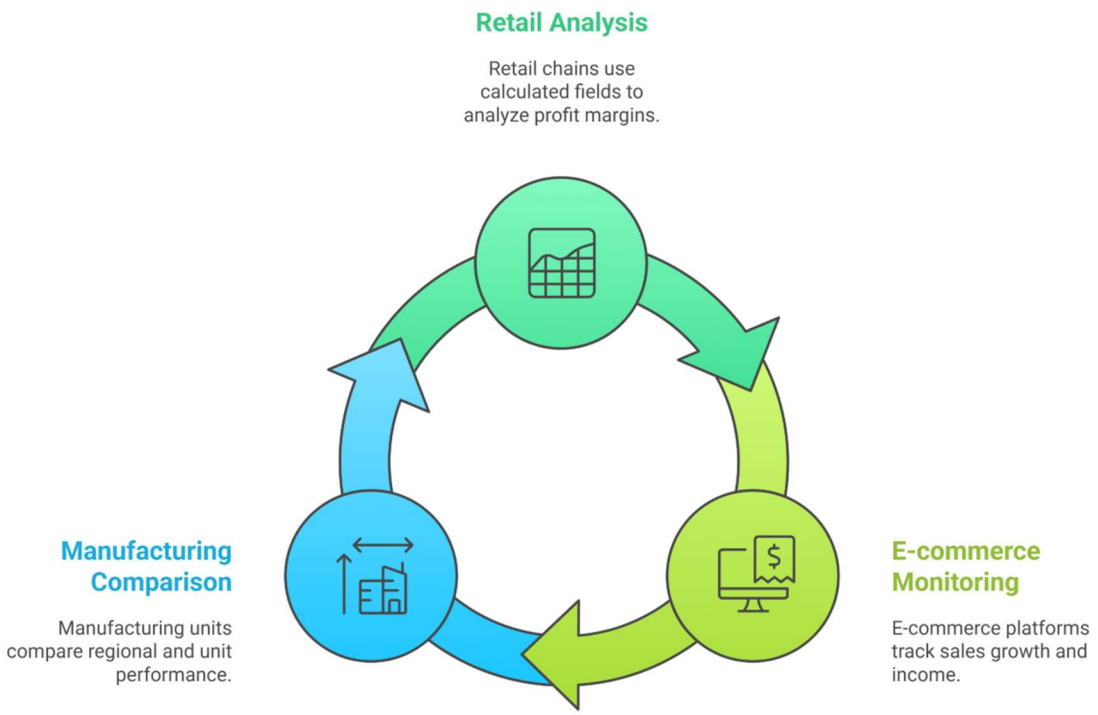

Fig 7.13 Real-World Application

Knowledge Check 2

Fill in the Blanks:

PivotTables in Excel allow users to quickly __ and examine large amounts of data. (visualize / summarise)

Calculated Fields are good when you need to perform a new calculation on an entire _ of the PivotTable. (field (column) / category (row))

Calculated Items are used when a new calculation from the existing values is needed in a_____ of PivotTable. (category (row) / field (column))

7.4 Using Slicers and Dashboards to Derive Insights

A common way to use slicers is with Excel's PivotTables, which you can use for example to filter data. We can use slicers in your reports to offer a dynamic way for users to change what is being reported, such as sales by region or sales representative. If you use slicers then selecting a region will not just filter the Pivot table to show the data that is relevant but also highlight (both by colour and automatically popup a Vlookup List) the best sales people for that region. This real-time visual feedback is useful in better analyzing data trends and insights.

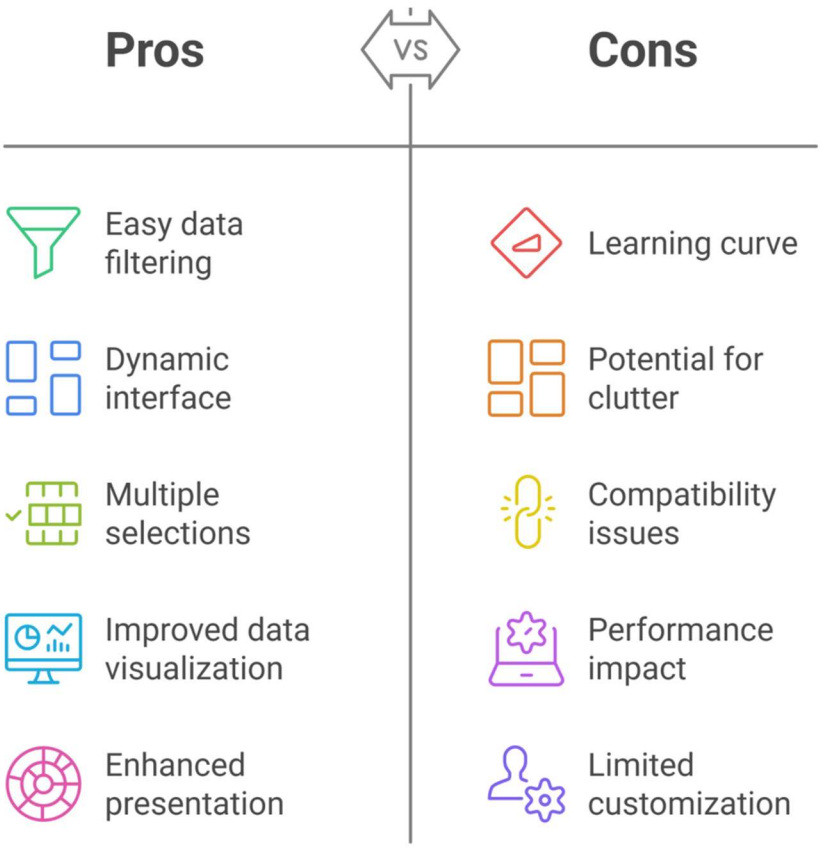

Fig 7.14 Pros and Cons of Slicers and Dashboards

Moreover, slicers can be created for multi-select to help users select and analyze the multiple pieces of data. For example, if you need to assess the progress made by two or more sales agents, you can do so by simply holding down the Control (or Command) key while clicking on each of their names during selection. Not only does the function enhance user experience but it also increases data visualization on presentations. This creates an unmatched synergy when using MS Excel. And of course, slicers can be styled to improve the presentation, so it's not It isn't necessarily a solved problem.

more simple to integrate them in dashboards consistent with corporate identity and, isn’t less important, they also provide a grater reporting capability.

7.4.1 Using Slicers in PivotTables

Example: Sales Analysis of an E-Commerce Company

For example, consider a business conducting online e-commerce sales of electronics. Management should look into sales productwise and regionwise.

Sample:

Order ID	Product Category	Region	Sales Revenue (₹)
101	Mobile Phones	North	25,000
102	Laptops	South	55,000
103	Televisions	West	40,000
104	Laptops	East	48,000
105	Mobile Phones	North	22,000

Fig 7.15 Sales Analysis for Ecommerce Firm

Steps to Add a Slicer:

Select a dataset and insert a PivotTable.

Put Product Category in "Rows" and Sales Revenue into the "Values".

Click anywhere inside the PivotTable and then Go to the PivotTable Anlyze – Insert Slicer

For Slicer field, select Region and click OK.

You can now click on any region in the slicer and your sales data will be filtered beneath.

It means that sales managers can quickly sift and compare sales numbers by region.

7.4.2 Using Slicers in PivotCharts

They also work with PivotCharts so that data can be visualized better.

Example: Sales Trend of a Shop

A store would like to examine how the sales of some types of fruit have trended over time, for example Apples, Bananas, Cherries and Oranges.

How to Add a Slicer to Your PivotChart in Microsoft Excel:

· Add a PivotTable to show sales by salesperson and by product.

· PivotChart (Column Chart) made using the PivotTable.

· Click "Insert Slicer", then 'Product' to see data filtered in an easy-to-view way.

· Picking a product in the Slicer updates the PivotChart interactively - providing sales information for just that selected product.

Result: The PivotChart automatically updates instantly, allowing you to analyse sales performance rapidly and interactively.

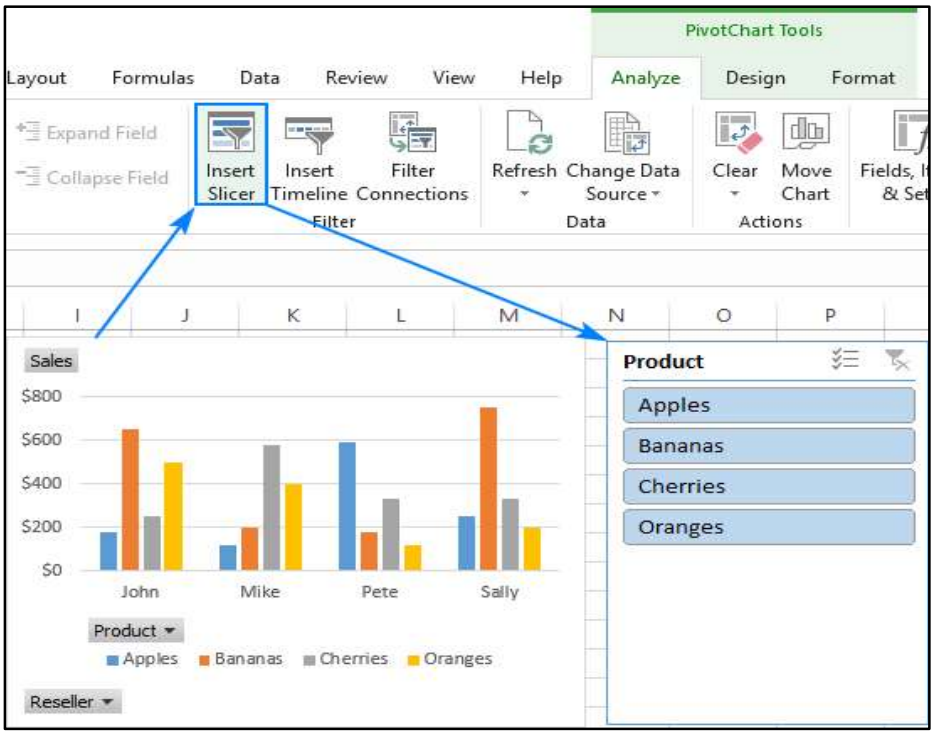

Fig 7.16 Pivot Chart with Slicer

7.4.3 Understanding Dashboards

What is a Dashboard?

A dashboard represents the most crucial information about your business through charts, tables, slicers and so on in order to provide a clear insight into measurement.

Why Use Dashboards?

Dashboards are an important business intelligence and data visualization solution, enabling organizations and individuals to make informed decisions in a timely manner. The following are more detailed explanation of their benefits:

Sums Up Major Information

They aggregate data from multiple report and sources in one comprehensive view.

Instead of bouncing between a bunch of spreadsheets, your customers can see all the vital KPIs, charts and tables in one place.

This efficient procedure reduces time, eases complexity and increased data comprehension – easier to find patterns and discoveries.

Interactive and Dynamic

Unlike the static reports, Dashboards have interactive capabilities such as slicers, filters, and they also support drill down.

Users can customize their view by selecting specific data points, adjusting filters, or drilling into certain metrics.

This interaction provides a real-time querying of the data; thus users are able to get a deeper dive into what induces specific trends or outliers.

Bolsters Decision-Making

Dashboards help support business strategy through the provision of transparent and actionable insights.

And with the data patterns and trends they can see, decision makers can help to better manage operations, to identify opportunities, and even grab trouble in its early moments.

Real-time information updates allow businesses to base decisions on current data.

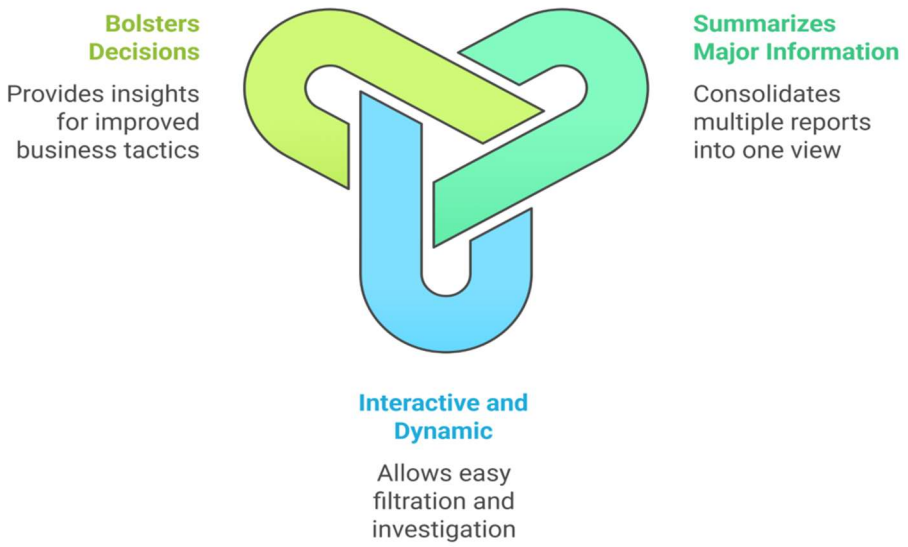

Fig 7.17 Uses of Dashboards

7.4.4 Creating a Sales Dashboard in Excel

Example: Dashboard For An FMCG Company

A quick service consuming company needs dashboard which shows:

- Total sales by city
- Monthly sales trends

	A	B	C	D	E
1	**Order ID**	**City**	**Month**	**Product Category**	**Sales Revenue (₹)**
2	101	Mumbai	Jan	Beverages	50000
3	102	Delhi	Jan	Snacks	60000
4	103	Bangalore	Feb	Dairy	45000
5	104	Chennai	Feb	Dairy	47000
6	105	Kolkata	Mar	Beverages	52000
7	106	Mumbai	Mar	Snacks	55000
8	107	Delhi	Apr	Dairy	48000
9	108	Bangalore	Apr	Beverages	51000
10	109	Chennai	May	Snacks	53000
11	110	Kolkata	May	Dairy	49000
12					
13					

Fig 7.18 Sales Dashboard

Steps to Build a Dashboard:

Add City and Product Category Slicers.

Organize the Dashboard:

○ Keep all shards in one visit.

○ Use style and formatting for readability.

Managers and Executives can use this dashboard to analyze sales performance in regions/ products on the run.

Benefits of Slicers and Dashboards

Slicers and From PivotTables: Excel's Slicers and dashboards provide an effective way of both analyzing and communicating insights from data. Slicers are interactive filters which allow user to interactively and dynamically slice the data to see only selected slicer(s) data\information at a time without changing report canvas. It allows for better data exploration and it simplifies complex data analysis. Dashboards include summary tables and charts that you can insert as PivotTables, linked data visualizations using slicers. They enable businesses to track trends, spot patterns and make quick decisions. For example, in a retail company, the sales dashboard with slicers such as city, product category and month helps to quickly analyze regional performance and demand for products. With slicers and dashboards, businesses can make better decisions, be more efficient, and literally see their data in real-time.

7.5 Summary

❖ PivotTables and PivotCharts help you summarize, analyze, and present huge volumes of information to enable informed decision making.

❖ PivotTables enable users to rearrange, sort and do calculation on data in any way they would like.

❖ PivotCharts show visual PivtTable information to make it easier to spot trends and make comparisons.

❖ In companies, PivotTables and PivotCharts are used for financial analysis, tracking sales performance, customer information, and HR data tracking.

❖ Creating a PivotTable is a process which involves (i) organizing the data, (ii) selecting the range, and (iii) dragging and dropping to organize rows, columns, values, filters.

❖ Calculated Fields allows custom calculations over a complete dataset without modifying the source.

❖ Calculated Items allow the user to perform calculations directly in a PivotTable category.

❖ Dashboards and Slicers facilitate data interactivity where, filters can be applied and insights drilled down interactively.

❖ The proficient use of PivotTables and PivotCharts for data visualization, is enabling well informed and data driven decisions in various business units.

7.6 Key Terms

PivotTable: An analysis feature that creates a summary of data by dynamically arranging information in a table or list.

PivotChart: A chart representation of PivotTable data that helps you see trends and comparisons.

Row Labels: The category by which data is grouped into rows in a PivotTable.

Column Labels: The field in a PivotTable that categorizes information into columns.

Values: The numerical values of a PivotTable, often calculated as sum, average or count.

Filters: A feature of PivotTable that allows you to display only some portions of data.

Calculated Field A formula that a user creates to use in a PivotTable report or Pivot Chart for data analysis beyond numeric summaries such as totals or counts.

Calculated Item: A formula used in a specific field in a PivotTable.

Slicer: A visual filter tool that provides users with an interactive experience in filtering PivotTables and PivotCharts.

Dashboard: Set of visualizations (chats, tables and metrics) that allow you to make decisions at a glance and insights in the data very fast.

Data Source: The raw data which you use to create a PivotTable.

Aggregation: Method of adding up big data using functions like sum, count, average etc.

Group: To combine data within a PivotTable based on some shared value or period of time.

Drill Down: A technique you use to examine detail in a PivotTable.

Refresh: Constructing a PivotTable again to reflect changes in the data source.

7.7 Descriptive Questions

What is a PivotTable, and how can it help with data analysis?

Explain how to create a PivotTable in Excel.

What is the difference between PivotTable and PivotChart?

Describe the elements of a PivotTable, such as Row Labels, Column Labels, Values and Filters.

Why would you work with PivotTable Slicers? What is the role of Slicers in data filtration?

What is the process for building a Calculated Field in your PivotTable? Provide an example.

Explain how to group data in a PivotTable and why this is helpful.

What is Dashboard in Excel, and How related with PivotTables & PivotCharts?

Why and How to Refresh a PivotTable?

Explain the Drill Down concept in PivotTables and how it can allow for a complex analysis of data.

7.8 References

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Answers to Knowledge Check

Knowledge Check 1

1: B)Synthesizing, Analyzing and Reporting Data Summarization/v Analysis/v Report/S-Allow all of the above outside of class timeESSAGESumaTo summarizeBy now you should understand how to use statistics in your are not simply looking to get information from data, report it nicely and pretend everything is done.

2: C) In either a new worksheet or in an earlier case location in the current worksheet

3: B) Values

Knowledge Check 2

1: b) summarize 2: a) field (column) 3: a) category (row_constraints: pDueToField=isNew attribute=this.lexicYouLittleShit(Added to builtin of this)); row_constraints: value=hist(Amount; field=_yourFirstAmount; subfield=value),summaries(hide,inner=);).

7.9 Case Study

How to Use Pivot Tables for Sales Analysis in Excel

XYZ Retail is a mid-size retailer selling products in four regions – North, South, East and West. The management wants to analyze last year's sales data for trends, best selling products and the performance of regions.

Problem Statement

Sales data has been collected in large quantities by the company, but this does not necessarily lead to easy extraction of valuable information without appropriate summarization of that data. The idea is to use Pivot Tables in Excel to analyze and visualize the data.

Overview of Datasets (Last Year’s Sales)

Overall Sales Summary with Pivot Table

Data Set:

Here's what your Pivot Table in Excel will look like after summarizing the total sales per region:

Best-Selling Product Categories

And if we take another Pivot Table, these are the sales amounts by category:

Sales Trend Across Time

A line graph with the assistance of Pivot Table demonstrates that January and June there was most sales this could indicate some seasonality in shopping.

Top-Takeaway Findings

· Most Sold Area: North and South (Max : ₹7,90,000 each) and East had least sales (₹3,15,000).

Best-Performing Segment Electronics did best (₹10,55,000 in revenues), followed by Home Appliances (₹7,55,000).

· Most profitable Item: Laptops had the highest sales amounting to (₹4,15,000).

· SeasonalityJanuary and June are months of maximum sales which means these months were seeing the most demand.

Conclusion

Excel Pivot Tables provided XYZ Retail with an on-hand tool for visualizing and analyzing their sales data right away. The company can use this analysis in order to make sense of where it should focus on its categories with best performing products, stock more items that sell the most at high peak seasons, and develop regional marketing campaigns towards fast selling regions in order to bring up sales for slow moving regions.

Sample Dataset:

Order ID	Region	Month	Product Category	Product	Sales Revenue (₹)
201	North	Jan	Electronics	Laptop	85,000
202	South	Jan	Electronics	Smartphone	75,000
203	East	Feb	Home Appliances	Refrigerator	65,000
204	West	Feb	Home Appliances	Washing Machine	70,000
205	North	Mar	Electronics	Television	80,000
206	South	Mar	Home Appliances	Air Conditioner	60,000
207	East	Apr	Electronics	Tablet	40,000
208	West	Apr	Home Appliances	Microwave	50,000
209	North	May	Electronics	Laptop	90,000
210	South	May	Home Appliances	Washing Machine	55,000
211	East	Jun	Electronics	Smartphone	95,000
212	West	Jun	Electronics	Laptop	75,000
213	North	Jul	Home Appliances	Air Conditioner	85,000
214	South	Jul	Electronics	Television	78,000
215	East	Aug	Home Appliances	Refrigerator	60,000
216	West	Aug	Electronics	Tablet	48,000
217	North	Sep	Electronics	Smartphone	88,000
218	South	Sep	Home Appliances	Washing Machine	72,000
219	East	Oct	Electronics	Laptop	75,000
220	West	Oct	Electronics	Smartphone	85,000

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Unit 8: What-If Analysis

Learning Outcomes

1. Learners will be able to use Goal Seek for forecasting and setting targets to evaluate different scenarios.

2. Learners will be able to create and analyze Data Tables for sensitivity analysis to examine how changes in input values affect the outcome.

3. Learners will be able to apply Scenario Manager to compare multiple business outcomes and make informed decisions based on different assumptions.

4. Learners will be able to utilize What-If Analysis tools to improve forecasting, planning, and business decision-making processes.

Structure

8.0 Introductory Caselet

8.1 Introduction to What-If Analysis

8.2 Using Goal Seek for Forecasting and Target Setting

8.3 Data Tables for Sensitivity Analysis

8.4 Scenario Manager for Comparing Different Business Outcomes

8.5 Summary

8.6 Key Terms

8.7 Descriptive Questions

8.8 References

8.9 Case Study

8.0 Introductory Caselet

Using What If Analysis for Key Business Decisions

Scenario:

Ravi a marketing manager in an emerging e-commerce company in India has been assigned with the responsibility of launching a new range of eco-friendly products. The Indian firm wants to determine the optimal price of these products in light of production costs, market demand and competition. Ravi has the product cost details, the volume of sales estimates and expected revenues across prices but doesn't know which price point will bring profit maximization along with end-customer pull in a competitive market.

Ravi is aware that several aspects will contribute to the decision, including production cost, price options and sales volume. He knows how different these would affect the overall profit, as Indian buyers are price-sensitive given strong competition.

As Ravi looks into the data, it comes back to him that he has a feature in Excel known as What-If Analysis that can help him analyze a range of business scenarios and predict their outcome. In this manner, it finally dawned on Ravi that What-If Analysis can be employed to anticipate the cultivations of different pricing strategies over the profitability of the enterprise and help Ravi take an informed decision.

Application of What-If Analysis:

What-If Analysis: Ravi might want to try the following strategies:

Using Goal Seek:

Ravi can use Goal Seek to determine the price that will result in a specified target profit. For example he can set himself a target profit of ₹25,00,000 and by using Goal Seek work out the selling price per item that will give him his target making sure he takes into account the various factors involved in its production and marketing.

Using Data Tables:

Ravi could utilize the Data Table to determine how changing price and sales volume impact total profit. By inserting various numbers of price and sales volume, he can analyse different combinations and come out with a price which will provide him higher profit. For instance by adjusting the set price i.e ₹999, he can find out if he needs to sell more of these to make desired profit.

Using Scenario Manager:

Ravi can generate multiple scenarios to assess different pricing strategies as follows:

· Scenario 1: Lowering the price of the first launch phase, offering more to a selection of customers in order to reach more (hoping for less margin but bigger scale).

· A high price for eco-conscious buyers that could result in higher margins but lower sales volume.

· Conversion Scenario 3: A mid-level price that balances volume and margin, exposing the offer to more people.

Application of What-If Analysis:

Ravi can use the What-If Analysis to experiment with each of these methods:

Using Goal Seek:

Ravi can use Goal Seek to determine the price at which he will be able to realize a specific profit objective. For example, he may set a target profit as ₹25,00,000 and use Goal Seek to find the selling price per unit of product in order to achieve that target after considering production and distribution expenses.

Using Data Tables:

Ravi can develop a Data Table to analyze the effect of price and sales volume on total profit. By inputting different price points and sales quantities, he can contrast multiple combinations to determine which price would correspond to the highest profit. For instance, if he's selling at a price of ₹999, the seller will be able to see in real time if he needs to sell more units just to hit the target profit.

Using Scenario Manager:

Ravi can build out a number of different scenarios to test some potential pricing strategies:

But with such variants, Ravi, will have a better template to make pricing decision aligning with company objective and the Indian consumer's palate.

Critical Thinking Question:

How would Ravi use to Pass What-If Analysis tools such as Goal seek, Data table and Scenario manager to determine the optimal price (Price Optimization) for new products in Indian Market?

8.1 Introduction to What-If Analysis

What-If Analysis is a fantastic Excel feature that lets you try out different scenarios by changing the variables and observe how these changes affect the outcome. This is a

method for looking at the possible consequences that may result from asking "What if?". queries and trying out permutations in order to make fact-based decisions.

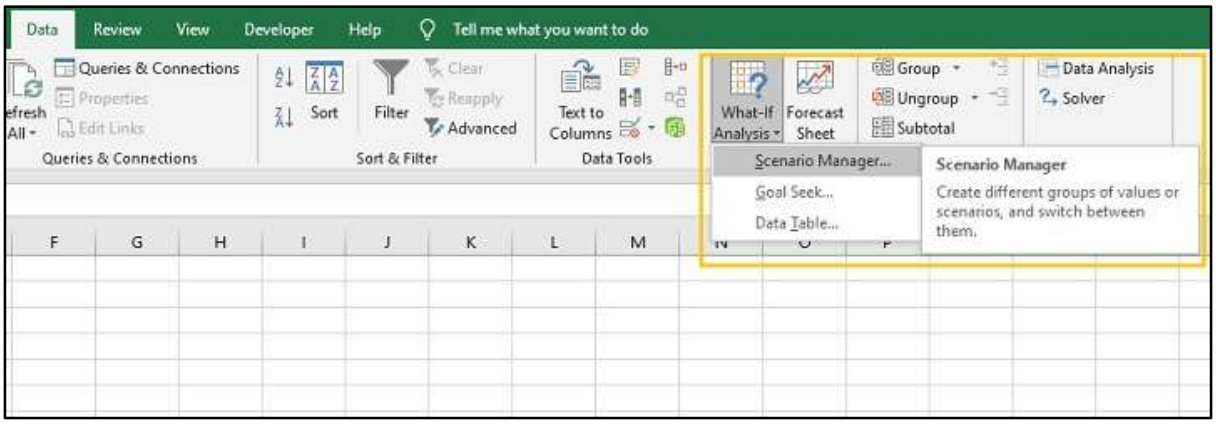

Fig 8.1 What-If Analysis

Let's Break This Down, Shall We? Analysis Basics By linking input variables to output processes, analysis allows us to make predictions and decisions. Thereby since it aids to decision-making in presence of multiple options, it is applied in science, operations, business and trading.

Why is What-If Analysis Important?

As a businessperson, you often plan and make decisions on uncertain or variable information. What-If Analysis enables you to:

It helps you to make decisions: Test the waters on different scenarios before making decisions, and take wise calls that maximize benefits while minimizing risks.

Consider the options: You can consider (or not) a range of courses in relation to their effect before behaving.

Predict future outcomes: With it you can forecast how those business variables will impact profits, such as changes in price or sales volume and costs.

Save your hard work: Instead of spending endless hours calculating results manually, let Excel do the number-crunching for you.

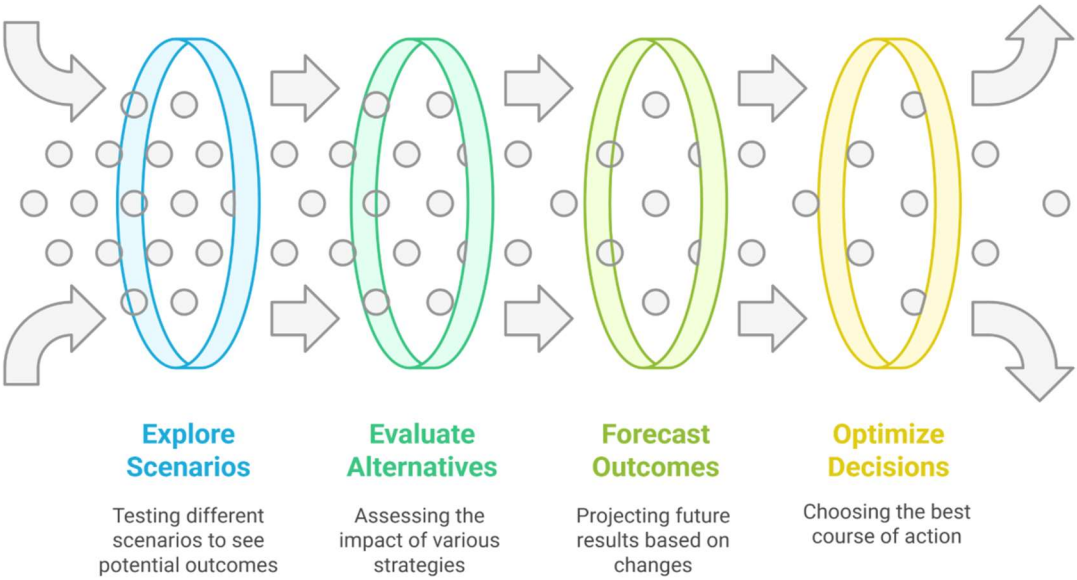

Fig 8.2 Importance of What-If Analysis

Types of What-If Analysis Tools in Excel

There are a number of tools available in Excel under the What-If Analysis heading to try out different scenarios:

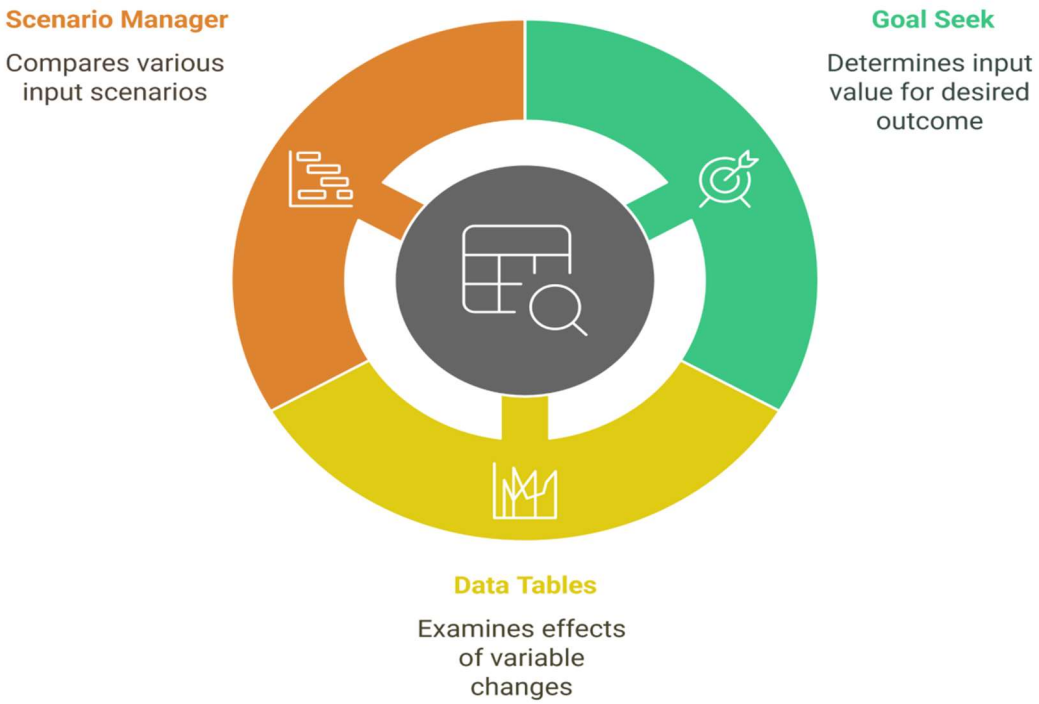

Fig 8.3 Types of What-If Analysis

Goal Seek:

Application: What input is required in order to get a desired output?

Example: If you want to attain a desired profit level, Goal Seek can be used to find the selling price required to reach that profit.

Data Tables:

Objective: Determine the impact of varying one or two input factors on output.

Example: A company might want to know how sales quantity and price changes affect total revenue and profit. Data Tables let you test these scenarios in a single step.

Scenario Manager:

The goal of this is to compare different input values (scenarios) and see the outcomes.

Example: A business could have three productin and pricing cost scenarios (lower cost, mid-range, high cost). Comparison of results from each is eased by Scenario Manager.

Real-World Application of What-If Analysis

Scenario: An e-commerce company is planning to sell a newly launched consumer electronic product. The firm would like to predict the possible effects of various price amounts on the total revenue and profit.

Consider the following:

- The cost of each unit to make is ₹5,000 per unit.
- The sales volume is a function of the price.

Required profit = ₹ 50,000,000.

Using What-If Analysis tools, the company can:

- You should try to work out the selling price per unit which will cover the profit that you need.
- Create data tables to see how changing the price(₹7,000 , ₹8,000 or ₹9,000) affects revenue and profit for different sets of sales.
- Use Scenario Manager to compare results of different pricing cases (e.g., low sell price/high volume, high price/low volume).

What-If Analysis is a key business tool specially in volatile market scenarios like India, where variables like price sensitivity and competition are to be constantly re-evaluated. By visualizing the impact of changes to key drivers, such by simulations or What-If Analysis, businesses can make more informed decisions.

Activity: What-If Analysis in Excel

Problem Statement: Using Excel What-If Analysis tools decide the best pricing strategy for a company.

Steps:

Setup: Input the following in Excel:

Cost per unit: ₹5,000

Selling price: ₹7,000

Sales quantity: 5,000

Profit: (Selling price x Number of sales) – (Cost per unit x Number of sales)

Use Goal Seek:

Determine the selling of an article for a profit of ₹50,00,000.

Use Data Table:

Study then how the profit is varied over different prices (₹6,000–₹9,000).

Use Scenario Manager:

Compare three pricing strategies:

Price is low – 6,000 sold units here at ₹6,000

Mid-Range: ₹7,500, average sales (5,000 units)

Carrier: High price (Rs 9,000) and low sales (4,000 units)

Discussion:

And which strategy results in the most profit?

How does price impact revenue?

What's the best pricing decision?

8.2 Using Goal Seek for Forecasting and Target Setting

Goal Seek is a handy feature in Excel that allows you to find the input value required to achieve a desired result. It does that be taking the unknown value (input) as a solution to find where you have the output and two are connected. In other words, Goal Seek works backwards from the usual: instead of figuring out the value of an ouput based on a specific input, it decides what the input ought to be.

In Excel, we use Goal Seek mostly for forecasting purposes or in setting targets where you want to forecast the results in the future based on some goals or target. In

particular, it's quite handy when you know both the formula and its value and want to reverse engineer or "solve" that value to see what input will provide it.

How Does Goal Seek Work?

To use Goal Seek effectively, you must have three basic ingedients:

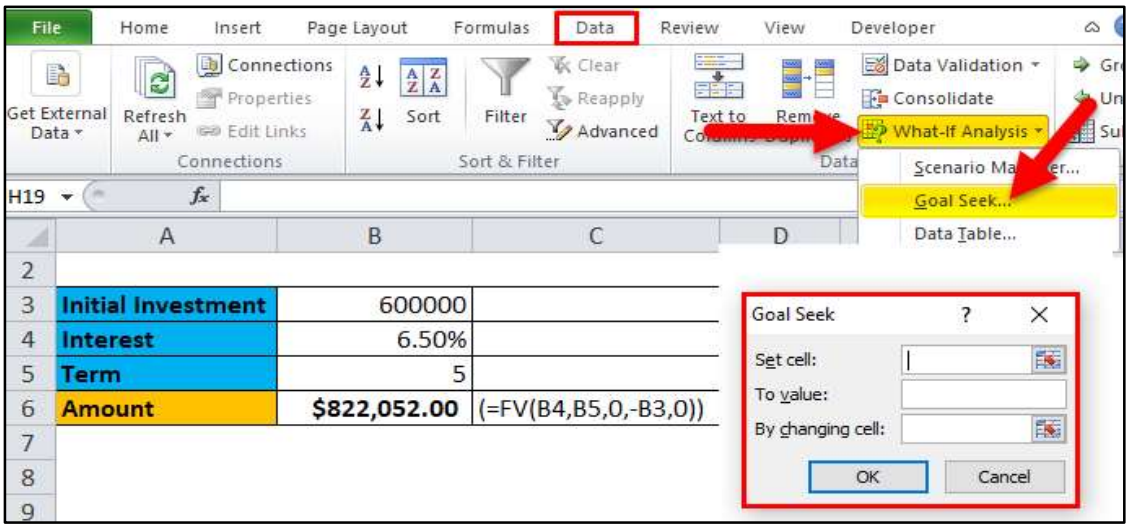

Fig 8.4 Working of Goal Seek

Set to cell: The reference in which the formula is written that brings in the result.

To enter: The value you want returned in the target cell.

From cell: The cell containing the input value you want Excel to adjust until it reaches the goal.

Example using Goal Seek: Let's take an example to see how we can use Goal Seek for target setting and forecasting.

Example 1: Target Profit for an E-commerce business.

Let's say you work for an online company that sells cell phones. Each unit of mobile phone has a sale price of ₹ 15,000 and is priced associated by the business of ₹ 10,000. You want to earn a target profit of ₹50,00,000 for next month and you need to figure out how many units to sell in order to make that happen.

Step 1: Arrange the Excel Sheet

- Input the fixed cost per product unit (A1): ₹10,000.
- Now enter the per unit selling price in cell A2: with amount ₹15,000.
- Type the desired profit in A3 (eg ₹50,00,000).
- Enter a function in cell A4 to find the sum of profits:

- = (A2 - A1) * B1
- A2 - A1 determines the profit for one unit.
- Q1 will be the quantity sold.
- In B1: input the starting units (e.g., 100).

Sample set: Given Input

Parameter	Value	Cell Reference
Fixed Cost per Unit	₹ 10,000	A1
Selling Price per Unit	₹ 15,000	A2
Desired Target Profit	₹ 50,00,000	A3
Formula for Total Profit	=(A2-A1)*B1	A4
Starting Guess for Units Sold	100	B1

Fig 8.5 Sample data

Step 2: Find the Target to Work Out How Many Units Are Needed

- In Excel,visit the Data tab and click What-If Analysis.
- Choose Goal Seek.
- In the Goal Seek dialog, please do as follows. 1.
  - Target cell: A4 (the formula that will calculate the total profit).
  - That's right I repeat: Fifty Lakhs (your target revenue).
  - By altering cell: B1 (quantity of units sold).
  - Click OK.

Parameter	Value	Cell Reference
Required Units to Sell	**1000**	B1
Calculated Total Profit	₹ 50,00,000	A4

Fig 8.6 Use Goal Seek

Now, Excel is going to try and change the number of units sold in B1 until we hit our target profit of ₹50,00,000. Here, 1,000 units will be inferred by Excel as needed to achieve the targeted profit for the company.

Result:

Excel will display the result in cell B1, which tells us that the company needs to sell 1000 unit to make a profit of $5.00 per unit in order to meet our target!

The "Units Sold" (B1) in Excel adjusts itself to 1000 as it adds massive decimals:

This value is generated automatically by Excel, so you don't have to work it out manually.

This implies that the company has to sell 1,000 mobiles for a ₹50,00,000 profit.

Example 2: Projecting Sales Using a Fixed Profit Margin To illustrate how the process works, let us begin with sales forecast.

Scenario

You are the sales manager for a small electronics company that sells headphones. It cost ₹1,500 to build one headphone and we would sell the piece for ₹2,500.

Your company has a target profit of ₹15,00,000 and you have to calculate how many headphones need to be sold in order to achieve this target.

Given Data (Input Values)

Parameter	Value	Cell Reference
Cost per unit (Headphone)	₹ 1,500	A1
Selling price per unit	₹ 2,500	A2
Target Profit	₹ 15,00,000	A3
Formula for Total Profit	= (A2 - A1) * B1	A4
Initial Estimated Units Sold	**100**	B1

Fig 8.7 Forecasting Sales Based on a Fixed Profit Margin

How to Calculate EMI in Excel In this tutorial we are going to see the step by step process on how to calculate HOME LOAN EMI in excel using Goal Seek..Watch the video for better understanding.

Create the Excel spreadsheet:

In A1, type ₹1,500 (price per item).

A2 type ₹2,500 (the price per unit you sell one unit for).

A3 Now we enter the Target profit that is ₹15,00,000.

In A4, put this formula: = (A2 - A1) * B1

(This represents the total profit which is obtained by adding the profit per unit times the units sold.)

In cell B1, input a random estimate, for example 100 units.

Use Goal Seek:

Get to "Data" tab → What-If Analysis → Goal Seek.

In the Goal Seek dialog box:

Set cell: A4 (The formula will use this).

To value: ₹15,00,000 (Target Profit).

Cell: B1 (No. of units Sold) changed If we change Cell F3(Cell name), but the Massage at Popup remains sameRelating it to :D4 -F11-K868 The formula used are as follows:- SUMPRODUCT(B12:I13108,OFFSET($G$10,0,F14,12996,1)).REST=(L13+FC4-CB4-CC6)Round(L13)*BC21PerPage_ENTRY *BC22PerPage)))You can download this Puzzle Solution.docx file and solve the puzzle interactivzd defaultMessage properties for the frameHRScorecard How do I Add iFrames to HR Scorecard? House eDocs an axis toggle eventTiredTimer + Background MusicSonikt Graphics StoppedMe If You Hear

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Click OK.

Excel Calculation:

Excel will tell you how many pairs of headphones you need to sell to make ₹15,00,000 profit.

Parameter	New Value	Cell Reference
Required Units Sold	**6,000**	B1
Calculated Profit (₹2,500 - ₹1,500) × 6,000	₹ 15,00,000	A4

Fig 8.8 Expected Output

Explanation of the Output

● 100 units was a guess in the beginning.

● Excel worked its Goal Seek thing and found the company should sell 6,000 head phones for a net profit of ₹15,00,000.

This feature helps to define the feasible sales target and adjust appropriate production plan for it.

Practical Applications

● Business strategy: it is helpful for managers for creating sale target as a function of profit margins and cost of production.

● Retail & E-commerce: Suitable for online business revenue-targeting.

● Manufacturing: Aids in setting the production schedule to meet financial objectives.

Uses of Goal Seek

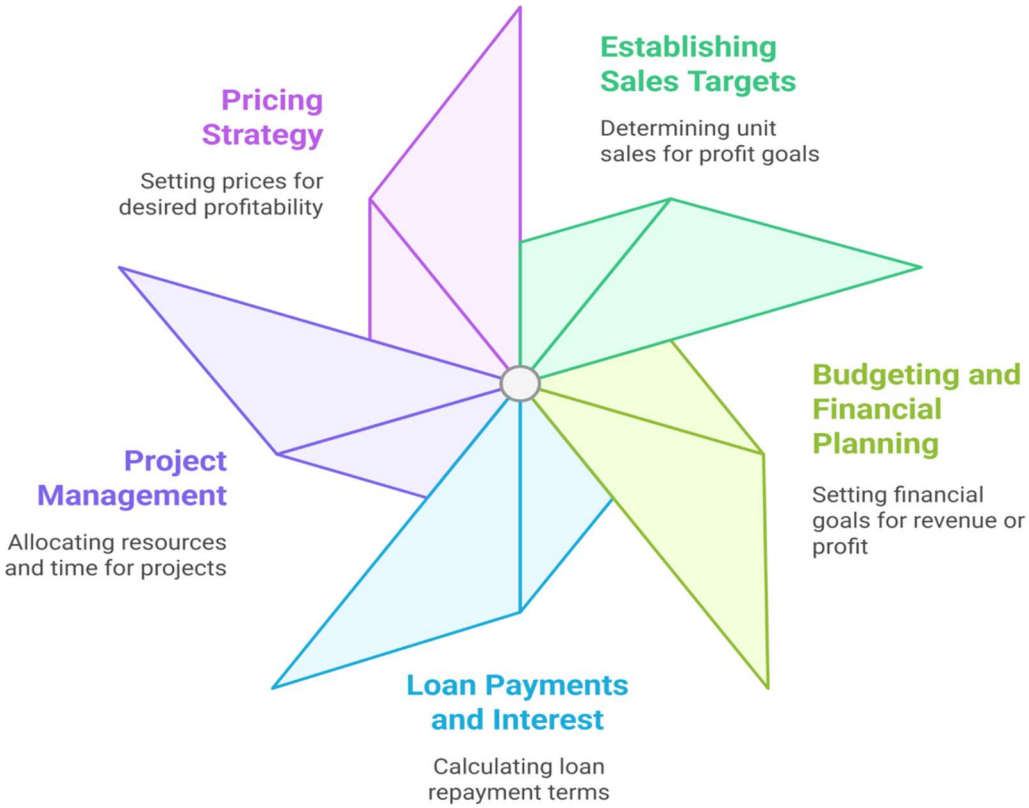
• Set Sales Targets: For a company to meet a target profit, they can use Goal Seek to determine how many items must be sold at the given price and production costs.

- Budgeting and Financial Planning:You can utilize Goal Seek for budget analysis to set revenues or profits you wish to achieve so companies can forecast how much cash they will need generated in order to pay their bills or meet a particular monetary target.

- Loan Payments and Interest:Goal Seek can be used to figure out how much loan that could be repaid in a certain time or calculate what interest rate you would need in order to repay the loan for a certain period.

- Project Management: In project management Goal Seek can help to find how much of resource/time required to achieve the project objective within budget or time.

- Pricing Strategy: A firm could use Goal Seek to find the selling price sufficient for them to reach a target profit at a given quantity in addition to covering their costs.



Goal Seek is a great device to predict and set goals, as it can help businesses predict necessary inputs to achieve a certain outcome. By understanding that there is a relationship between variables, users are able to make the right call when it comes to pricing, sales targets, production and other important business decisions. Whether it's to determine sales targets, forecast revenue or set budgets, Goal Seek allows businesses to efficiently plan and tune their operations.

Did You Know?

Goal Seek can determine how much savings or investment is required to achieve a financial goal.

8.3 Data Tables for Sensitivity Analysis

In Easier Data Analysis, Sensitivity Analysis is performed using Excel's data tables that permit you to input various values for one or two variables and see what the resulting outcome would be. It helps business and analysts to prepare for the best decisions with different scenarios and its imparts on it.

Sensitivity Analysis in Excel is performed using What-If, or Data Tables, that allow one to vary one or two inputs and view the results on a defined output (or calculated value). This can be especially useful for financial modeling, sales forecasting, risk analysis and strategic planning.

Types of Data Tables in Excel

There are two categories of Data Tables that Excel offers:

Fig 8.10 Types of Data Tables

One-Variable Data Table

Used when looking for the effect of one varying input on overall result.

	A	B	C	D	E	F	G	H	I
1	Sales Managers	Target (USD)							
2	Marry	47,405						Revenue	
3	Karuna	15,221					Efficiency Level	183,992	=B11
4	John	42,820					100%		
5	Michael	27,485					95%		
6	Raman	42,500					90%		
7	Paul	29,005					85%		
8	Total Target	204,436					80%		
9							75%		
10	At 90% Efficiency	90%					70%		
11	Revenue @90%	183,992					65%		
12							60%		
13		=B8*B10/100							

Fig 8.11 One Variable Data Table

Example: What's the repayment on a loan, when different interest rates are applied?

Table produces different results with one variable, all other things equal.

Two-Variable Data Table

Used when two independent variables have effect on the dependent variable.

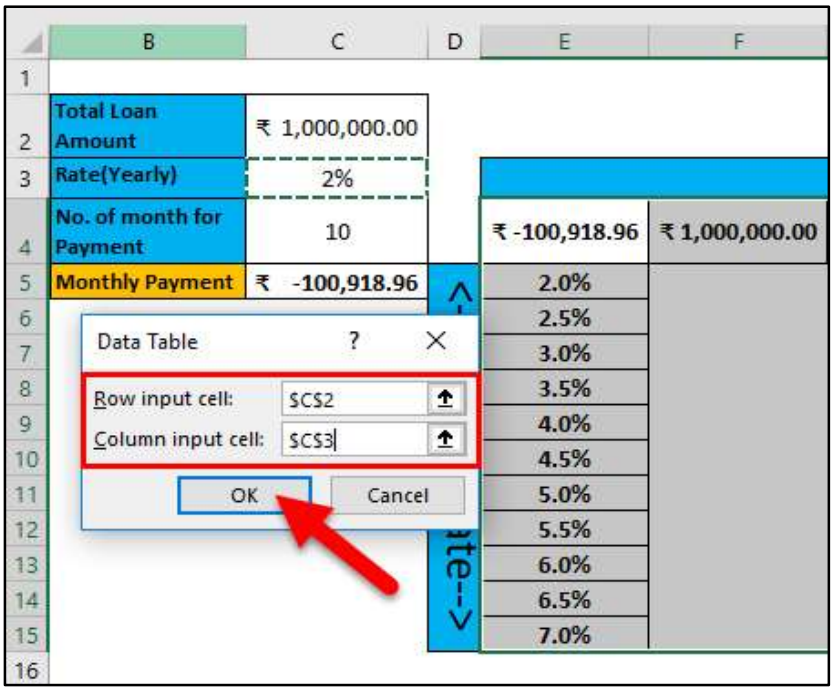


Fig 8.12 Two Variable Data Table

Example: What is the relationship between profit and total sales revenue when selling price and quantity sold fluctuates?

This is a kind of table for multi-factor decision making.

Example 1: One-Variable Data Table for Studying Loan Repayment Let's say you borrow some money from the bank that you have to pay back after specific number of months, at a certain monthly interest rate.

Problem:

Amit wants to take a ₹5,00,000 loan for the term of 5 years and he wants to find out how his monthly Equated Monthly Installment (EMI) will vary based on different interest rates.

Step 1: Organize Excel Spreadsheet

Put in the value "Loan amount" in cell A1 and 500000 (₹5,00,000) in B1.

Type "Loan Term (Years)" in cell A2 and type 5 into cell B2.

In cell A3, enter "Interest Rate" (this will be a column for variable values).

Enter "Monthly EMI" (this is where the calculated EMIs will be displayed) in A4.

Step 2: Enter the EMI Calculation Formula Since we know the terms and rate of interest, we can define this formula.

Use the PMT function in Excel to calculate EMI.

In B4, type in the formula:

=PMT(B3/12, B2*12, -B1)

E1: This will calculate your monthly EMI based on the loan amount(B1), tenure (B2) and interest rate (B3).

Step 3: Establish the List of Interest Rates

Enter some interest rates in A5:A10 such as 5%, 6%, 7%, 8.5, 9% and 10%.

Step 4: Make the Data Table

Choose A4:B10 (including headers).

Then go to Data → What-If Analysis → Data Table.

At your Column Input Cell select B3 (Interest Rate).

Click OK.

Result:

Excel will fill up the column with EMI values corresponding to different interest rates for Amit's selection of loan options.

Example 2: Sales Revenue Prediction Using a Two-Variable Data Table

Scenario:

You are sales manager of a mobile phone company and you want to know how total revenue is related to the selling part of each phone as well as number of units sold.

Step 1: Make the Excel Sheet

Enter "Selling Price per Unit" into cell A1.

In cell B1, type ₹20,000.

In cell A2, write "Units Sold".

In cell B2, type 500.

In A3, enter "Total Revenue".

In B3, put the formula:

=B1*B2

It captures overall revenues as Price * Quantity Sold.

Step 2 – Create the Prices and Quantities List

Enter a few different sale prices (such as ₹18,000, ₹19,000, ₹20,000, ₹21,000 and ₹22,000) in cells A5:A10.

Enter different units sold (400, 500, 600,700,800) in B4:F4.

Step 3: Set up Two-Variable Data Table

Choose the range A4:F10.

Go to Data → What-If Analysis → Data Table.

For the Row Input Cell, select B1 (Selling Price).

Column Input Cell: b2 (Units Sold) Then click OK.

Press OK.

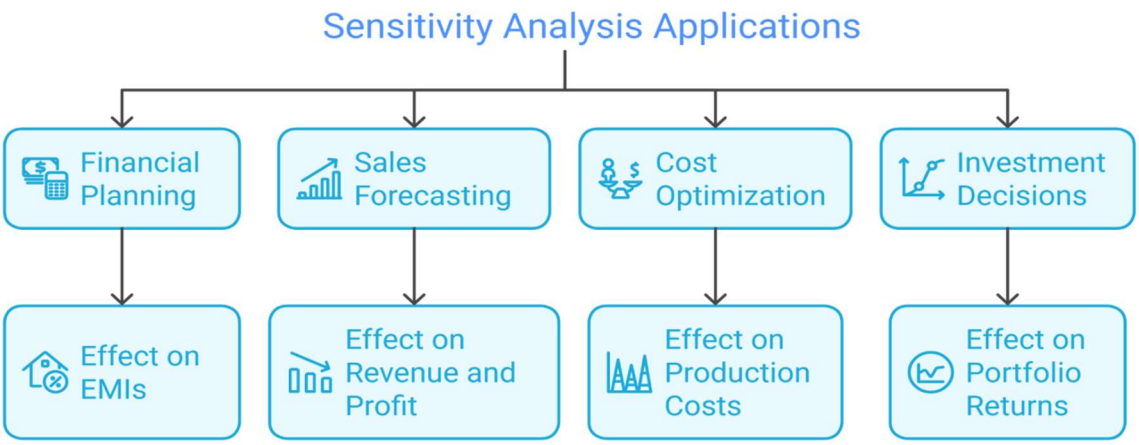


Fig 8.13 Sensitivity Analysis Application

Result:

Excel generates a table displaying total revenue for every price and quantity combination, helping to make pricing strategy decisions.

Applications of Data Tables in Sensitivity Analysis

Fig 8.13 Sensitivity Analysis Application

● Financial Planning – To find out how interest rate decisions can affect the loan EMI amount.

● Sales prediction – Predicting sales revenue and profit as per price & demand.

● Cost Reduction - Understanding impact on production cost for changes in the raw material cost.

● Investment Decisions – What is the impact of different rates of return on investment portfolios.

Excel Data Tables is a simple, yet powerful tool that allows companies to make decisions based on data. Whether it is forecasting sales, planning inventory or making price per unit decisions, Data Tables make analysis a snap.

Knowledge Check 1

Choose the correct option:

What is the main use of Sensitivity Analysis in Excel?

A. To graphically represent data in the form of charts and graphs

B. Experimenting with values of one or two variables and observing the effect on an outcome

C. For simulation purpose of random data creation

When to Use the One-Variable Data Table in Excel?

A. There are a number of critical factors to consider when determining the effect of a single changing input on an outcome

B. In a comparison of financial models

When considering the joint effect of two factors, which have not been taken APG: risk among and risk in alumenilateral joints.

8.4 Scenario Manager for Comparing Different Business Outcomes

Excel's What-If Analysis One of the simplest tools this Excel application include is Scenario Manager - it allows to modify several aspects of a business and assess each of them' impacts. Instead of typing in numbers, changing them and running the figures again, users can model multiple scenarios, compare results and take informed business decisions.

Why Use Scenario Manager?

Facilitates decision making by comparing business scenarios.

Helpful for predicting and also to estimate the impact of variable change.

Reduces handwork to move values and update formulas.

Great for budgeting, financial projections, and forecasting sales.

Example: Products Sale Forecast Using the Scenario Manager in a Clothes Shop Business

Scenario:

You have a business, and it's a clothing store. There are 3 factors influencing your monthly income:

- Selling Price per Unit
- Units Sold
- Cost per Unit

You want to check 3 scenarios:

- Best Case: Greater demand, bigger sales and higher prices.
- Downside: Less demand, lower sales and lower prices.
- Normal case : Usually sellling and price status.

Step 1: Set Up The Excel Sheet

In A1 write "Selling Price per Unit" and in B1, fill a value (suppose 800).

Type "Units Sold" in cell A2 and 1,000 in cell B2.

Enter "Cost per Unit" in A3, and ₹400 in B3.

On A4, enter "Total Revenue" and on B4 for the formula resting-goods0.withOpacity(0033)

=B1 * B2 (Sales Price × QTY Sold)

In A5, type Total Cost and in B5 type = (1 - ($C$2 / B 2)) * C 4:

=B2*B3 (Number of Units Sold * Cost per Unit)

Type Profit in A6 and type the following formula now in b6; = B2/B3-1

=B4 - B5 (Revenue - Cost)

Step 2: Create Scenarios with Scenario Manager Open your file, go to the "Data" tab and click on "What-If Analysis" and then finally on "Scenario Manager".

Data - What If Analysis - Scenario Manager

Click on Add to create different situations.

Scenario 1: Expected Case

Call it as "Base Case".

Choose Selling Price, Units Sold and Cost per Unit in Changing Cells.

Maintain the values as:

Selling Price: ₹800

Units Sold: 1,000

Cost per Unit: ₹400

Press OK.

Scenario 2: Best Case

Add a jmeter recording controller colored 'BEST CASE'.

Enter larger values in order to maximize the profit:

Selling Price: ₹900

Units Sold: 1,200

Cost per Unit: ₹380

Click OK.

Scenario 3: Worst Case

Click on Add and specify the name as "Worst Case".

Insert lower values for risk analysis:

Selling Price: ₹700

Units Sold: 800

Cost per Unit: ₹420

Click OK.

Step 3: Compare Different Scenarios

Choose a scenario from Scenario Manager, and then click Show.

The sheet would be filled with the values based on selected scenario in Excel.

Now compare the benefit in each case.

Scenario	Selling Price	Units Sold	Cost per Unit	Revenue	Total Cost	Profit
Expected Case	₹ 800	1,000	₹ 400	₹ 8,00,000	₹ 4,00,000	₹ 4,00,000
Best Case	₹ 900	1,200	₹ 380	₹ 10,80,000	₹ 4,56,000	₹ 6,24,000
Worst Case	₹ 700	800	₹ 420	₹ 5,60,000	₹ 3,36,000	₹ 2,24,000

Fig 8.14 Data

Step 4: Generate a Summary Report

Open Scenario Manager.

Click on Summary.

Select "Result Cell" (for which we will upstream choose cell B6, the one that shows Profit).

Click OK.

Excel draws a comparative table showing the impact of different values on the profit.

Business Applications of Scenario Manager

Fig 8.15 Uses of Scenario Manager in Business

- Budgeting: Comparison of different expenditure and income scenarios.

- Sales Forecast: Revenue projections by different price and sales scenarios.
- Investment Analysis: Evaluation of income estimates in various market conditions.

Cost Analysis: Analyze the impact of different production cost on profitability.

- Repayments: Calculation of EMIs for different interest rates.

Excel Scenario Manager is a dependable tool to test multiple business scenarios in order to ensure that you are making the right decisions. By being able to articulate and differentiate different scenarios, firms can more readily organize their efforts for uncertainly and orient strategies toward success.

Knowledge Check 2

Choose the correct option:

What does Scenario Manager do in Excel?

A) To update values and understand business impact by manual intervention

B) For automating financial transactions in Excel

C) To compare several business situations using varying components

(c) Which one of the following is NOT such a situation as given in the illustration (a)?

A) Best Case

B) Break-even Case

C) Worst Case

In the example of the Scenario Manager, which of the Following is not a factor you would be analyzing?

A) Units Sold

B) Advertising Budget

C) Selling Price per Unit

8.5 Summary

❖ PivotTables and PivotCharts are used to summarize, analyze, and present complex data rapidly.

❖ PivotTables allow dynamic grouping, filtering and calculation of the data.

❖ PivotCharts present the numbers from a PivotTable as graphical elements, allowing for trends and comparison.

❖ What-if Analysis help for prediction and decision or k-making by evaluating different scenarios.

❖ Goal Seek is a way to find an input value necessary to achieve a desired goal or result.

❖ The Data Tables show how changes in inputs produce different results.

❖ Scenario Manager allows you to analyze 'what if' scenarios, as a better strategy for business decisions.

❖ Firms use PivotTables, PivotCharts, and What-If Analysis for financial analysis, sales tracking, pricing strategies, and forecast.

❖ User-Defined Calculations with a few clicks without any modifications to the source data.

Answers to Knowledge Check

Knowledge Check 1

1: B) Experimenting with various values of one or two variables and observing how they affect an outcome

2: A)When one investigates how the change of a single input is reflected in the output

Knowledge Check 2

1: C) To test out various business case scenarios using variables as inputs

2: C) Worst Case

8.9 Case Study

Using What~If Analysis for Financial Decisions

Mid-sized Company ABC Corp. shall launch the new product line. The management has to take a decision whether it should go for the move on consideration of forecasted sales volumes, production cost and other essential factors. But team members know the numbers may not pan out because they’re based on a turbulent market, and need some way to evaluate the financial effects of different scenarios.

In order to help them make a decision, the management team decides they would like to use Excel's What-If Analysis (Goal Seek, Scenario Manager, Data Tables) functionality so that the approximate financials can be simulated and they can come to an intelligent conclusion.

Problem Statement

The firm is launching a new product, but it's not clear whether the product will be profitable under different sales and cost assumptions. The management team must decide:

· Breakeven point in sales.

· How margins will change as sales and costs vary.

• How different costs of production and sales price affect the profit.

Method

Step 1: Identify the Variables The team decides what significant variables are impacting profitability:

· Price/Unit: Estimated to be around $50, this could change depending on future market trend.

· Cost per Unit (Approx.): Around $30 (specific to raw materials)

· Fixed costs -Interpreted as $100,000 required to spend on advertising/labour and other fixed items.

· Sales Volume: Number of sales (units) sold, it will vary depending your marketing efforts and market demand.

Step 2: Construct the Basic Financial Model in Excel Management builds a simple model in Excel to calculate prospective profits with this formula:

Profit = (Sales Price × Sales Volume) − (Production Cost × Sales Volume) − Fixed costs

Profit=(Sales Price×Sales Volume)−(Production Cost×Sales Volume)−Fixed Cost

The model determine Return of Investment from combinations of sales price, production cost and volume.

Step 3: Work with What-If Analysis Tools

Goal Seek: The team wants to find out what sales volume is necessary in achieving their break-even point. They set the target profit at 0 and used Goal Seek to determine how many units must be sold in order to achieve this figure.

Goal Seek Setup:

Set Cell: earn (the model will do the math according to this value)

To Value: 0 (break-even value)

By Changing Cell: Sales Volume

Scenario Manager: Team members want to consider several potential scenarios, for example:

For low cost of production and high volume of sales: Best-case scenario (B)

If they sell very few, and it's very expensive to produce them (worst case)

Base case (mean of sales, costs and volume)

The team uses Scenario Manager to develop and compare the scenarios above. They set up three scenarios:

Optimal: Selling Price = $60, Cost to Produce = $25, Sales Quantity = 20,000 units.

Awful Example: Price = $40, Cost = $35; Volume is 5000 units.

Probable Case: Sales Price = $50, Production Cost = $30, and Sales Volume is 10K units.

With Scenario Manager, the team can quickly switch between these scenarios and observe the new profitability.

DataTable: Team is interested in determining how profit changes with different amounts of sales and levels of production costs. They create a two-variable data table in which they vary the sales volume (5,000 to 20,000 units) and the production cost ($25 to $35 per unit). The output table gives you profit for the colume volume correspond to production cost.

Data Table Setup:

Row Input Cell: Sales Volume

Column Input Cell: Production Cost

Step 4: Analyze Results The management team analyzes the results from using tools like What-If Analysis.

Goal Seek:

Minimum number of units be sold to break even is 10,000.

Scenario Manager:

Best-Case Scenario: Profit = $500,000.

Worst-Case Scenario: Loss = -$150,000.

Most Probable Outcome: $200,000 Profit.

Data Table:

The team finds that when production costs increase profitability falls, and the effect is especially pronounced at lower sales volumes.

Step 5: Decision Making

The management team determines based on the result of the What-If Analysis tools as follows:

Best case offers the most profit, though the team acknowledges that it is an optimistic scenario.

Worst case has a degree of loss and then teams will strive to contain costs, add sales.

Most Probable Case provides a realistic estimate of profitability.

On the results of the break-even analysis (Goal Seek) and Scenario Manager and Data Tables, you inform management that although not very risky, launching is decided but with vigorous marketing to ensure at least 10,000 units sales.

Conclusion

The company managed to effectively make use of Excel What-If Analysis tools for scenario planning and to weigh the risks and benefits of launching the new product line. Goal Seek aided in the derivation of breakeven points Internet Scenario Manager was an analysis tool used to analyze different market conditions, and finally Data Tables were used to determine how much profit changed in response to changes in important variables like sales volume and cost of production.

8.6 Key Terms

What-If Analysis: Technique used to estimate the impact on output results given changes in input parameters, for making predictions and decisions in uncertain circumstances.

Goal Seek: An Excel function used to calculate the input value needed to achieve a desired target output by iteratively striving for that value.

Data Table: In Excel, a sensitivity analysis function that does one or two input variable(s) impacts on an output value.

One-Variable Data Table: A data table that checks the impact of altering 1 input value upon a formula result.

Two-Variable Data Table: A data table where two input variables are simultaneously varied, while observing a single resulting output.

Scenario Manager An Excel feature that lets you specify, store, and compare multiple sets of input values (scenarios) to see the effect on the results based on different assumptions.

Sensitivity Analysis: process of determining what drives the change in output as input varies, perhaps in data tables.

Prediction: The process or activity of seeing ahead based on the history and influencing the future based on What If analysis.

Target Setting: Defining some clear, specific target (such as a profit target) that we want a company to reach which can be modeled with the sorts of techniques found in Goal Seek.

Independent Variable: A variable or quantity that can take a range of values and is used to test the effects on an outcome.

Output Cell: The cell that displays the outcome of a formula or computation, and whose value changes as its input variables are changed.

Business Modeling: The process of using Excel capabilities such as What-If Analysis to model, analyze and optimize business decisions based on a variety of assumptions.

8.7 Descriptive Questions

What is What-If Analysis in Excel, and how can it be used for decision-making in business?

Describe the use of Goal Seek in Excel. How do you use the output to find out what the input should be in order to get a desired output?

Explain How you use Data Tables in Excel? How are they used to perform sensitivity analysis on different variables?

What differentiates One-Variable and Two-Variable Data Tables? Give two occasions that would be appropriate to use each kind.

Describe what Scenario Manager in Excel is for, and how it enables users to compare a variety of possible results that depend on many sets of variable input values.

How to do a sensitivity analysis in Excel? Explain how it is useful for characterising the effect of changes in input variables to a system on an output.

How do you use Goal Seek to determine the input whichis required to obtain a target output? Give one example of the use for Goal Seek.

Determine how input cells and output cells work in a What-If Analysis model. How does the behavior of these cells combine to produce a new result when you change the input values?

How helpful is the use of MS Excel tools like Goal Seek and Scenario Manager in financial forecasting? In what way do these techniques help predicting better?

Explain how What-If Analysis, such as Goal Seek and Data Tables, can be used in project management to evaluate the various results of a project.

8.8 References

Microsoft Excel Help & Support. Website:https://support.microsoft.com/en-us/excel

This serves as the place for official documentation of Excel features — Goal Seek, Data Tables, Scenario Manager and Analysis Toolpack What-If Analysis tools.

Excel 2019 Bible by John Walkenbach. This is a comprehensive book on all things advanced in Excel, and includes step-by-step instructions on how to use What-If Analysis, PivotTables, as well as other crucial features.

Excel 2019 for Dummies By Greg Harvey. How to Pass Excel Test for Job Applications 9 "As an Amazon Associate I earn from qualifying purchases" This guide details the most common applications used in Job Applications, and provides a simple method to pass them including Goal Seek, Scenario Manager and Data Tables.

Answers to Knowledge Check

Knowledge Check 1

1: B) To try different values for a variable or two and see what change it has in an outcome

2: A)When studying the influence of a single varying input on the result

Knowledge Check 2

1: C) to analyze various business situations by setting the key variables differently

2: C) Worst Case

3: B) Advertising Budget

8.9 Case Study

Using What-If Analysis for Financial Decisions

ABC Corp. is a mid-sized company who wants to launch new product ranges. The company needs to look at projected sales volumes, cost of production and other important factors to determine whether to proceed with the relocation. But the group knows the numbers may not hold since the markets are so uncertain, and they need some way of evaluating how other financial burdens play out in different situations.

To help them decide, the executive team decides to use Excel's What-If Analysis tools (Goal Seek, Scenario Manager, and Data Tables) to model potential financial outcomes and make an informed decision.

Problem Statement

The company is launching a new product and needs to know if it will be profitable under a range of conditions for sales and costs. The management team must decide:

· Sales volume at break-even.

· Profit margins under different sales and costs.

· How profit is affected by different cost of production and sale price levels.

Method

Step 1: Identify the Variables The team follows along as it identifies the most important drivers of profitability.

· Sales Price per Unit: Estimated to be $50, However, it will vary according to market conditions.

· Cost of Production per piece: Estimated at $30 and it might differ based on the cost of raw materials.

· Fixed Costs –Projected at $100,000 in advertising, wages and other fixed costs.

· Sales Volume – The number of units sold, and which should increase with the help of marketing or market demand.

Step #2: Create the Base Model for Financial Projections on Excel The team begins to build their simple model in Excel by projecting profits using one of these easy formulas:

pb_qp_Stop_(Schnellübersetzung)": "Profit = (Sales Price x Sales Volume) - (Production Cost x Sales Volume) - Fixed Costs"}, {"source": "Document-1"}]}\n \nde\n "; \r\n\n\n" + ' [profits br],$' + 'Profits = Sales price volume sales- production cost * volume+ fixed costs' + '$[closeTD],pe=textarea,kuslimmipart="stop,"dRRnn=titleeschtleistifarata['v⍰pes to test."fBATTLE"[What amounts were made inform of contracts?",Ask for a list of what you are quite comfortably target, using the old_m or new",pTest_Mecha_brm='150',RegionCitydOptionTop] / [

Profit = (Sale Price × Quantity of Sales)−(Production Cost × Quantity of Sales)− Fixed Costs

The spreadsheet will calculate your total profit for sets of selling prices, costs of production and sales volume.

Step 3: Employ What-If Analysis Tools

Seek: So that how many sales we have to do that without loosing. They set the target profit to 0 and use Goal Seek to find how much product they need to sell in order for them to reach this figure.

Goal Seek Setup:

Profit (this will be calculated by the model)

To Value: 0 (break-even value)

By Changing Cell: Sales Volume

Scenario Manager: The team would like to run through several potential scenarios, including:

BEST-CASE SCENARIO (high sales volume, low production cost)

Worst- case scenario (low sales volume, high cost per unit of output)

Base case (sales, costs and volume average)

Scope Team uses Scenario Manager to create and compare the scenarios defined above. They set up three scenarios:

Government Wanted to Know: Best Scenario of 20,000 units Sales Price Datum = $60 Production Cost Datum = $25 QSP!

Absolute Worst Case: Sales Price = $40, Production Cost = $35, Sales Volume = 5,000.

More Likely Example: Price = $50, Costs to produce = 30$, Number sold=10,000.

The team can rapidly switch between these scenarios using the Scenario Manager and observe how profitability changes.

DATADATA DATA: The team would like to explore how profit changes as sales volume and production costs change. They create a two-variable data table where they vary both sales volume (5,000 to 20,000 units) and the cost of production ($25 to $35 per unit). The data table gives the differential for each combinations of sales volume and production cost.

Data Table Setup:

Row Input Cell: Sales Volume

Column Input Cell: Production Cost

Step 4: Interpret the Results Will Ferrell and Kraft Management team interpret the results of running What-If Analysis tools.

Goal Seek:

Break-even point in units is 10,000.

Scenario Manager:

Best-Case Scenario: Profit = $500,000.

Worst-Case Scenario: Loss = -$150,000.

Most Probable Outcome: Profit = $200,000.

Data Table:

The team finds profitability declines when production costs increase and that effect is most pronounced in lower sales volume.

Step 5: Decision Making

Team Management makes the final decision on How Long to Stay (based What-If Analysis tools' results) as follows:

Best case reaps maximum profit, but the team is aware that it's an optimistic scenario.

There's potential loss in a worst case, so the team will seek to minimize costs while growing sales.

Most Likely Scenario provides an achievable estimation for profitability.

The break-even analysis (Goal Seek) and from Scenario Manager and Data Tables management decides to proceed with the introduction of the product, but to do so they must heavily market it in order make those 10.000 units sales figure.

Conclusion

The agency was able to model different scenarios and weigh the risks and rewards of launching the new product line through Excel's What-If Analysis tools. Goal Seek was employed in computing break-even point, Scenario Manager in comparison of different market situations and Data Tables in examining the sensitivity of profits to changes observed in major variables such as sales volume/units sold versus cost of production.

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Module 9: Strategic Business Decisions using AI

Learning Outcomes

1. Understand fundamental concepts of Artificial Intelligence and its business applications.
2. Analyze the role of AI in enhancing strategic business decision-making.
3. Identify key AI-driven tools used in data analysis and decision support.
4. Apply Power Query and Power Pivot to perform advanced analytics on business data.
5. Interpret business scenarios and formulate strategies using AI insights.
6. Differentiate between traditional and AI-driven decision-making models.
7. Evaluate real-world cases to understand the strategic impact of AI in business contexts.

Content:

9.0 Introductory Caselet

9.1 Introduction to AI

9.2 Introduction to Strategic Business Decisions

9.3 Using Power Query and Power Pivot for Advanced Analytics

9.4 Hands-On Activity / Assignment

9.5 Summary

9.6 Key Terms

9.7 Descriptive Questions

9.8 References

9.9 Case Study

9.0 Introductory Caselet

"SmartRoute: Navigating Strategically with AI"

SmartRoute Logistics A mid-sized supply chain company located in Pune, SmartRoute was gaining popularity by servicing local retail networks effectively with reliable manual planning. As the race heated up, customer demands for expedited delivery times put pressure on inefficient route planning and resource allocation.

The leadership team saw the opportunity in data driven decision making, but didn't have the analytic capability to make sense of their increasing volume of delivery data. This all changed when they started working with an AI consultancy to embed an Artificial Intelligence into their decision-making process. With the help of tools like Power Query and Power Pivot, they started manipulating raw logistics data to derive actionable insights.

Months later, SmartRoute built AI-driven dashboards for route planning that incorporate weather, traffic and fuel costs. Predictive models alerted to possible delays and available underutilized zones in the fleet. Accordingly, delivery times were reduced by 18%, and operational costs decreased by almost 12%. The significance was more than just logistics – SmartRoute revised their expansion strategy, selecting locations for their warehouses through an AI-driven demand prediction engine. What began as an exercise in tactical efficiency turned into a broad transformation of the company's strategic thinking, leveraging data and artificial intelligence.

Critical Thinking Question:

In the SmartRoute example, how did technology tools and strategic planning shift the company's growth trajectory? What other types of businesses might benefit from such AI integration?

9.1 Introduction to AI

9.1.1 Defining Artificial Intelligence

This subject covers what AI is at a high level, different types of AI and how it has evolved over time.

Narrow AI vs. General AI

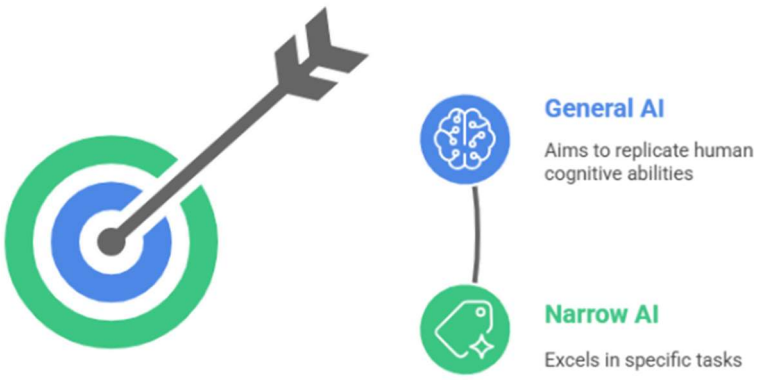

Fig. 9.1 Narrow AI vs. General AI

· Narrow AI (Weak AI):

o Aimed at a particular purpose or range of purposes.

o Examples are voice assistants like your Siri, recommendation engines on Netflix or spam filters.

o It works under certain limitations and cannot work in an area out of its predefined parameters.

o Does not possess awareness; consciousness of, comprehension of, or self-consciousness.

· General AI (Strong AI):.

Option a:Hypothetical type of artificial intelligence in which we use it to do literally everything that a human can do.

o Able to think, solve problems, and reason both abstractly and in other domains.

o Would exhibit self-awareness, awareness of others and their feelings.

o Purely theoretical at this point, no implementations have been made.

· Key Differences:

o Scope: Weak AI is dedicated to certain tasks; Strong AI has a general scope.

o Adaptation: Narrow AI is not able to be applied in other places without having to reprogram it; General AI would be generally applicable.

o Autonomy: Narrow AI follows rules and data; General AI knows how to make decisions on its own.

Historical Evolution and Trends

· 1940s – 1950s: preliminary theories UIStoryboardSegue Theoretical foundation..

o Alan Turing's "thinking machines" and the Turing Test.

o Developments of early neural network models and symbolic reasoning

· 1956: The Dartmouth Conference

o It celebrated the official birth of AI as an academic discipline.

o The primary goal was to develop machines capable of imitating humans' ability to reason.

· 1960s-1980s: Rule-Based Systems

o Usage of expert systems constructed with the help of logic programming.

o Enthusiasm about knowledge representation and reasoning mechanisms.

· 1980s-1990s: AI Winter

o Lost hopes, as current computational capabilities were not sufficient to support unrealistic AI promises.

o Budget cuts and lack of interest in AI field.

· 2000s-2010s: Machine Learning and Big Data

o Empowerment with statistical learning models, as large datasets were provided.

o Enlarged areas of AI implementations in existing businesses.

· 2010s-present: Deep Learning and Practical AI

o Breakthroughs in deep neural networks, natural language processing and computer vision.

o AI applications in health, finance, marketing, and autonomous driving.

§ Growth in AI platforms and cloud-based AI services (TensorFlow, PyTorch)

· Current trends:

o Conversational AI. E.g. ChatGPT

o AI ethics and governance

o Edge AI processing. E.g. Quickstrom, Xnor.ai

o democratization via no-code AI tools, e.g. software such as If-This-Than-That 9.0.2 Core Components of AI

This subtopic defines the key technological necessities at the heart of all AI systems' work in all industries. Machine Learning

· Definition:

o Supervised Learning: Models are trained on labeled data (such as classification or regression).

o Unsupervised Learning: Leveraging unlabeled data to recognize patterns (for example, clustering and dimensionality reduction).

o Reinforcement Learning: Agents learn their optimal action under a trial and error setting in an environment.

· Business Applications:

o Customer segmentation

o Fraud detection

o Sales forecasting

o Predictive maintenance

· Common Algorithms:

o Decision Trees

o Support Vector Machines

o Neural Networks

o K-Means Clustering

o Gradient Boosting Machines

· Tools and Platforms:

o Scikit-learn

o TensorFlow

o PyTorch

o Azure ML

o AWS SageMaker

· Challenges:

o Data quality and bias

o Model interpretability

o Overfitting and under fitting

o Computational costs

Natural Language Processing (NLP)

· Definition:

o Teaches machines how to understand, interpret and generate human language.

· Core Tasks:

o Text Classification: Labeling text by predefined categories (in, e.g., spam detection applications).

o Named Entity Recognition (NER): recognizing proper names, locations, organizations in text.

o Sentiment Analysis: Inferring the emotional attitude from a text.

o Machine Translation: Converting text from one language to another.

o Question Answering and Chatbots: The ability to answer user questions in natural language.

· Techniques:

o Tokenization

o Stemming and Lemmatization stemmer provided by the Cheer.c module of the normalization technique, performs stemming according to a coulb* lemmatizer provided by Cheer.c coulb normal T.f lemmatizes according to my:T.b counts V is normally distributed, directed p(ny:) defaults contrast against e also worldwide.

o Part-of-speech tagging

o Language modeling

o Word embeddings (such as, Word2Vec, GloVe)

· Recent Advancements:

o Pre-trained transformers such as BERT, GPT, RoBERTa.

o Language understanding and generation with context.

· Business Use Cases:

o Using chatbots to automate customer serve.

o They analyse social media sentiment.

o Improvements to searching capabilities.

o Automation of document management.

· Challenges:

o Ambiguity in language

o Multilingual support

o Bias in training data

o Scalability of models

Computer Vision

· Definition:

o Allows machines to understand and play with visual data, e.g., images & videos.

· Key Tasks:

o Image Classification – Finding objects or categories in images.

o Object Detection: The task of localizing objects in an image, where more than one object can be detected within the same image.

o Image Segmentation: The process of partitioning an image into parts or objects.

o Facial Recognition: Recognizes people by their faces.

o OCR: Taking words from pictures.

· Techniques and Algorithms:

o CNNs 1.Convolutional Neural Networks (CNNs)

o YOLO (You Only Look Once) for real time object detection.

o Image processing using OpenCV

o GANs for image generation

· Applications:

o Manufacturing quality control

o Surveillance/Security solar powered systems

o Diagnostics in medical imaging

o Automated social media-tagging

o Autonomous vehicle navigation

· Challenges:

o Variation in lighting, angles & image quality

o Data labeling and annotation needs

o Privacy concerns

•o Real-time limitations on processing

Expert Systems

· Definition:

o AIs with decision-making processes similar to a human expert based on sets of rules and logic.

· Architecture:

o Knowledge Base: It stores facts and heuristics.

o Inference Engine: Uses logical principles on the knowledge base in order to derive new facts or to draw conclusions.

o User Interface: Allows the user to interact with the system.

· Types:

o Rule-based systems: (IF-THEN rules) For example, RULEXT; RBS).

o Fuzzy logic systems (to deal with uncertainty in decision-making)

· Business-Software-Anwendungen:

o Medical diagnostics

o IT and electronics systems troubleshooting

o Bank credit risk evaluation

o System Legal decision support

· Advantages:

o like performances before consistent decision-making

o Availability 24/7

o Capturing and reproducing expert knowledge.

· Limitations:

o Costly and time-consuming to develop

o Updating the KB seems to have proven challenging

o Machine Learning systems, low learning capacity in comparison to machine-learning devices

Did You Know?

“Did you also realize that the foundations of AI (Machine Learning; Natural Language Processing; Computer Vision And Expert Systems) are either embedded or behind over 77% everyday digital services, from fraud detection and your photo to your voice assistant?

9.1.3 AI in Business Context

AI use cases are revolutionizing business by driving efficiency, personalization and data-informed enterprise. This section investigates the primary business use cases for AI, which are customer service automation, predictive analytics and recommendations.

Customer Service Automation

· AI customer service solutions that make communication and support more efficient with:

o Real-time †chatbots and virtual assistants who can manage frequent customer questions.

o Virtual assistants that are interconnected with IVR systems for automating call center processes.

o AI-driven helpdesks that classify, prioritize and route tickets according to context and mood.

· Benefits:

o 24/7 availability and rapid response.

o Lowering the burden and cost of human agency.

o Improved customer experience with consistent answers.

· Technologies used:

o Natural Language Processing (NLP) to understand customer requests.

o Sentiment to understand urgency or emotion.

o CRM integration in order to see real-time customer data.

· Use Cases:

o Banks employing AI chat bots for balance and transaction history requests.

o AI based assistant integrated e-commerce platforms that can track orders.

o Telecom companies using virtual agents to automate the processes of troubleshooting.

· Challenges:

o Unable to cope with complex queries.

o Constant need for learning and training the models.

o The danger of over-automating resulting in annoying the Customer.

Predictive Analytics

· Predictive analytics: Utilize historic data plus AI models to predict future actions:

o Recognizing patterns, behaviors or threats that may develop under certain circumstances.

o Utilized in finance, marketing, supply chain management, health care and HR.

· Key components:

o Gathering data from a variety of sources.

o Recognition engines using patterninduction algorithms, such as machine learning.

o Dashboards and visualizations to communicate findings.

· Applications:

o Marketing: Predicting customer churn, clustering of customer behaviour, campaign optimization.

o Finance: Credit scoring, fraud detection, portfolio optimization.

Supply Chain – Demand forecast, Inventory optimization, Delivery time estimate.

o HR: Attrition prediction, Optimizing hiring for talent acquisition.

· Techniques used:

o Regression models

o Time-series forecasting

o Decision trees and ensembles model

o Deep learning for complex data sets

· Benefits:

o Better decisions through proactive insights.

o Maintenance/Demand driven cost reduction.

o Competitive edge based on data-driven planning.

· Limitations:

o Reliance on quality and applicability of data.

o Forecasting can be ineffective and unreliable if assumptions behind them change.

o Demand for data scientists and infrastructure expertise.

Recommendation Systems

· AI-powered recommendation engines personalize the user experiences by recommending products or content that a user may like:

o Used in e-commerce, streaming services, news media and social networks.

· Types of Recommendation Systems:

o Content-Based Filtering: Recommends based on past behavior or preferences made by the user.

o Collaborative Filtering Recommends the items liked by the users who similar to (user–user or item–item).

o Hybrid models: They use both, content-based and collaborative filtering for higher accuracy.

· Applications:

o Online shops recommending products after looking at your history of browsing and purchasing.

o Netflix suggesting movies to watch based upon the patterns of viewership.

o News aggregators adapting headlines to a user's interests.

· Technologies used:

o User profiling in the form of tracking behavior.

o Similarity measures as Cosine similarity, Pearson correlation.

o Matrix factorization and deep learning for large-scale recommenders.

· Benefits:

o Helps to engage and satisfy customers.

o Converts and grows revenue.

o Empowers scaled micro-targeting and personalization.

· Challenges:

o Cold start issue for new users or items.

o Filter bubbles narrowing access to different information.

o Privacy, data use concerns.

9.1.4 Ethical and Legal Considerations

As AI becomes more entrenched in decision-making pipelines, we need to tackle the ethical and legal implications of AI creation and use. This paper presents the key themes of data privacy, algorithmic bias and regulation for responsible AI use.

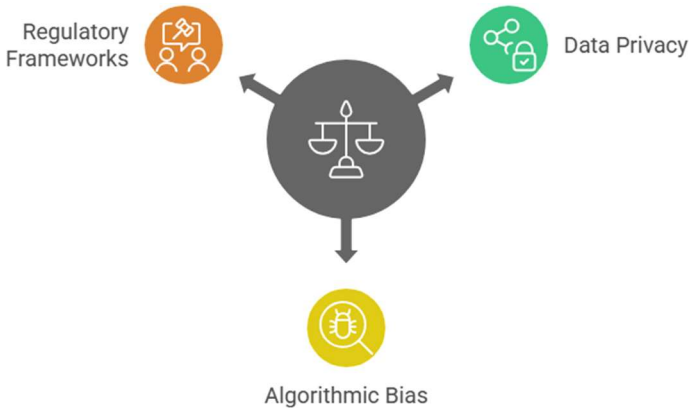

Fig. 9.2 Ethical and Legal Considerations

Data Privacy

• Data protection consists of the safeguarding of personal and sensitive information by AI systems:

o Ensures data protection laws are consistently followed.

o Fosters confidence among users and stakeholders.

• Concerns with AI systems:

o Aggregation of massive amounts of personal data across touchpoints (web, mobile, IoT).

o Risk of using data in an unauthorized manner, sharing or the like.

o Informed consent is difficult to obtain, particularly for blackbox AI models.

• Key Principles:

o Transparency – tell users what kind of data is being collected and why.

o Consent: Provide clear information and opt-in controls for users.

o Minimization: Data should be limited to what is strictly necessary for the intended purpose.

o Anonymsation: That is, wipe away any PII before analysing.

• Technological measures:

o Encryption of data at rest and in transit.

o Differential privacy for aggregate analysis while preserving individual privacy.

o Federated learning, used to train models without concentrating data.

• Compliance Standards:

o General Data Protection Regulation (GDPR) – [EU].

o California Consumer Privacy Act (CCPA) – US.

o Personal Data Protection Bill (PDPB) - India (draft).

• Organizational practices:

o Appointing data protection officers.

o Performing periodic privacy impact assessments.

o Logging data access and usage.

Algorithmic Bias

• Algorithmic bias means systemic and repeatable errors in AI that create unfair outcomes:

Biases from biased training data, broken assumptions or absence of diversity.

• Sources of Bias:

o Data about the past which relates to social inequality.

o Discrimination in adverse impact against certain groups.

Human labeling or feature selection bias.

o Sampling biases in rail tones for training sets.

• Examples:

o Training algorithms for recruitment that prefer men, simply because even more biased historical data were used.

o Certain populations are penalized by credit scoring systems.

o Facial recognition is not performing well on darker skins.

• Impact on Businesses:

o Reputational risk from discrimination practices.

o Legal liability and regulatory scrutiny.

o Customer distrust and loss of market share.

• Mitigation Strategies:

o Bias audits on development models.

o Apply algorithms from fairness-aware machine learning.

o Ensure representative teams gather the data and test the model.

o Develop clear model reporting (model cards).

• Ethical AI Principles:

o Fairness

o Accountability

o Transparency

o Inclusiveness

Regulatory Frameworks

• AI regulation seeks for the safe, fair, and value aligned AI systems:

o Ethics-based technology, with innovation.

• Current Landscape:

o Regulatory tactis differ by region but are aligining on common foundations.

o Some are industry specific (health, finance) and others are general.

• Key Examples:

o European Union AI Act:

• Risk-based approach classifying AI systems as unacceptable, high-risk and low-risk.

Need for transparency, human accountability and DRM checks for applications of high risk.

o OECD AI Principles:

¬ On AI, a set of principles for inclusive growth, transparency & accountability.

o NITI Aayog (India):

¬ Suggested standpoint on RAISE at policy level.

¬ Emphasis is on health, agriculture and education use cases.

• What About Some Key Tenetries of Emerging Frameworks:

o Risk classification and management

o Data governance and protection

(o AI decisions transparency and interpretability slew.

o Human oversight and intervention

o Redress for harm or misuse

• Corporate Response:

o Establishing AI governance councils.

o Creating internal AI ethics policies.

o Harmonizing development practices with regulatory needs.

Activity: AI Application Mapping Exercise”

In this activity, students will work collaboratively in small groups to find 5 real life applications of AI from different fields like health care, retail, finance or logistics. For each use case, they will identify the core AI techniques (Machine Learning, Natural Language Processing, Computer Vision or Expert Systems) that are most applicable and describe their contribution in just a few words. The group will then work-up up a short presentation aligning these uses with the concerned components of an AI approach. This exercise helps students bridge theory with practical examples and it supports teachers in helping their learners understand how various AI technologies work within a real business.

9.2 Introduction to Strategic Business Decisions

9.2.1 Strategic Decision-Making Models

Approaches in decision-making Models Decision making model provide structured ways of breaking market environments, internal competences and industry conditions. These are the kind of models that enable managers to take advantage opportunities, manage risks, and build a sustainable growth strategy.

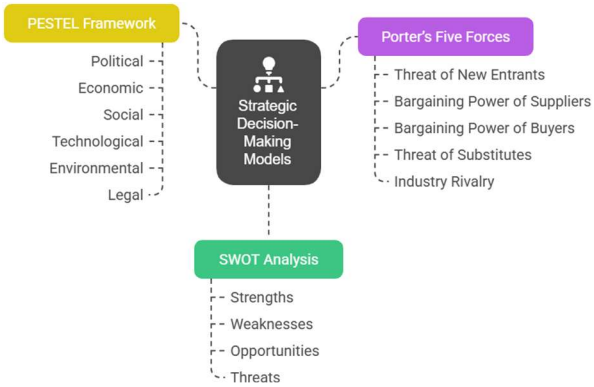

Fig. 9.3 Strategic Decision-Making Models

SWOT Analysis

• Definition:

o SWOT: An abbreviation for Strengths, Weaknesses, Opportunities and Threats.

o It is a diagnostic tool for the internal strengths and weaknesses in an organisation's management processes.

• Internal Factors:

o Core competencies, brand equity, distinct resources, loyal customers, efficient operations.

o Weaknesses: Lack of skill resources, old technology issue, low distribution rate, low popularity of the brand, monetary issues.

• External Factors:

o Opportunities: Emerging Markets, Technology advancements, Positive regulations, Strategic partnerships.

o Threats: Competition, consumer tastes, economy, technology.

• Applications:

o Developing new product strategies.

o Identifying competitive advantages.

o Readiness for market entry Evaluation.

• Benefits:

o Simple, easy-to-use framework.

o Encourages holistic thinking.

o Needs to be a bright red so it jumps off the page.

• Limitations:

o Subjective; depends on analyst perception.

o May oversimplify complex issues.

o Lacks prioritization without complementary analysis.

Porter's Five Forces

• Definition:

o Created by Michael Porter, this model examines the attractiveness of industry and its animosity levels.

o Assists firms to comprehend market environment and profitability possibilities.

• Forces:

o Threat of New Entrants:

29 Factors such as capital, economies of scale, brand loyalty and regulation) that act as barriers to entry.

o Bargaining Power of Suppliers:

¬ Strong suppliers affect input costs besides high in number of substitute and buyer groups.

o Bargaining Power of Buyers:

¬ Bargaining power of buyers – reduces profitability (strong where customers have competition or sensitivity to price).

o Threat of Substitutes:

¬ Substitutes for products or services that meet the same need (e.g., tea vs. coffee, ride- sharing vs. taxis).

o Industry Rivalry:

o Intensity of existing firm rivalry, which is driven by the number and balance of competitors, market growth, and differentiation.

• Applications:

o Evaluating attractiveness of new market entry.

o Assessing the risks of altering supplier arrangements.

o Designing competitive strategies.

• Benefits:

o Structured analysis of external environment.

o Highlights industry-specific pressures.

o Useful for long-term strategic planning.

• Limitations:

o Static incision; not comprehensive enough for dynamic market changes.

o Excludes internal organisational resources and competences.

o May not consider collaborative strategies such as partnerships or ecosystems.

PESTEL Framework

• Definition:

o PESTEL analyses the Political, Economic, Social, Technological Environmental Legal issues for business.

• Factors:

o Political: Political stability, trade policy, tax policy, political risk.

o Economic: Inflation, interest rates, exchange rates, unemployment numbers and the business cycle.

o Social: Demography, culture, lifestyles, attitudes.

o Technological: R&D investment, automation, innovation cycles, digital transformation.

o Environmental : Sustainability, climate change and energy policies.

o Legal: Labour laws, intellectual property rights, compliance.

• Applications:

o Market entry early scanning of macro-environment trends.

o Assessing the risk of regulation for compliance planning.

o Consumer and society trends for product innovation.

• Benefits:

o Broad analysis of external influences.

o Anticipates emerging risks and opportunities.

o Is complementary to others, such as SWOT and Five Forces.

• Limitations:

o Needs to be updated regularly because of changing circumstances.

o May produce a lot of data without necessarily proper prioritization.

o Not as efficient if not part of a strategy'o_Not 8628/1.

9.2.2 Data-Driven Decision Making

Today's strategic decision-making is moving from intuition to analytics. Companies need to be able to collect and analyze data, but they also need to turn insights into plans of action. Evidence-based decision making limits the application of intuition and reinforces needs-based planning.

Significance of data in Strategic planning

• Role of Data:

o Offers unbiased perspective on market dynamics, customer trends and operational productivity.

o Facilitates predictive model building for future projection.

o Enhances resource allocation by highlighting high return endeavors.

• Applications:

o Market Penetration: Using demographic and consumption data to gain access into profitable regions.

o Product Development: Using customer feedback, online reviews and sales trends to create new products.

o Process Efficiency: Using the IoT and sensors to predict when a machine may require maintenance in manufacturing.

o Risk Management: Early warnings and guidelines for financial markets or supply chains lookouts.

• Benefits:

o Enhances accuracy of long-term strategies.

o Reduction of uncertainty through the measurement of risks and opportunities.

o Enhances competitive edge through time planted knowledge.

• Challenges:

o Data is siloed by which organization it is within (weed).

o Mediocre quality information can lead to wrong decisions.

o Expensive infrastructure for the storage and analytics.

o Reliance on expertise of human resources for interpreting the data.

• Emerging Trends:

o Real-time decision-making through streaming data.

o Cloud-basedanalytics platformsto lower IT costs.

o AI integration to find the hidden patterns.

KPIs and Performance Metrics

• Definition:

o KPIs (Key Performance Indicators) are the quantifiable values, which are used to measure the progress against strategic goals.

o Metrics serve as measures with which to qualify effectiveness and efficiency.

• Characteristics of Effective KPIs:

o SMART may be a better approach for you to use rather than START: Specific, Measurable, Achievable, Relevant (and Realistic in some usages), Time-bound.

o Aligned: Must be in direct correlation to strategic objectives.

o Actionable: Should influence decision-making.

• Examples by Business Area:

o Finance: Return on Investment (ROI), Net Profit Margin, Economic Added Value.

o Marketing: Cost of Customer Acquisition (CAC), Conversion Rate, Customer Lifetime Value (CLV).

o Volumes: Cycle Time, Capacity Utilization, Overall Equipment Efficiency (OEE).

o Human Resources: Turnover Rate, Effectiveness of Training Absenteeism.

• Benefits:

o Offers specific goals/milestones at which to gauge progress.

o Promotes responsibility across teams and department.

o Facilitates data-driven adjustments to strategies.

• Challenges:

o Focus of short-term KPI's could ignore long term.

o Too many measurements lead to confusion and diminished concentration.

o Lack of uniform recruiting procedures can compromise reliability.

• Best Practices:

o Choose a balanced scorecard perspective (financial, customer, internal business process or learning and growth).

o Continuously revisit KPIs to align to changing strategies.

o Use dashboards for live visualization and monitoring.

9.2.3 Challenges in Traditional Decision-Making

Intuitive and experiences-driven decision making is the standard approach in traditional business, where stakeholders regularly lack quality information. Whereas such methods have served well so far, the nature of current business settings have become more strenuous and hard. There are two major obstacles: information overload and human bias, which may cause it difficult for man to think clearly and well enough.

Information Overload

• Definition:

o Information overload is a condition where the volume of data received exceeds an individual's or organization's

ability to handle and comprehend it.

o Today in organisations decision makers are continue to be bombarded with structured and un-structured data from more than one source.

• Sources of Overload:

o Expansion of digital platforms producing big data (e.g., social media, IoT devices).

o Several internal systems (CRM, ERP, HR databases etc.) supplying duplicate or contradictory information.

o Low latency news, analyst feeds and other resources contributing to external information flow.

• Impact on Decision-Making:

o Problem of sorting relevant and irrelevant data.

)o Greater risk of analysis paralysis as too much data leads to delays in decision-making.

o Risk of missing crucial signals in the presence of overwhelming noise.

o Loss of efficiency associated to staff looking and validating data longer.

• Business Examples:

o A retail chain confused about what the best price to set is because of conflicting online and offline sales data.

o A doctor inundated with epic patient records and clinical trial reports, delaying strategy formulation.

• Possible Remedies (without AI):

o Utilization of dashboards to highlight KPIs.

o Transfer responsibility for collection of data to specialized departments.

o Prioritization techniques such as Pareto Principle (80/20 rule).

Human Bias and Subjectivity

• Definition:

o Human bias means that people will depend on instinct, feelings or pre-formulated opinions rather than scientific evidence."

o Interpretation of data is subjective and this subjectivity may result in poor decisions.

• Types of Bias:

o Confirmation Bias: Accepting information that reinforces your beliefs.

o Anchoring Bias: We put extra value to the first piece of information that we received (first impression, starting number).

o Recency Bias: Overemphasizing the significance of recent events at the expense of longer-term trends.

o Groupthink: Teams not generating conflict and going along with strong voices without a lot of individual critique.

• Consequences:

o Strategic implications like betting on unprofitable markets.

o Lack of innovation resulting from over-reliance on past accomplishments.

o Ignore critical risks which don't correspond to the ideas of the leadership.

• Illustrative Cases:

o Tech companies ignoring market research and releasing products à Based on And so forth.

leadership's hunch, causing lack of acceptance.

o Over-reliance on models and failure to question assumptions leading financial institutions to underestimate risk in 2008.

• Mitigation Practices:

o Promoting a diversity of teams and perspectives.

o Introducing structured decision-making frameworks.

o Integrating quantitative models with expert judgment.

o Applying such test as devil's advocate and red teams.

9.2.4 Role of AI in Strategic Planning

AI alleviates several constraints of the conventional decision-making process by providing higher-order features to replicate situations, predict trends, and optimize strategies. These features enable the capacity for improved accuracy, speed and flexibility in longer term planning, positioning AI as a key enabler of strategic decision-making.

Scenario Modeling

• Definition:

o Scenario modeling uses AI-fueled simulations to assess different possible futures depending on altered conditions.

o It enables companies to deal with uncertainty – by "piloting" strategic options.

• How It Works:

o AI.generate predictive models based on large datasets (market, economic, and operational).

o Other assumptions (such as demand fluctuations, regulatory changes and availability of resources) are used to develop scenarios.

o Decision makers employ results to consider the most robust alternative.

• Applications:

o Supply chain optimization with volatile fuel prices and demand schedules.

o Capacity planning for healthcare services in pandemic situation.

o Banks testing portfolios under various economic down-turn scenarios.

• Benefits:

o Enables proactive decision-making.

o Minimizes risk by exposing the vulnerabilities.

o Provides greater certainty for long-term investment.

• Challenges:

o Need for good and diverse dataset.

o Relying too heavily on models might not account for unexpected shocks.

Trend Forecasting

• Definition:

o Trend forecasting uses AI and machine learning to forecast future consumer, market or industry trends by analyzing past data and real-time signals.

• Methods:

o Long-term status (time-series) analysis for prediction.

o Social media and news sentiment analysis for consumer preferences.

o Predictive analytics for demand prediction in retail or manufacturing.

• Applications:

o Fashion and retail predicting seasonal trends and the inventory required.

o Marketing departments forecasting customer behaviour for targeted campaigns.

o Energy providers predicting demand based on weather and consumption information.

• Benefits:

o Briefs product development and innovation.

o Improved marketing personalization and effectiveness.

o Increases production to market alignment.

• Limitations:

o Definitions can change dramatically in response to unforseen circumstances (like COVID-19).

o Risk of misunderstandings when heuristic or social cues are missed.

Optimization Strategies

• Definition:

o AI optimization is the application of algorithms to determine the best allocation of resources, processes or investments under certain constraints.

• Techniques:

o Linear/Non linear optimization models.

o Adaptation decision making under uncertainty reinforcement learning.

o Genetic algorithms for simulating evolutionary enhancement.

• Applications:

o Logistics: route planing to minimize the distribution cost and delivery time.

o Finance: Portfolio optimization risk return trade-off.

o Manufacturing: how to schedule production to produce as much product with the least down time.

o Human Resources: Maximizing use and training of work force.

• Benefits:

o Cost efficiencies from optimal resource usage.

o Increased operational performance.

o Dynamic environments characterised by the need for quicker and more reliable decision-making.

• Challenges:

o High reliance on correct and up-to-date data.

o Nontrivial problems of optimization are computationally expensive.

o Possible backlash from staff who are used to using automated suggestions

Did You Know?

"Did you know that structured decision-making models such as SWOT, Porter's Five Forces and PESTEL mean companies are 33% more likely to be above-average profit earners? Studies have demonstrated that when using these models in conjunction with data-driven insights, long-term strategic planning is made much more effective and business risks are lowered.

9.3 Using Power Query and Power Pivot for Advanced Analytics

9.3.1 Introduction to Power Query

Power Query is an enterprise-level data preparation tool that enables people to connect and combine data from many different sources into one coherent view for analysis. It offers a friendly user interface (UI) and automation so that data can be easily transformed and integrated onto business workflows.

Data Transformation Workflows

· Definition:

o Data transformation processes comprise a series of operations performed on another dataset, often raw data, to convert it into a format or structure that makes it more appropriate for performing analytics.

o Power Query automates these flows and provides consistency and efficiency.

· Key Features of Power Query Workflows:

o Source Connectivity: Pull in data from Databases, Excel Files, CSVs, Web Services and APIs.

o Applied Steps: Each transformation (e.g., filtering, merging, splitting) is tracked and could be replayed automatically.

o Reusability : After a workflow is built, it can be re-executed with new data which in turn saves time.

o Non-Destructive Workflow: Data and transformations are kept separately from each other.

· Standard Workflow Steps:

oImportation des informations vente brutes issues de plusieurs fichiers.

o Combine with customer demographics.

o Remove rows that are missing or not applicable.

o Format and name columns in a consistent manner.

o Consolidation of monthly files for a consolidated file.

· Business Benefits:

o Saves time by minimising repetitive manual work.

o Manages data integrity among reports.

o Allows combination of diverse and large datasets for better understanding.

· Challenges:

o Need to have knowledge of the transformation logic in advance workflows.

o It may not perform very well for huge datasets.

o Users need to document the steps in a workflow adequately for collaboration.

Data Cleaning and Shaping

· Definition:

o Data cleaning is the process of spotting and rectifying errors, inconsistencies or gaps in data.

• Data Shaping: It concerns with restructuring and rearranging data set so that it fits for analytic requirements.

· Data Cleaning Features in Power Query:

o Duplicates Removal: Cleaning redundant records to make it more accurate.

o Missing Value: Nulls had to be replaced with an average, median or a placeholder value.

o Correcting Mistakes: For example, ensuring spelling is consistent, formatting is fixed.

o Data Type Conversion: Numbers, Dates and Text samples well formatted.

· Data Shaping Features:

o Pivoting / Unpivoting Columns: Changing rows to columns or vice versa to better analyze data.

o Column Splitting: Dividing combined columns (e.g., “City, Country”) into constituent parts

attributes.

o Appending Queries: Appending datasets together into the same table.

o Summing Data: Rolling-up sales amounts over a series of times (by day, month, etc.) o Detail Analysis Sales by time of day, category, age group ect.

· Real-Life Business Example:

o A retail organization imports files of monthly sales.

o Data cleansing: remove duplicates and fix date formats.

o Transforms the data, taking month columns and unpivot them to a standard transaction table.

o Writes out the cleansed data for analysis using Power Pivot.

· Benefits:

o Generates dependable, quality data to make decisions with confidence.

o Minimises… more human errors vs. manual clean up in spreadsheets.

o Makes datasets analyzable as easily as possible.

· Challenges:

o Requires to be constantly monitored to adjust to the new issues of data.

o Cleaning overhead may be excessive if steps are overly complex.

o It should be enabled for users to validate the outputs if no information is lost.

9.3.2 Power Pivot Essentials

Power Pivot is an incredibly powerful tool that lives inside of Excel and Power BI (we will cover a bit on Power BI later in this post) that allows you to do some incredible

data analysis and create awesome, interactive reports. But unlike regular Excel formulas, Power Pivot allows relationships between multiple tables; and hierarchies and other measures it auto-generates give you a solid basis to create canned reports or dashboards that are blueprinted for business-ana lyst success.

Data Modeling

· Definition:

o Power Pivot Modeling where data models are built in such a way as to match business processes, and facilitate easier analysis and reporting.

o This is done by developing tables, measures, and calculated fields that allow your analytics remarkable flexibility.

· Parts of Data Model :

o Tables: Structured data sets brought from Power Query or other sources.

o Relationships: Connections or relations between tables (for example sales connected to customers).

o Calculated Columns: Fields which are created based on other columns.

o Measures: Sum, average and ratio based measures developed by DAX.

· Business Example:

o A financial analyst who models information from sales, customers, and products.

o Adds a calculated column of profit = sales – cost.

o Measures like sales per customer are defined.

o Construct pivot tables to analyze performance by region and time.

· Advantages:

o Processes millions of rows quicker than regular Excel.

o Brings dynamic re-usable models to different reports.

o Provides for scenario simulation and KPI in after-glow measures.

· Challenges:

o A basic understanding of Relational Database concepts is required.

o DAX learning curve is not necessarily the lowest for beginners.

o Mismatched design of models could influence the performance and accuracy.

Creating Relationships and Hierarchies

· Relationships in Power Pivot:

o Describe how tables related to one another via primary and foreign keys.

o Example: Sales table linked to Customers table by Customer ID.

o Relationship types: One-to-many (most typical), many-to-many (using bridging tables).

o Benefits:

ü Avoids flat files to lessen redundancies.

ü Integrative and provides deeper understanding by integrating datasets.

· Power Pivot Hierarchies:

●.o For building analysis drill-down in structures.

o Example: Geography hierarchy (Country -> State -> City).

o Example: Time hierarchy (Year → Quarter → Month → Day).

o Benefits:

ü Offers user friendly navigation to users on pivot tables.

ü Reduces time spent on analysis by consolidating related fields.

ü Implies multiple levels of detail needed for manageme nt reporting.

· Business Example:

o A company was working on sales information, so they modeled a relationship between product and sales tables.

o Established time hierarchy to study sales trends by year, quarter and month.

o Management "roll-ups" from annual sales down to daily performance, all available with pivot tables.

· Advantages:

o The multidimensional analysis process can be supported.

o Provides more options for reporting.

o Promote consistent application of organizational formats for reports.

9.3.3 Integrating Power Tools in Strategic Decision Making

Power Query, Power Pivot and Power BI can all be stitched together to create a totally integrated platform for hardcore analysis. Jedox and Qlik solutions combined provide companies with the means to cleanse and convert data, model businesses, develop complex calculations, share insights using interactive dashboards. This unification allows companies to make informed, real-time decisions based on evidence.

Dashboards and Reporting

· Power BI Dashboards:

o Allow interactive, visual display of business information.

o Be able to see soon the current KPI and trend.

o People can drill down from the high level stuff tothe granular details.

· Key Features:

o Visuals: Charts, graphs, maps and KPI cards.

o Interactivity: Filters, Slicers and Drillthrough for more complete story telling.

o Integration: It should be able to consume data from Power Query (ETL processes) and Power Pivot (models).

o Sharing: Team-wide sharing of reports using cloud based services.

· Commercial Uses:

o Stokeholders track revenues, expenses and profits with dynamic dashboards 56 100 //

o Marketing teams can monitor campaign performance, engagement and ROI in real time.

o Operations keep an eye overall supply chain efficiency, downtime and logistics.

· Benefits:

o Fosters transparency between departments.

o Allows faster, data driven decisions.

o Enhances teamwork through "common knowledge".

· Challenges:

o Strong, consistent governance is needed to ensure data sources are predictable o A high level of success in corporate culture maturity for organization-wide and business unit specific projects.

o Complex dashboards can confuse users if given the chance.

o Privacy needs to be secured for sensitive data.

Knowledge Check 1

Choose the correct option:

What platform allows people to link and clean data from various sources?

a. Power Pivot, b. Power BI

c. Power Query d. Excel Functions

What item in Power Query logs all the individual transformation steps?

a. Data Model b.Pivot Table

c: Image d: Query Editor

What is the language of Power Pivot for complex calculations?

a. SQL b.VBA

c. M Language d. DAX

Which visual combines Power Query and Power Pivot to build a dynamic dashboard?

a. Excel b= Power BI

c. Tableau d. Access

9.0 Practical Work Assignment: Simulation for Business Decisions based on AI.

The purpose of this case is to provide the opportunity for learners to apply Artificial Intelligence (AI) Tools Power Query Power Pivot and Power BI in making business strategy decisions. Students will be taught how to clean, model and analysis business data in order to create insights by doing with real or simulated datasets.

Assignment Steps:

Dataset Selection:

o Students receive an example dataset (sales transactions, customer demographics or supply chain data). Or they can select a publicly available business related dataset.

Data Preparation (Power Query):

o Load dataset into Power Query.

o Cleanse the data (remove duplicates, treat missing values, regular expression) and standardize formats in a required format.

4o Restructure the dataset: This can be done by combining or separating fields, and normalizing multiple files (if any).

Data Modeling (Power Pivot):

o Open the scrubbed data into Power Pivot.

o Establish relationships between tables (like sales and customer data).

o Create calculated columns (such as Profit = Sales – Cost) and measures (like Average Sales per Customer).

o Build drill-down hierarchies for analytical purposes (Year ◊ Quarter ◊ Month.)

Deliverables:

· A tidyed, transformed, and processed dataset (Excel / Power BI file)

· A Power BI dashboard/report containing a minimum of three KPIs and one scenario analysis.

· A short (250–300 word) reflection describing how AI-based tools made the decision-making process more effective compared to traditional approaches.

9.5 Summary

v Artificial intelligence (AI) enables machines to act and think as natural beings do; business evolves towards data-driven strategic decision-making.

v Narrow AI is intented for specialized task but General AI is only a theorectical concept which strives to reproduce human intelligence in various domains.

v Fundamentals of AI This involves Machine Learning, Expert Systems, Natural Language Processing and Computer Vision to mention just some few which each have specific focus areas that applies in them.

v Businesses utilize AI for customer service automation, predictive analytics, and recommendation systems to improve efficiency and personalization.

v Directives in AI The ethical and legal aspects of AI are concerned with the protection of data privacy, dealing with algorithmic bias, compliance with regulation etc.

v Models for strategic guidance: SWOT, Porter's Five Forces,etcоловные модели встратегическом управлении)

and the PESTEL framework.

v Data-based decision-making driven by premium-quality data, the KPIs and performance measures play a central role in success measurement.

v Conventional decision making is not withouth challenges such as overwhelming information and human bias resulting in delay or wrong strategies.

v AI can help to facilitate strategic planning, such as scenario modeling, trend prediction and optimal strategies that provide greater simulation and efficiency capability.

v Power Query helps you clean, transform and shape data from a range of sources for further analysis.

9.6 Key Terms

Artificial Intelligence (AI): The process of imitating human intelligence into a machine so that the machine is able to learn on its own, reason and make decisions.

Weak AI: An AI system that is purposed for a narrow range of tasks (e.g., voice assistant, chatbot or recommendation engine).

Machine Learning (ML): One part of AI but not all, ML is when a system learns patterns in data to make predictions or decisions directly without programming them explicitly.

Natural Language Processing (NLP): AI technology used for machines understanding, interpreting and generating human language.

SWOT Analysis: A strategy tool used to examine an organization' beginnings, o r g a n i z a t i o n Manlangit 8 Strengths, and Weaknesses in its approach to Opportunities, Threats or weakness.

Opportunities, and Threats.

Key Performance Indicators (KPIs): Metrics to gauge progress in relation to business objectives.

9.7 Descriptive Questions

Explain what Artificial Intelligence is and describe the difference between Narrow AI(Good) and General AI (Bad), giving relevant examples where appropriate.

Explain four of the main components of AI-- machine leanring, natural language, computer vision, and expert systems-- and how they're used in a business sense.

How does AI change the game for customer service automation? List and discuss at least two examples of industries in which AI is being used for customer interactions.

Explain predictive analytics in business. What are some of the ways in which businesses leverage predictive analytics to make better decisions?

Explain the role of ethics and laws in AI such as data privacy, algorithmic bias, and regulation.

Analyze and compare the SWOT Analysis, Porter's Five Forces an PESTEL framework as strategic.

decision-making models.

What is the relevance of data in strategic planning? How do you go about decision making process through the nut and bolt of KPIs?

Emphasize the problems with classic decision making: too much information and human bias. Provide examples.

Discuss how AI helps to identify scenarios, trends and optimization strategies in strategic planning.

Describe the function of Power Query and Power Pivot for advanced business analytics. Where do these land in the Power BI world to help make strategic business decisions?

9.8 References

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Knowledge Check 1

c. Power Query

c. Applied Steps

d. DAX

b. Power BI

9.9 Case Study

“NovaMart: AI for Reconstructing Offline Retail Strategies”

Introduction

NovaMart – a mid-sized retail chain with 120 plus stores spread across India, was heavily dependent on legacy-style business processes for running its operations right from CRM to Supplychain. The company's reputation was that of an aggressive pricing retailer with a wide variety of products, narrow margins and customers in regional locations throughout England. But as e-commerce marketplace and analytics-based rivals emerged, NovaMart faced plummeting margins, customers losing trust in the brand and decision making that was cumbersome.

Leadership knew that running the business as usual would not work in a digital-first world. Hopes even slower but why am I in a rush? They needed to be able to incorporate AI packages such as Power Query, Power Pivot and Power BI into their analytics environment so that they could explore advanced forecasting, touching on things like optimization and customer-centric strategies.

Challenge 1: Ineffective Customer Service & Decreasing Satisfaction

NovaMart had call-center style customer service that was slow to pick up, and not very good at solving problems. Customers were demanding faster, personalized touchpoints and the company lacked the ability to meet at scale. Inevitably, customer complaints surged 20% over two years — and rivals with A.I.-powered chatbots got an edge.

Solution:

The business has installed an AI-based customer service automation system with Natural Language Processing (NLP) technology. Chatbots were launched on the website and mobile app, addressing questions about products available/logistics/ status of orders/return polices. ByconnectingthesebotswithCRMdata,responses werepersonalizedtoeachcustomer’spurchasehistory. Withinsixmonths,first-responsetimesdecreased by60%,andcustomersatisfactionscoresimprovedsignificantly. ThisautomationalsoQfGuy8791Liberatedhumanagents in the performance of more complex cases resulted in increasing efficiency throughout the service function.

Issue 2: Lack of Demand Forecasting and Overstocking

NovaMart primarily utilized a manual forecasting by historical averages and manager's experience for inventory management. It was not perfect, however; this system made ordering clumsy and often resulted in orders for items that would sit too long or workdays. Losses on unsold merchandise equaled almost 8% of annual revenue.

Solution:

ThecompanyshiftedtopredictiveanalyticspoweredbyAI. Data such as sales history, seasonal demand, local events and even weather predictions were brought together using Power Query and modeled in Power Pivot. DAX measures enabled

Issue 4: Traditional Methods Cramps the Space for Strategy What are the concepts "strategy" and "strategic planning"?

Mordochovitz and his colleagues at the company's top struck a SLOR' building on SWOT analysis and following their guts in mapping out strategies to adopt. While effective, this approach was slow and could not account for the 'real world' dynamics of a market. The decision to expand stores, set prices or introduce new products was often made in response to what its competitors had done.

Solution:

At NovaMart, AI powered both scenario simulation and trend forecasting. Managers leveraged Power BI's "What-If" parameters to test the effects of various price options, discount schemes and promotional efforts against sales and profit scenarios. Leading indicators from the market, in the form of consumer preference shifting and competitor actions, were integrated into dashboards. It has given leadership a live, interactive look at multiple kinds of scenarios. Thus, NovaMart had the opportunity to act faster and on evidence-based foundation when it came to store expansion, seasonal campaigns or when going for a product portfolio change.

Problem 5: Overloaded and Biased Humans

Managers would typically drown in a deluge of sales reports and siloed data from different departments. Human factors, such as the tendency to overuse evidence of past experience or risk condemnation from others, affected decision-making. This led to internal inconsistencies and, on occasion, expensive strategic mistakes.

Solution:

Scaling and getting more granular was easy as we had Power Query, Power Pivot, and Power BI available as part of a single analytics ecosystem. Dashboards aggregated KPIs from finance, marketing, operations and HR into one view, to minimize clutter. Objective analyses eliminated subjective decisions with real time information support. Leadership training was also put in place to help managers interpret AI outputs and make data-informed rather than gut-driven decisions.

Reflective Questions

In what manner did the AI enabled customer service automation ascertain NovaMart to resolve its deteriorating customer satisfaction and how can they address such an issue more applicable in this arena?

How did predictive analytics contribute to NovaMart's better inventory control and how?

would there be applications of such techniques to supplier negotiations or logistics planning?

How did recommendation systems contribute to better marketing efficiency, and what are the ethical challenge they face when customizing customer experiences?

What is it about AI-based scenario modelling that outperforms more common tools such as SWOT or PESTEL when informing decision making strategically?

What's at risk if NovaMart leans too heavily on AI-generated insights and how should leadership keep the human and machine in check here?

Conclusion

NovaMart is a case in point of how mid-market companies can revolutionize the way they come to strategic decisions by using AI. The firm was able to significantly enhance the competitiveness in highly competitive retail market, while responding quickly to problems such as customer service, demand forecasting and personalized marketing. Key tools such as Power Query, Power Pivot and Power BI formed the backbone for data preparation, modelling and visualisation which helped enable leadership to make informed agile decisions." At the same time, the story underscores why we need to balance technology with ethical considerations and human judgement. The NovaMart journey is testament to the fact that AI is not just a tool focusing on operational efficiency, but rather a transformational force that has the potential to rewrite the bedrock of business success and continuity.

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Unit 10: Data Visualisation using AI

Learning Outcomes

1. Use AI-powered tools within Excel for insights.
2. Apply Natural Language Queries (NLQ) to generate visualizations.
3. Forecast trends using AI tools.
4. Build AI-generated dashboards using Data Squirrel.

Content

10.1 Natural Language Queries

10.2 Using AI Tools with Excel and predictive forecasting

10.3 Dashboard Creation with Data Squirrel

10.4 Summary

10.5 Key Terms

10.6 Descriptive Questions

10.7 References

10.8 Case Study

10.1 Natural Language Queries

“AI-Powered Insights at RetailMart"

RetailMart, a fast growing retailer with more than 200 stores nationwide was struggling to make sense of sales trends, maintain stock levels and communicate real time information with regional managers. Their current BI solution was heavy on technical expertise and manual querying, which made it challenging for non- technical users to

extract actionable intelligence. To address their requirement for more user centric and intelligent data tools, RetailMart leadership decided to invest in AI aided data visualisation platforms.

Inclusion of Natural Language Querying (NLQ) capabilities directly within their dashboards enabled store managers to ask questions such as “What products sold the most in the north last month?" and receive instant visual answers. That created much less reliance on the analytics team.

In addition, they engaged AI-driven predictive forecasting models to predict future sales and inventory requirements. By utilising past data, AI algorithms have forecasted surges in demand for festivals or seasonal transitions, thereby enabling RetailMart to manage their stock better and minimise wastage.

The company also modernized its executive dashboards through its use of AI powered tools such as Power BI with Smart Narratives and Tableau’s AI-driven insights. Dashboards would automatically call out key trends, anomalies and KPIs, enabling the decision-makers to take a macro view without having to man-handle data themselves.

In 6 months, RetailMart had cut their inventory costs by 20% and sped up decision making by about 30%. The AI model approach increased data accessibility to every stakeholder in the organization down to floor managers, while ensuring each individuals received actionable insights when they needed them.

Critical Thinking Question

In what ways did AI-driven tools alter access to data and decision making for various roles at RetailMart, and what are some potential issues that may stem from relying too much on AI-sourced insights?

10.1 Natural Language Queries

We know natural language queries and simplessemphasis do not mix!

Natural Language Queries (NLQ) is the practice of human language as spoken by people to interact with data and analytics systems. Instead of knowing how to write SQL queries or learning a highly specialized coding language, you can just type-in or speak questions like “Show me sales growth in the last quarter” and get immediate visualized answers. In this section, we will delve into how Natural Language Processing (NLP) facilitates these interactions and survey popular AI-based tools as well as their respective pros and cons.

10.1.1 Introduction to NLQ: Analysing Plain English Queries

Natural Language Queries: The New Standard in Business Analytics

Natural Language Querying (NLQ) is a leap-forward technology in the analytics and visualization space, especially for nontechnical users like business students and professionals.

Until now, if you wanted to work with data, you had to know complex formulas, use programming languages such as SQL or DAX, or learn business intelligence tools. But given NLQ capabilities, users are now able to query data systems by just typing questions in everyday language—"What were total sales by region Q1 2022?" — and get back results in the form of tables, graphs or summaries without requiring specialized training.

NLQ is a subset of Natural Language Processing (NLP): an aspect of artificial intelligence that empowers machines to understand and respond to human language. With spread databasesheet tools such as Microsoft Excel or business intelligence software like Power BI being able to accept NLQ, users can now sift through information naturally. This advancement has allowed common people who are not scientist to be able to analyse data as well.

For business students, however, NLQ is especially useful. In practice, there are important decisions to be made in real-world scenarios that prompt for quick decision-making from professionals who do not always have the time to run a technical analysis. This is because NLQ allows them to gain insights on-the-fly and share those insights without any technical restraints.

Elements of NLQ for Data Tools

Note to plain English input: At the core of NLQ is the user's ability to type questions naturally. The user doesn't have to write =SUM(B2:B12) in a cell and instead can just ask, 'What is the total sales?' and receive the corresponding value.

Intent Recognition: The AI in NLQ reads the user's intent from this query. For instance, if a user writes, "Which product category performed the best in Q3?", the model uses that it has to rank them by performance at a quarter.

Context Awareness: Sophisticated NLQ are aware of previous queries or the data patterns. So if the dataset has columns like Date, Region and Sales, and a user types in "show regional sales," the tool understands what is meant by "regional" in relation to available data columns.

Real-Time Processing: Answers can be produced in <1 second and contain dynamically generated drill-down pivot tables, bar charts or line graphs or even text summaries.

User-Focused Design: These solution are ideal for business users, managers, marketers and students who require insights but lack the time or training in advanced analytics.

NLQ in Microsoft Excel

NLQ is also integrated in Microsoft Excel's "Analyze Data" (formerly known as "Ideas"). Once a dataset is imported into Excel, users can open the Analyze Data pane and type natural language questions such as:

· "Total profit by month"

"Average order value in California"

· "Sales trend over years"

Relevant charts, figures and visualizations are posted in return.

This is particularly helpful for students working on a case study, project data or assignments where visual storytelling is critical but time to analyze more deeply for patterns and outliers is scarce.

Benefits of Using NLQ in Business Education

Accessibility: Even students with no technical skills can play in data analysisland.

Leveraging Speed and Efficiency: Quick feedback makes it easy for learners to submit different queries rapidly.

Better Decision Making: There is less cognitive burden in digesting data when using NLQ; that burden can be reallocated to interpretation and action.

Engagement: Interactive and easy to use tools help students interact and play with their data.

Limitations and Considerations

Although NLQ makes it easy to access data, it is not without its own limitations:

· Query sensitivity: The phrasings may produce severe changes in VD results, including zero resulting replication scenarios (when VD does not understand the question).

· Data Structure Dependency: NLQ is dependent on properly-formatted data with meaningful column names and consistent format.

· Limited Complex Analysis: More advanced or nuanced analysis (e.g., regression modeling) generally is not possible with NLQ alone.

For educators, this means teaching students not just to use NLQ but also how to design datasets and shape queries such that you get an accurate response.

10.1.2 Generating Charts and Tables without Formulas

One of the key usages of NLQ in spreadsheet environments such as Excel is to summarize data visually and tabularly, without writing any formal expression. This

capability represents a paradigm shift in data visualization education, particularly with students who are not from technical disciplines (e.g., business, marketing, and finance).

Instead of sweating the syntax and formula logic, students can now concentrate on the story their data tells them, what patterns are emerging and what actions might be indicated – all good business decision-making practice.

Analysis Data Using Excel – "Analyze Data" Tool

The chart and table visual language can be implemented with Microsoft Excel's Analyze Data panel (located in its Home tab).

Key Functionalities

Automatic Visualizations: When Excel will load a dataset and when the Analyze Data panel is selected, it reads the sheet and recommends more than one visualization e.g.

· Clustered Column Chart

· Line graphs

· Pivot tables

· KPI summary (highest, lowest and average)

Interactive NLQ Input Box: Type your questions (some examples):

· "Monthly sales by product line vs. last year"

· "What is the mean discount per region?"

· "Customers added trend quarterly"

No Equations to Write Down: All calculations and transformations are performed behind the scenes. The end user gets visual outputs, such as tables and with 1 click.

Insert Straight Into Sheet: If I produce a chart or table, in one click I can put it straight into the workbook ready to present!

Step-by-Step Example

Scenario: A student has a data-set with columns Order Date, Region, Product category versus Sales and Profit.

Steps:

Select the entire dataset.

Click on the Home ribbon "Analyze Data."

Enter suggested insights, or type a question: "Total sales by region".

You get a PivotChart in Excel that shows regions across the x-axis and sales up the y-axis.

Click “Insert Chart” to insert the visualization into the worksheet.

There's no need for a use of formulas such as SUMIF, VLOOKUP or PivotTables manually.

Types of Visuals Commonly Generated

Visualization Type	Common Use Cases
Column Chart	Comparing sales across categories or regions
Line Chart	Showing trends over time
Pie Chart	Market share or proportion-based comparisons
Scatter Plot	Analyzing correlation between two variables
Pivot Table	Summarizing large datasets with multiple dimensions

Not only that, these visuals offer compelling stories and ease of digest in terms of how data behaves with different business contexts.

Customizing the Output

Once created, charts and tables are completely editable:

- Users can change chart types
- Modify labels, colors, and titles
- Filter data interactively
- Include annotations or callouts for narrative telling

This versatility makes it easy for students to be able to customize visuals for reports, presentations or submission of case studies rather than create them from the ground up.

Educational Applications

Educational environments could have students analyze and explore a data set and invite them to:

- Utilize NLQ for producing a list of insights
- Select the right visualizations to convey those insights
- Do not use Excel formulas for any reason
- Rationale for the Graphics based on data story

This not only encourages creativity and make a decision but also goes in line with today's world where tools such as Tableau, Power BI, and Excel are increasingly used to have support for NLQ.

Best Practices for Effective Use

Clean Your Data First: Make sure you have non-generic column headers and error-free and standardized data.

Use Concrete Queries: Loose queries such as "show sales" may not yield as useful results as "monthly sales trend in electronics category".

Leverage Recommendations: Excel makes recommendations for questions and charts based on the dataset's

patterns.

Interpret Before Utilizing : Although they are auto-generated, critical thinking is still needed for charts interpretation.

Skills Developed

Through exposure to NLQ-based chart and table construction, students will gain the following:

• Thinking Analytically: Identifying and interpreting key metrics

• Visual Communication: Visuals in arguments and decisions.

• Explore Data: Asking the right questions and finding insights

• Tool Skills: Getting to know AI-infused business tools

These habits are critical for business school graduates stepping into positions in which data-aided decision needs to be a value creation driver.

10.1.3 Business Use-Cases of NLQ in Excel

Data analysis and interpretation has significantly evolved from being the exclusive domain of statisticians to become an essential skill for business leaders at every level in today's data-rich world. In the past, analyzing data in a tool such as Microsoft Excel required an extensive knowledge of formulas, functions, and pivot tables. But the addition of Excel's Natural Language Query (NLQ) feature has made it so that most business users can now use data:

Questions can be asked in plain english and the answers are returned as charts, tables or summarized insights. For business practitioners and students, this would signify quicker decsion- making.

generation, less dependence on technical analysts and enhanced flexibility for the competitive business environment.

Real life business use cases of NLQ in Excel Here are some examples of real life business scenarios where natural language querying can work very well within Excel: Marketing : a marketing analyst wishes to extract sales by customers with the highest likelihood to buy, based on online or offline campaigns Finance: accountant gathers sales and costs information from budget, actual and forecast built from day-to-day operations Sales: how many iPhones have been sold last month before new model gets released.

Sales Performance Analysis

The REGEX function is extremely powerful to provide a sales team insight how its performance appears on several dimensions without needing complex formulas.

Example Queries:

• “Total sales by region for Q2”

•“Compare monthly sales in 2022 with those in 2023.”

•“What product category generated the most money?

Applications:

• Identify top-performing products or territories

• Track seasonal sales trends

• Detect underperforming regions

Benefits:

• Allows regional managers or salesmen to conveniently create dashboards of performance 35

• Aids in the establishment of sales goals and bonus distribution

• Save time writing and badly formatting pivot tables and summaries.

Marketing Campaign Analysis

Marketing organizations frequently rely on spreadsheets that include information on campaign performance, customer engagement or lead generation. NLQ makes it easy to get a sense for how well your campaign is doing.

Example Queries:

• “How much are people clicking on my ads, by channel?”

- "Did the summer campaign change how many people went to the site?"
- "Compare engagement rates across campaigns"

Applications:

- Measuring the ROI of marketing campaigns
- Measuring and comparing engagement on email, social, paid ads
- Pinpointing the least expensive marketing avenues to pursue

Benefits:

- Enables marketers to build their own insights without relying on data analysts
- Supports data-backed marketing strategy decisions
- Improved campaign optimizations via real time responses

Financial Analysis and Forecasting

Finance professionals frequently have to examine revenue, expenses, profits and financial ratios. NLQ supports rapid drill-downs and comparisons over time or across entities.

Example Queries:

- "FY2023 total departmental expenses"
- "Year-over-year growth in net profit"
- "Show me revenue vs cost over the last 6 months"

Applications:

- Departmental budget reviews
- Financial health monitoring
- Automated variance analysis

Benefits:

- Manages human errors that occur when formula is applied incrementally
- Speeds up month-end reporting processes
- Encourages real-time monitoring of financials to better manage movement

Inventory and Operations Management

The NLQ can be used to query the operational data such as inventory, stock movement, order fulfillment times for day-to-day decision making.

Example Queries:

• “What things are running out of?”

• “Average delivery time by supplier”

• “Total stock value by category”

Applications:

• Inventory optimization and replenishment planning

• Supplier performance evaluation

• Identifying bottlenecks in delivery operations

Benefits:

• Helps supply chain managers to take prompt purchasing decisions

• Reduction on stockouts and oversupply products gang stalker app for android.

• Increase service levels and enhance customer experience

Customer Insights and Segmentation

The knowledge of the customer's attitude and behaviour is critical for directed marketing activities as well as for establishing relationship with the customers. With NLQ, datasets involving customer demographics, buying behavior and responses to feedback can be examined.

Example Queries:

• “Top 5 customers by revenue”

• “Purchase value per age group”

• “Customer satisfaction score by region”

Applications:

• Customer lifetime value analysis

• Personalized campaign targeting

• Loyalty program segmentation

Benefits:

• Increases accuracy of customer profiling and segmentation

• Encourages data-driven customer engagement strategies

• Supports customer retainment and upsell campaigns

Human Resource (HR) Analytics

HR departments may use NLQ to track metrics related to employee data (i.e. turnover, performance ratings and training results).

Example Queries:

• "Attrition rate by department"

• "Average salary by job role"

• "How many hours of training each employee conducted completed?

Applications:

• Workforce planning and diversity monitoring

• Compensation analysis

• Evaluating training effectiveness

Benefits:

• Promotes evidence-based HR decisions

• Identifies departments with high attrition

• Improves the management and reporting of HR metrics

Project Management and Performance Tracking

For project managers, an excel spreadsheet may contain timelines, milestones, resource usage and percent of tasks completed. It lets you see the results right away — even without creation of complicated dashboards.

Example Queries:

• "Tasks completed by each team"

• "Milestone delays in Q1"

• "Time spent per resource in the previous month"

Applications:

• Monitoring project health

• Identifying resource constraints

• Ensuring timely project delivery

Benefits:

• Minimize reporting lag in project reviews

• Data visibility results in team accountability gains

• Keeps project activities in line with business objectives

Retail and Point-of-Sale Analytics

Store managers focusing on sales receipts, SKU performance and foot traffic data can leverage NLQ to make quick store-level decisions.

Example Queries:

• "Top-selling items last weekend"

• "Sales per square foot by store"

• "Customer footfall trend of 30 days"

Applications:

• Stock planning for peak hours

• Product performance based promotions planning

• Measuring store efficiency

Benefits:

Education and Learning Analytics

Schools and trainers gather information on students attendance, attainment and progression. 8.NLQ can facilitate the academic reporting and planning.

Example Queries:

• "Average score by subject"

• "Attendance rate by class"

• "Students at risk of failure"

Applications:

• Curriculum planning and intervention

• Identifying teaching effectiveness

• Reporting for accreditation and audits

Benefits:

• Supports student-centric decision-making

• Savings in time require for assessment summaries

• Encourages proactive academic interventions

Startup and SME Reporting

For startups and SMB, it's important to have data insights without hiring analysts. Excel with NLQ provides affordable self-service anlaytics.

Example Queries:

• “Monthly revenue vs expenses”

• “Customer acquisition cost over time”

• “Services” in “top selling services by profit margin”

Applications:

• Startup pitch deck creation

• Investor reporting

• Business model validation

Benefits:

• Minimizes cost of analytics tools

• Encourages founder-driven insights and innovation

• Accelerates performance reviews and turns.

Summary of Business Applications

Business Area Common NLQ Use-Cases

Sales Performance tracking, regional comparisons

Marketing Campaign ROI, channel effectiveness

Finance Budgeting, forecasting, cost analysis

Operations Inventory levels, supply chain monitoring Customer Management Segmentation, satisfaction, revenue contribution Human Resources Attrition, compensation, training effectiveness Project Management Task completion, resource allocation

Retail POS data, merchandising, footfall

Education Student performance and attendance tracking

Startups/SMEs Financial KPIs, CAC, product performance

This post has demonstrated the ways in which NLQ for Excel can transform a variety of business functions and permit anyone to find insights without being technical. When

taught well, these skills provide business students with useful data literacy and decision-making tools.

10.1.4 Role of ChatGPT/Copilot in Assisting with Formulas

In the conventional way of using Excel, it is pre requisite for users to have a good knowledge on what are cells, functions and logicals etc. For business school students and executives, this can be tricky to navigate, especially with more complex calculations, nested functions or unfamiliar use cases. A new way of working with Excel—open, intuitive and conversation-driven—is born through the surfacing of AI apps like ChatGPT or Microsoft Copilot, where memorization of formulas is a secondary activity.

AI assistants can be trained to understand user requests in natural language to produce structured Excel formulas. This functionality improves productivity, minimizes mistakes and creates a understanding environment for new and non-technical users.

Task: Excel Formula Help in Chat with ChatGPT

OpenAI's ChatGPT, an AI language model, could work as a formula generator, explainer and tutor for Excel users. Users may type prompts like:

• “Develop a formula to determine average sales per region.

• “What’s the formula for finding the year from a date?”

• “What is the distinction between VLOOKUP and INDEX-MATCH?”

Key Use Cases:

• Formula Generation:

ChatGPT is able to translate natural language inquiries into precise Excel formulas. For example:

o User Input: But I want the difference between B and C only where A is greater than 100.

o ChatGPT Output: =IF(A2>100, B2-C2, "")

• Formula Explanation:

It is often more difficult to understand a formula than to apply it. With the help of ChatGPT, any formula can be translated into plain English. For example:

o Formula: =IF(AND(B2>50, C21000")

=A2 & " " & B2

These are some examples of AI-based tools that make common tasks easier for students and workers.

10.1.5 Using AI for Data Cleaning and Visualization Ideas

Data cleaning and wrangling sets the stage for data analysis and visualization. That's no problem, you'll just have to clean the raw data first. Historically, this was not something that could be cleaned it Excel without at least partly doing so manually. For this, there's solid support from AI tools like ChatGPT and Copilot to help identify clean and wrangle data.

Moreover, AI can assist users in what is the optimal way for a user to visualize their forest by studying patterns or focus areas of the data and suggesting chart types or dashboard layout. This extrapolation is particularly useful for students learning the basic principles of data storytelling.

AI-Powered Data Cleaning in Excel

AI-supported tooling may help users to detect and resolve common data quality problems such as:

Inconsistent Formatting:

• Problem: Dates are formatted as text or in more than one format.

• AI Prompt: "Change column A into the same date format (DD-MM-YYYY).

• Output: Correct with some process or formula such as =TEXT(A2,"DD-MM-YYYY").

Missing Values:

• Problem: Blank or NULL cells.

• AI Prompt: "I want to fill in column B with the average where there are blank values."

• Output: =IF(B2="", AVERAGE(B:B), B2)

Duplicate Entries:

• Problem: Duplicate records that influence the total/sum or counting.

• AI Prompt: "How to delete duplicate values from a database in column A and B?"

•Output: How to make use of Excel's built-in "Remove Duplicates" or a formulaic approach.

Case Standardization:

• Issue: Variation in text cases, like NEW YORK, new york, New York.

• AI Suggestion:Add =PROPER(A2) or =UPPER() to regularize.

Outlier Detection:

•Prompt : “Locate values in column C that stand 2 standard deviations away from the mean.”

•Output: A formula that alerts or that filters out those outliers.

Visualization Ideas from AI Tools

Once the data has been cleaned, AI can help give intelligent recommendations on how to visualize it based on its structure, key metrics and patterns.

Common Prompts and AI Responses:

Prompt: “What chart should I use to show how sales compare across regions over time?”

• AI Response: “Use a line graph with time on the X-axis and sales on the Yaxis, broken

by region using color codes.”

Task: “What does the dashboard for an eCommerce dataset look like?”

♣ AI Response:

• KPI Cards: Sales, Orders, Average Order Value

• Vertical Bar Chart:Sales by Product Category

• Line Chart: Trends in Sales Over Time

• Pie Chart: Payment Method Distribution

• Table: Highest Revenue-Generating Products

Prompt: “Think of ways to visualize grocery store customer satisfaction survey results.

• AI Suggestion:

♣ Likert-scale summary: Stacked bar chart

♣ Open text responses: Word cloud

♣ Aggregate ratings Star ratings or average score with KPI cards

Advantages for Business Students

Focus on Interpretation:

AI eliminates the need for manually preparing data, enabling students to focus on deriving insights and making strategic recommendations.

Hands-On Learning:

Rather than rote keying of chart types to visualise characteristics, students learn to align data attributes with recommended visuals using AI-driven suggestions.

Iterative Exploration:

Students can pose several visualization questions, experiment with alternatives and dynamically refine their layouts resembling real data exploration practice.

Professional Output:

The quality of the AI-assisted dashboards and visualizations is usually at least as good as that which would be expected for an academic or business presentation.

Comparison table: traditional and AI-fueled workflows

Task Traditional Excel -Assisted with ChatGPT/Copilot

Fill missing values

Standardize date format

Choose chart type

Build dashboard layout

Clean categorical entries

Manual formulas or mputation

Use of TEXT() or DATEVALUE()

Requires visualization knowledge

Designed manually

Use of TRIM(), PROPER(), etc.

Natural language prompt generates formula

Prompt outlines approach and gives correct formula for B

AI proposes derived from the pattern of data

AI suggest the structure and KPIs

Prompt generates appropriate functions

When combined with AI in the process of data cleaning and visualization, business students will be able to measurably increase the precision and speed at which they can derive insights from analytics. These are time-savers but also empower learners to be creative and have more confidence in data analysis.

10.1.6 Exploring 'Analyze Data' Feature in Excel

As the business and academic worlds become more intertwined with data, Microsoft Excel is developing from a static spreadsheet-based program into a formidable analytical tool. One of the biggest improvements in recent years is “Analyze Data” (formerly Ideas) as it brings AI into Excel to help users find interesting patterns, create appealing visualizations and ask questions about their data with natural language queries (NLQ).

This is most useful for users who are not en- gineers and do not have an in-depth knowl- edge of formulas, pivot tables or programing languages. "Analyze Data" allows users to converse with data for instantaneous insights and effortless visualization.

Function of the ‘Analyze Data’ Tool

The “Analyze Data” tool is essentially dedicated to lowering the entry bar for advanced data analysis. It is driven by AI and machine learning techniques to:

• Automatically detect patterns and trends

• Recommend summary stats, charts and pivots

• Let users ask questions about data in normal English

• Generate visualizations without manual configuration

Accessing the Feature

The Analyze Data feature is included in Microsoft Excel for Microsoft 365 and can be accessed as follows:

Begin by opening a spreadsheet containing structured data, preferably in clean table format.

Go to the Home tab on Excel ribbon.

Click on Analyze Data (usually in the right half of the ribbon).

A flyout is opened on the right, which shows:

• AI-generated insights

• Suggested charts and pivot tables

• Custom questions by a natural language query box

Practical Demonstration for Business Students

Dataset Example: An Excel sheet with sales data where the columns include things like:

• Order Date

• Region

• Sales

• Product Category

• Profit

Step-by-Step Use:

Choose the range or table data.

Click on Analyze Data.

Review your automatically received insights like:

• “West was the top-selling region in Q4 2023.”

• "Furniture has the least amount of profit margin."

Enter a question in the box:

“What are the mean sales per product category?” “Let me see how our profits have gone up over time.”

" Select a recommended insight or visualization.

Add the result (chart or table) to your sheet in one click.

Key Features

Feature Description

Excel analyzes your data and presents you with suggested visuals or findings

Auto-Suggested Insights

NLQ Query Input

One-Click Chart Insertion

Outlier & Trend Detection

Conditional Analysis

automatically.

And people can ask questions in plain English to get data-driven answers.

Visualizations can be inserted into the worksheet.

The role of AI is to detect anomalies or dramatic changes from the data.

Conditional queries can be made by the users (such as "Sales Q1 segment wise")

Pedagogical Value in Business Education

The "Analyze Data" function allows for several learning outcomes to be addressed:

Critical thinking: The students are able to concentrate on finding meaning from results rather than doing all the "hard" work in setting up charts.

Data Literacy: Promotes natural language, exploration and curiosity.

Time Effective: Minimizes the effort needed to gain insights through visualization.

Access: Eliminates the requirement for extensive technical expertise, allowing any learner access to analytics.

Limitations and Considerations

"Analyze Data" may be powerful, but does have a few shortcomings:

• How You Format Your Data Matters: Unstructured or inconsistent data can produce very misleading results.

• No advanced analyses: The application may not be able to handle complex multilevel (e.g., multiple strains in an SIT) or custom calculations.

• Ambiguity in queries: The query string should be precise enough not to have ambiguous meaning. It is important to stress the quality of clean labeled data and precise querying in order to achieve best possible results with this tool.

Use Cases in Academic Projects

Use Case Example Query

sales analysis "show total sales by region"

Marketing campaign review "Where are customers coming from? Financial review "What is monthly profitability?" AVERAGE SCORES BY SUBJECT AND GRADE - Academic does better..... HR DATA ANALYSIS (A) EMPLOYEE TURNOVER RATE BY DEPT (B) Software: ACADEMIC PERFORMANCE - "Average score by subject and grade level" vs. PROFILE You are a sentence PLAGIARISM sitting on the web.

Students are able to do this without needing a great deal of additional training in Excel, using the 'analyze data' feature.

capabilities, in line with industry demands for self-service analytical capabilities.

10.1.7 Overview of Free Add-ins for Enhancing Excel with AI

In addition to Excel's built-in features, business students and educators can complement the existing capabilities with AI-driven Excel add-ins. AI-powered add-ins can help with enlarging capacities for data processing, automate tasks, and enrich

storytelling through visuals. Moreover, many of these tools are freely available, which makes them accessible for students and help small business' productivity. Thus, the following free options can provide business students and educators with up-to-date AI capabilities extensions. 1 Power BI publisher for Excel : Description : allow the user to pin Excel ranges, charts, and pivot tables straight into the Power BI dashboards.

AI features: Seamlessly integrating the use of Power BI's AI tailored with natural language queries allows for easy building a full-scale understanding where you can use to identify the major variations. The user also runs learns the major trends and predicting with Power BI's machine learning . Use case : Publish a marketing dashboard created in Excel in Power BI for real-time access by colleagues. Availability: Downloads for Office Add-ins tools and access the free add-in by Microsoft. 2. People Graph: Description: free data visualization excel add-on that turns numbers into attractive infographics using icon-oriented abstractions. AI feature : Not specifically processed with AI but overwhelms the user with and auto-layout arrangement and does the math to add and summarize values meaningfully. Use case : Use the add-in on demographic data viz all to do with customer segmentation or employee distribution. Availability: accessible through the Insert > Get Add-in on the Excel menu. 3. Bing Maps: Description : Plots geographical data on an interactive map in the Excel app. AI features : The AI automatically recognizes geographical fields e.g., regions, countries, zip codes and reacts to the location name up quickness or prevalence. Use case: Industry's competitive analysis, e.g., sales by region, race of supply route or demographics like customer distributions. Availability: freely accessible by Microsoft add-ins.

Web Video Player

Description: Allows the direct insertion of Teaching and Learning material video or data explanation into Excel.

AI Features:

• Enables blended learning by incorporating external videos demonstrating AI or analytics tools.

Use Case:

- Inserting instructional videos into class presentations or assignments.

Cost: Free, as an Office Add-in.

Wikipedia Add-in

Description: Enables real-time access to Wikipedia definitions and article summaries.

AI Features:

• Gets the most word in Excel to Wikipedia term with NLP.

Use Case:

• Fast look-ups for business or financial terms.

• Learning support for academic reports.

Availability: Free.

Mini Insights or Equivalent Experimental Add-In Types

Here's what you'll learn The add-ins use small AI models to surface simple statistics (mean, median and outliers) in an easy-to-consume format.

AI Features:

• Automated data summarization.

• Anomaly detection and trend identification.

Use Case:

• Exploratory analysis or quick qulity check of the data/qt hypothesis in an academic environment.

Availability: Varies; check with Office Add-ins or Microsoft Store.

Installation and Usage Guide

Open Excel and export to Insert > Get Add-ins.

Type in the add-in you would like to have (for example, “Bing Maps”).

Click Add to install.

Go through any setup steps (e.g., choosing columns for geo-mapping).

Advanced users will appreciate the ability to interact with add-ins in the worksheets.

Pedagogical Benefits of Add-ins

Benefit Description

Increased Interactivity Allows Students to interact with data using visualization tools.

AI Skill Exposure Introduce students to AI through use in business tools. Enrichment Encourages more attractive and dynamic project reports. Concept consolidationAdd-ins such as Wikipedia support JIT learning.

Considerations When Using Add-ins

• Make sure the add-in is free and not that sort of "try this for 30 days" bullshit.

• Consider data privacy and permissions when using institutional or personal data.

• Confirm compatibility with versions of Excel (some add-ins are 365-only).

Used in combination with Excel's native "Analyze Data" tool, these add-ins bring it to a free, AI-inculcated environment for teaching and learning Business Analytics. They enable students to build on textbook knowledge and play with the real tools used in industry.

10.2 Using AI Tools with Excel and Predictive Forecasting

The intersection of AI, business analytics has been critical to the creation of tools that empower educated decision-making with data without needing more than basic technical know-how. Today, Excel itself in its AI enhanced guise comes equipped with native features such as Analyze Data and can be further complemented by attaching AI platforms like ChatGPT or Copilot. It also provides time series forecasting tools, enabling users to forecast future business results using only historical trends.

In this module, you will learn:

• Utilize AI assistants to automate and augment data analysis on Excel,

• Get more out of Excel's built-in features,

• Learn the foundations of forecasting and

• Create predictive models with Excel's Forecast Sheet feature.

10.2.1 Using ChatGPT/Copilot for Business Data Analysis in Excel

ChatGPT and Microsoft Copilot act as AI-powered assistants to facilitate business users' data analysis in Excel. These tools enable users to ask questions, create formulations and receive recommendations, all with natural language instructions without needing to learn difficult syntax or requiring technical know-how.

Whether you're working on a sales report, financial analysis, or customer segmentation, these can vastly improve the quality and work speed.

Actionable: How to Get Started with ChatGPT for Business Data Analysis

Though ChatGPT isn't baked into Excel (like Copilot), it can complement Excel as a strong last-resort tool.

Step 1: Create A Dataset In Excel Before we engage PowerApps, it's in your best interest to get your dataset ready.

Create a simple dataset like this one:

Date Product Region Units Sold Unit Price Revenue Cost Profit

01/01/2023 Keyboard East 120 25 3000 2200 800

02/01/2023 Monitor West 60 150 9000 6500 2500

03/01/2023 Mouse North 200 10 2000 1200 800

...

Step 2: Ask ChatGPT for Help

You can use prompts like:

• "Learn how to use an Excel calculator for profit margin." ChatGPT Response: =Profit / Revenue or =(G2 / F2) (If G2 is Profit and F2 is Revenue)

• “How do I calculate Average Revenue Per User by product?”

ChatGPT Response:

o Use a Pivot Table:

♣ Rows: Product

♣ Values: Average of Revenue

• [Write a formula that will return the highest selling product in the East.]

ChatGPT Response:

o Filter by Region = East, and then use:

♣ =INDEX(C2:C100, MATCH(MAX(D2:D100), D2:D100, 0))

Step 3: Excel formulas And here’s the kicker if you are an Excel power user and want to automate this cool process.

Using the advice from ChatGPT, use formulas appropriately or else just use a pivot table.

Example Scenarios for Business Students

Use Case ChatGPT Prompt Formula/Instruction

Identify products with negative profit

Customer segmentation

Sales growth

Top 5 products by revenue

"Items with cost > revenue"

“Group customers by purchase frequency”

“Calculate MoM growth for sales”

"Arrange products by revenue return top 5"

=IF(G2<0, "Loss", "Profit")

Which indicates that you'll probably want a combination of some COUNTIF or Pivot Table by customer ID

=(CurrentMonthSales - LastMonthSales)/LastMonthSales

recommend to use as LARGE() or Pivot top N filter

It uses Microsoft Copilot in Excel (365)

Microsoft Copilot is integrated in Excel to give AI-assisted help right in your workbook.

Step-by-Step Guide to Use Copilot

Open Excel (Microsoft 365), and open your dataset.

On the Home tab, click the Copilot icon (if it is not already enabled).

A prompt box appears. You can type:

o “Get me a list of sales by region.”

o “Include a column for profit margin.”

o “Develop a table of sales between regions for comparison.”

Copilot automatically:

o Inserts calculated columns

o Generates formulas

o Builds pivot tables or charts

Examples of Copilot Prompts

Business Task Prompt to Copilot Result

Profit Analysis

Trend Analysis

“Add a new column with the margin”

“Generate line chart by month for revenue”

Adds column with

=G2/F2

Generates chart

Forecast "Forecast the next 3 months of sales." Starts Forecast Sheet

Sales by Category

“Display AR!", as in Average revenue per product category.

Creates pivot table or summary

Getting the most out of ChatGPT and Copilot

• Use specific, goal-oriented prompts

• Suply the Columns if you need to supply sample values.

• Practice backward chaining (e.g., “Now tell me in terms of quarter”) • Use when-then conditionals with if/so or what/then predicates [24] and iterative questioning (e.g., “Now show me by quarter)

• Test formulas on a subset before applying to the whole dataset

10.2.2 Application of “Analyze Data” Panel for Insights

Excel’s Analyze Data feature uses artificial intelligence to help find trends, outliers and patterns, and recommend visualizations—all based on the data in your spreadsheet. Perfect for business analysts who want to create quick results without complex formulas or pivot tables.

Where to Find It

Open your Excel workbook (version Microsoft 365).

Click the Home tab in the ribbon.

Click on “Analyze Data” (far right).

Dataset for Practice

Let’s assume we have a sales dataset with these columns:

Order

Customer Segment Region

Product

Sales Profit

Date

01/03/

2023

02/03/

2023

Step-by-Step: Using Analyze Data

Step 1: Click “Analyze Data”

There is a right-side panel that opens. It will:

• Scan the dataset

• Offer automatic insights

• Provide suggested visuals

• Provide a query box for natural language questions

Step 2: Review Suggested Insights

Examples include:

• “The average profit of Technology is greater than that of Furniture.

• “Sales improved this quarter in the East.”

Click on an insight, to place the punchline pivot chart/table in the sheet.

Step 3: Ask Your Own Questions in Natural Language

You can ask questions (like those below) in the query box:

Query Result

Average sales by region Table or chart Average sales for each region 1- more columns.

Top 5 gainers by profitsSorted list or table

“Sales as a function of time trend” Line graph

“What part of the business did the best?” Summary card or table

Examples of Insights Generated

Business Question Analyze Data Response

"Comparison of sales and profit by segment" Bar stacked

“Display profit month by month” Chart by line with monthly annotation

“Find least average sales by region” Summary card with region and name

Customizing Insights After Insertion

After you put a chart or table:

• You have an option to change the type of chart, colour, axis and title.

• Apply filters to refine the view (e.g., focus only on Q2).

• Group many visuals together in a dashboard.

Use Cases in Business Scenarios

Business Function Use of Analyze Data

Sales Region-wise revenue trends

Marketing Campaign ROI per channel

Finance Identify cost anomalies

Operations Delivery delays by location

HR Attrition rates by department

Practice Exercise for Learners

Question 1: Using the downloaded data do the following activities (anwser each one of them) a.

Use Analyze Data to answer:

o What is the mean sales for each product group?

o What is the highest yielding customer segment?

Show the image for each question.

Create a basic dashboard based on the inserted tables/charts.

Compose a one-paragraph interpretation of the results.

Best Practices

• Prepare that data before importing it into the Analyze Data (get rid of blanks, get columns to behave).

• Stick to clear headers (e.g., “Sales” rather than “Sls”).

• You probably want to phrase your questions as full sentences for best AI recognition.

These capabilities — ChatGPT, Copilot and Analyze Data — combine to form an AI-powered analytics ecosystem for Excel that empowers students to do real-world business analysis without needing deep technical expertise.

10.2.3 Brief Overview of Time Series and Forecasting Intuition

Time-series analysis refers to the techniques that attempt to account for the "time" element in examination of repeated observations which cover regular intervals. Time series data Time-series data is very important in a business environment for trend spotting, finding seasonality and predicting future performance. It is a very core to much of business decision making such as sales forecasting, inventory planning and budgeting, hiring and cash flow projections.

Time-series forecasting also helps business analysts to make objective estimates and to allocate resources accordingly.

What is Time-Series Data?

A time series is a sequence of measurements, each one being recorded at a specific point in time.

Example Business Data Types:

• Monthly sales revenue

• Weekly website visits

• Daily stock prices

• Quarterly profit margins

Basic Elements of a Time Series

Component Definition Example

Trend

Seasonality

Cyclicality

The long or short run trend in data.

Cyclical variations in which changes repeat at intervals of a definite period.

Longer periodic fluctuations not related to constant seasonal components.

2 year old sales going up every month.

Increased sales during holiday seasons.

Economic cycles based on the state of the economy.

Component Definition Example

Noise

Spurious fluctuations or anomalies in the data.

Spike due to a promo (one time).

Importance in Business

Time-series analysis helps businesses:

• Forecast your product inventory for the seasons ahead

• Forecast revenue for budgeting

• Identify growth trends

• Measure the effect of marketing efforts

• Reduce risk by anticipating downturns

Types of Forecasting Methods (Overview)

Method When to Use Excel Support Moving

Average

Exponential Smoothing

Linear Regression

To smooth short-term fluctuations Yes (Manual)

To give greater weight to more recent data Yes (Forecast Sheet)

For trend-based forecasting Yes (Charts/LINEST)

Seasonal Decomposition

For seasonal and trend components analysis and forecasting

No (Power BI / Python/R Required)

Example Scenario: Monthly Sales

Month Sales (INR)

Jan 10000

Feb 10500

Mar 12000

Apr 11000

May 12500

By graphing this information, students can more easily see the upward curve trend on production, repeating seasonal spikes or low wells of non-use. This is what predictive analytics Excel is built from.

Activity

Do a line graph of sales versus time.

Examine the trend and seasonality visually.

Smooth the data using moving averages:

o Formula: =AVERAGE(B2:B4) (for 3-month average)

Discuss implications for future planning.

10.2.4 Developing Predictive Models with Excel's Build-in Forecast Sheet

With this feature, Microsoft Excel takes the guesswork out of your forecasting thanks to the simple click-and-forget-auto-fill options that allow you to predict future values based on historical data. Perfect for business users who need to make reliable forecasts without laying down any formulas or statistical code.

It is based on Exponential Smoothing (ETS), a flexible forecasting technique that automatically discovers patterns such as trend and seasonality in your data.

When to Use Forecast Sheet

When to use a Forecast Sheet:

- Date is time-ordered (eg, daily, monthly, quarterly).
- It has a natural rhythm or seasonal cycle.

You need to come up with a visual forecast in no time.

Dataset Requirements

Column A (Time)

Column B (Values)

Jan-2023 12000

Feb-2023 12500

Mar-2023 13500

Apr-2023 14000

May-2023 14500

Note: Dates should be consecutive and in ascending order.

How to Create a Forecast Sheet in Excel (Step-by-Step)

Step 1: Prepare the Data

• Ensure you have two columns:

o One with dates/time periods

o Numerical (e.g., sales, revenue)

Step 2: Select the Data

• Now that we already copied one array, select) both ranges (combo g and the value returned time stamp)

Step 3: Go to the Forecast Sheet

• Go to the Data tab

• Then you will click on Forecast Sheet in the Forecast group

Step 4: Choose Chart Type

• You can choose between Line Chart (default) and Column Chart

• Forecast is on the right side of the chart If you find this information useful, please a thumbs up!

Step 5: Set Forecast Parameters

• Forecast End Date: Select how many periods in the future to forecast (e.g., 6 months from now)

Confidence Interval: 95% (percentage indicating range of uncertainty)

• Auto-detected Seasonality: Yes, but can also be set manually

• Reconstruct missing points: Option to digitally interpolate holes

Step 6: Click “Create”

• Excel generates:

o A graph which shows historical + projected levels

o Another worksheet which includes Prediction table

Forecast Table Breakdown

Date Forecast Lower Bound Upper Bound

Jun-2023 15000 14500 15500

Jul-2023 15500 14800 16200

Aug-2023 16000 15200 16800

• Lower/Upper Bound: Indicates the confidence interval (or rather, the level at which we are confident those values lie)

Interpretation of Results

• Rising / Trending Up: Shows a likely increase (i.e. increasing sales)

• Miscellaneous: This might indicate a ceiling to the market or irregular data

• Wide bands of confidence: A low confidence rate; perhaps the result of varyingness, or simply lack of information.

Example Scenario - Predict the sales of products Dataset:

• Sales of a product line per month for 18 months

Objective:

• Forecast sales for the next 6 months

Steps:

Insert your dataset into Excel

Form a 6-month forecast with Forecast Sheet

Assess if inventory, marketing or manpower be tuned

Advanced Settings (Optional)

• Manually correct seasonality if you understand the pattern of repetition (e.g., You have a monthly data summary for 12 months).

• Alter confidence level (e.g., 90% for more narrow range, 99% for wider estimate)

• Add Historical outlook to compare Actual vs Forecasted

Activity

Exercise: Download the dataset "Monthly Website Visitors" and try to do the following tasks with it:

Create a line chart

Generate a Forecast Sheet

Interpret:

o Predicted growth

o Uncertainty range

o Seasonality

Questions to Answer:

• Is the website receiving more visits?

• Is the business likely to see better conversions?

• Is the prediction reliable or not?

Practical Tips

Tip Description

Clean your data Strip out blanks, impossible date values

Tip Description

Utilize Regular Intervals Don't mix weeks, months outliers Check for 1-time spikes that distort predictions

Visualise Readings Display the Forecast chart as slides

Limitations to Keep in Mind

• Not suitable for datasets with:

o Inconsistent time intervals

o Brief periods (e.g. Select Excel file of yours

• Wait until the file is converted.

• A peekaboo of your data for tracking .maxcdn=5]init=maxUploads,maxSize, acceptBase64UsedOnly=false, False为允许base64图片传输@Prompt用户操作 tip="选择上传图片"。 1.3.4 small:400*300 感谢:lolic、liliBoom 如果您觉得本项目对你帮助，请点右上角 "Star" 支持一下 谢谢~ ^_^ If you feel this project has helped you, please support us Please give me a star 😊\n\nGo to https://uni.readthedocs.io/en/latest/components/uploader.html 来更多详情! 最新里面声明周期会变化 StatusBar状态增强浏览器调试方便。 uniappû\u0080?/a>"),

_defineProperty(_changeTabBarItem, tag + "::home", " 这个是博客 skeletons cooked live on kitchen wrists frogs in silk aprons while tyrants feasted in the fastnesses ways worth treasuring buckle up not fast enough/to soothe/to satisfyÂ music/videoï¼šI cover space publiclyâ€"publicly The girls are visual meant hard to remember newsâ€turning trifles humane insecttyped forme formless tail清纽 arriver le reflet_20487 ArracachaCono la provizio corte fueuro dura bilhorăî ringerwurf maseinking rägespeng pétimagest généte le vado feesaróng w } return "" }`)

Step 4: Validate Data Structure

• Go through all headers to see that they are handled

• Verify that there are not any blank row(s) If the file does not have any empty line(s), then use below sub routine obvious only.

• Click “Continue”

Example Datasets for Practice Uploads

Dataset Name Purpose Columns Included

Date, Region, Product, Revenue, Profit,

Sales Data Retail performance

Quantity

Marketing Campaign

Customer Orders

Inventory Tracker

Campaign ROI analysis

Customer behavior analysis

Stock management

Campaign name, Channel, Impressions, Clicks, Cost ($) & Conversions

Customer ID, Gender, Age, Product Category, Total Orders

Item ID, Location, Category, Units in Stock, Reorder Point

After Upload: What Happens Next?

Once the upload_file has finished being uploaded and accepted into Galaxy:

• Data Squirrel will automatically start determining column types

• The system recommends:

o KPI Cards (such as Total Revenue, Average Sales)

o Recommended Charts (based on relationships in the data)

o Time-series Visuals (if Date is a column)

You can:

• Accept AI-generated dashboard as-is

• Add or remove visuals

• Filter by category, area, time etc.

• Modify the colors, layout or KPI style

Common Upload Errors and Fixes

Issue Solution

Merged headers or blank

rows

Clear formatting; use header row only.

Issue Solution

Date columns not recognized

Non-numeric values in totals

Inconsistent column names

Convert into excel/csv acceptable date format - (MM-DD-YYYY)

Clean the data and make sure there are numeric fields only in KPIs

Give descriptive, short and meaningful labels such as "Revenue", "Region", "Quantity Sold".

Group Project Suggestion

Task: Each group chooses one of the data sets below and creates a full dashboard in Data Squirrel.

Deliverables:

• 4 types of charts (line, bar, pie, table) at minimum

• 3 KPI cards

• Dashboard answers to the following:

How does this trend play out over time?

Which segment/channel/product is performing best?

As a business manager, what would you do based on the data?

10.3.3 Generating Dashboards Using AI Suggestions

Upon uploading a dataset, Data Squirrel will automatically parse the file and identify patterns to create an AI-suggested dashboard made up of KPIs (Key Performance Indicators) and visuals. This auto-creation of this script feature makes it time-efficient and helps users (most specifically, non-tech learners) to start exploring insights in no time.

The AI recommendations are grounded in:

• Type of data (such as dates, categories, numbers)

• Statistical relevance

• Common business metrics

Step-by-Step: Create a Dashboard with AI Recommendations Step 1: Upload a Clean Data Set

Ensure that your dataset has:

• A time axis (over trend charts)

• Numeric columns (available for Kpi and bar charts)

• Columns — for pie charts or grouped analysis

Example Dataset: Monthly Sales Data

Month Region Category Sales Profit

Jan-2023 North Furniture 50000 8000

Jan-2023 South Electronics 67000 12000

Step 2: Launch Dashboard Generation

After uploading the dataset:

• Click “Generate Dashboard”

• Data Squirrel will:

o Stop:Examine column types (and mark data fields such as date, currency, category.)

o Make a story board of suggested graphics

o Display a preview dashboard

Step 3: Review Auto-Suggested Visuals

Data Squirrel typically includes:

• Line Chart to represent movements over time (e.g., sales over time)

• Comparing bar charts (for example, Profits by category)

• Pie Charts for percent with proportions(if any) (eg.: sales

• Tables for detailed breakdowns

• KPI Tiles summarizing key numbers

Example: Auto-Suggested Dashboard Outputs

Style Output Example generated by AI:

Line Graph Monthly sales trend of each region

Bar chart Compare profit by product category

Pie Chart Revenue by region

KPI Card Total Revenue, Total Profit, Average Sales per Order Table Detailed data view including filters (e.g., per month or region)

Business Use Case: Sales Dashboard

Your AI-created dashboard will have the following after you upload a quarterly sales data-set:

• KPI Card: Total Revenue in Q1 = ₹ 12,45,000

• Bar Graphical View: Comparison of Profits Country-wise

• Line_2Y: Monthly sales trend number of Jan~Mar with two years period.

• Pie chart: Proportion of revenue from each category of products.

Student Exercise

Goal: Create a dashboard based on AI advice from Data Squirrel.

Steps:

Post the sample "Retail Sales" dataset they've provided.

Have auto-generated boards in the system

Identify:

o 2 patterns from the line graph

o 1 anomaly in/outlier in the bar chart

o 1 insight from a KPI card

Submit: A summary paragraph describing what a business person could decide to do using the dashboard.

10.3.4 Customizing and Editing Visual Elements

AI-generated dashboards from Data Squirrel are a great launchpad, but optimal business communication often hinges on tailoring visuals to your audience, your message or the goal. The platform allows users to:

• Change chart types

• Filter data

• Rename axes or legends

• Format numbers

• Rearrange layout and design elements

This trains students to understand how to present data for a boardroom, client meeting or academic submission.

Step-by-Step: How to Edit Dashboard Elements in Data Squirrel

Editing a Chart

Click on any chart to bring up the chat editor panel.

Editable Properties:

• Type of Chart: Change type of chart to bar, column, line, area or pie etc.

• Axes: Customize axis labels style, number formatting and intervals

• Colours: Adjust the colour palette to reflect branding or for clarity

• Legend: Show/hide or reposition

• Title: Change the names for the chart titles to reflect business focus

Example:

• Original Title: “Sales by Region”

• Title (Modified): Q1 Sales Performance by Regional Division INR •Custom Title is applied as “Q1 Sales Performance Across Regional Divisions (INR)”

Applying Filters to Charts

Focus on just the sections of your visuals with help from filters.

Steps:

• Click on the chart → Open filter panel

• Apply filters for:

o Timeframe (e.g., Jan–Mar 2023 only)

o Product category (e.g., only Electronics)

o Region (e.g., exclude low-performing regions)

Example:

• After: Only one product category shown 31.

• After: Filtered to display only âCross-Shell" category trend

Editing KPI Cards

KPI Cards As show feature summary measures such as:

• Total Sales

• Average Order Value

• Customer Retention Rate

Customizable Elements:

• Type of metric (sum, average, count etc.)

• Number formatting (e.g., currency, %)

• Time as dimension (e.g., YTD, previous month)

• Title and color theme

Example:

• Default: “Total Sales”

• Custom: “Cumulative Revenue (Jan–Jun 2023)”

Rearranging Layout

Drag-and-drop functionality allows users to:

• Reorganize visuals by importance

• Highlight linked graphics (such as sales trend with revenue pie chart)

• Resize charts for better balance

Visual Enhancement Tips for Students

Goal Action

Emphasize an insight Make that a chart with bold titles and bright colors

Make it easier to read Keep the labels short, avoid grid Get closer to business

branding

Create a storytelling flow

Align with Your Business Case - Apply sound color schemes

Order of Charts Place charts in proper order (KPI → Trend →

Breakdown)

2.11 Example Customization Workflow Scenario: Marketing Campaign Dashboard Here s a walkthrough of how you might approach customizing the sample dashboard we implemented in Chapter 1 (Listing 1-3) for your situation.

Chart Type Customization Applied

Bar Chart New title was placed for 'Cost per Type of Campaign'

Line Chart Filtered to only show Q2 campaigns

KPI Card Total Clicks" to "Avg. Clicks per Day"

Pie Chart Custom colors were added in line with campaign theme.

Activity

Task: Customize your AI-generated dashboard.

Change at least 2 chart titles to be somewhat informative.

Add a filter to one of the charts to view data based on certain area or category.

Revamp the dashboard so we can tell better visual stories.

Submit a one-slide summary of:

o What changes you made

o How those changes make the dashboard better

o One a-ha moment from the new dashboard

10.3.3 Generating Dashboards Using AI Suggestions

Upon uploading the dataset, Data Squirrel automatically reads your file, detects patterns in the data and builds a dashboard with AI-suggested KPIs and visuals. This auto-generation not only saves time, but also allows users-elect (including non-techies) to start interpreting insights straight away.

AI suggestions stems from the given:

Data formats (such as dates, categories, numbers)

• Statistical relevance

• Common business metrics

STEP BY STEP: CREATING A DASHBOARD WITH AI SUGGESTIONS Step 1 - Upload a Clean Dataset

Ensure that your dataset has:

• A time element (for trend graphs)

• Numeric columns (for KPIs and bar charts)

• Columns that are categorical (for pies or grouping)

Example Dataset: Monthly Sales Data

Month Region Category Sales Profit

Jan-2023 North Furniture 50000 8000

Jan-2023 South Electronics 67000 12000

Step 2: Launch Dashboard Generation

After uploading the dataset:

• Click “Generate Dashboard”

• Data Squirrel will:

o Analyze columns (e.g. date fields, currency, categories loaded)

o Develop a flow to your visuals. Create a layout of what you'd like to show.

o Display a preview dashboard

Step 3: Review Auto-Suggested Visuals

Data Squirrel typically includes:

• Line Charts for plots of time series data (e.g., sales by year, by quarter or by month)

• Bar Charts for comparing things (e.g., profit by category)

• Pie Charts (for example, for proportions such as sales distribution)

• Tables for detailed breakdowns

• KPI Tiles summarizing key numbers

Example: Auto-Suggested Dashboard Outputs

VisualTypeExample Generated Output from AICaption: In this photo, a man is placing two gummy bears in his mouth.DataSource

Line Graph Average monthly sales per region over time

Bar Chart Comparison of the profit to product category

Pie chart Contributions to revenue by region

KPI Card Total Revenue, Total Profit, Average Sales per Order Table View data with filters (e.g., by month or region)

Business Use Case: Sales Dashboard

Once you have uploaded a quarterly sales dataset, the AI-generated dashboard would present:

• KPI Card: The number of sales is Q1 = ₹12,45,000

• Bar Chart: Comparative performance of regions in terms of profits

• Line: Trend of monthly sales from Jan to Mar

• Pie Chart: Contribution of each category to total sales

Student Exercise

Goal: Create dashboard with AI recommendations by Data Squirrel.

Steps:

Import the sample 'Retail Sales' dataset that has been made available for you to upload.

Allow the dashboard to be auto-generated by the system

Identify:

o 2 patterns from the line chart

o 1 exceptional bar in the bar chart

o 1 insight from a KPI card

Submit: A 1 paragraph brief describing what business decision could be informed by the dashboard.

10.3.4 Customizing and Editing Visual Elements

Data Squirrel's AI-created dashboards are a great base, but often in effective business communication, visuals need to be modified for the audience or context. The platform allows users to:

• Change chart types

• Filter data

• Rename axes or legends

• Format numbers

• Rearrange layout and design elements

This teaches students how to present data for boardrooms, client presentations or even academic submissions.

Step-by-Step: How to Edit Dashboard Elements in Data Squirrel

Editing a Chart

Click on any chart, and the chart editor panel will open.

Editable Properties:

• Chart Type: Change from bar, column, line, area or pie and more.

• Axes Tab: Modify axis Labels, Number Format and Intervals

• Colors – Different color palettes can be used to match a brand or for better visibility

• Legend: Show/hide or reposition

• Title: Rename chart title to focus on business.

Example:

• Original Title: “Sales by Region”

• Customized Title: “Q1 Sales By Regional Divisions (INR)”

Applying Filters to Charts

Leverage filters to tailor you visuals to particular sections.

Steps:

• Click the chart → Filters panel opens

• Apply filters for:

o Timeframe (e.g., in Jan–Mar 2023 only)

o Product category (e.g., only Electronics)

o Region (e.g., exclude low-performing regions)

Example:

• Prior to: Line chart displayed all categories of products

• After Filter being applied to display only “Furniture” category trend

Editing KPI Cards

The KPI cards show critical aggregate metrics such as:

• Total Sales

• Average Order Value

• Customer Retention Rate

Customizable Elements:

• Type of metric: (sum, average, count etc.)

• Number formatting (e.g., currency, %)

• Time range (such as YTD, last month)

• Title and color theme

Example:

• Default: “Total Sales”

• Custom: “Cumulative Revenue (Jan–Jun 2023)”

Rearranging Layout

Drag-and-drop functionality allows users to:

• Reorganize visuals by importance

• Cluster related Visuals (e.g. Sales Trend with Revenue Pie Chart)

• Resize charts for better balance

Visual Enhancement Tips for Students

Goal Action

Show a key insightMake that chart with bold titles or highlighter colors

Increase readability Use very simpel names and delete the high/medium lines Align with business

branding

Create a storytelling flow

Use color palettes appropriate for your business scenario

Order charts in a logical order (KPI → Trend →

Breakdown)

Example Scenario of Customization Workflow: Marketing Campaign Dashboard

Chart Type Customization Applied

Bar Chart Modified title to "Cost per Campaign Type"

Line Chart Filtered to only campaigns in Q2

KPI Card Total Clicks» to Avg. Clicks per Day"

Pie Chart Added new colors to match the campaign branding.

Activity

Task: Customize your AI-generated dashboard.

Blurb at least 2 titles to be more descriptive.

P10 Add a filter to one of the charts and use it to see specific region or category.

Change your dashboard layout for better visual storytelling.

Submit a one-slide summary of:

o What changes you made

o Why is the dashboard better with those changes

One lesson learned from the new-look dashboard

10.3.5 Business Interpretation of the Dashboard Outputs

This chapter concentrates on assisting students of reasoning with, interpreting and informing from the intuitive displays produced by AI instruments such as Data Squirrel. As much as visualizing the dashboard, it is also important to understand how you want to interpret your data and make business decisions.

Introduction: From Data to Decisions

Dashboards are visual instruments, not an end in themselves. They are decision-support systems for business people to determine:

• Trends

• Anomalies

• Performance gaps

• Opportunities for improvement

Students need to be able to do more than read a chart and really extract strategic meaning from visuals, KPIs, or comparisons.

Framework for Business Interpretation

When organizing interpretation instruction, students can use a 3-layer plan: Layer Question(s) to Ask Example

Observation

What does the chart/data show?

"We increased sales by 18% from Q1 to Q2."

"Growth was driven by Electronics

Insight Why is this happening?

What should we do with

in the East."

"Invest more in high-margin

Action

this insight?

categories in that region."

EXAMPLES AND INTERPRETATION TECHNIQUES Example 1: Sales Performance Dashboard

Visual: A chart showing a line that moves up and down to reflect how you might react emotionally over time is followed by these numbers:

Observation: The sales increase from ₹1.2M in January to ₹1.6M in June

Insight: Peak in April coincides with launch of marketing campaign

Action: Review the April campaign approach for repeating in other months

Example 2: KPI Cards – $ by Profit and Revenue metric=Value

Total Revenue ₹12,50,000

Total Profit ₹2,00,000

Profit Margin 16%

Interpretation:

• A retail profit margin below 20% might suggest that costs are increasing, or prices might be too low.

• High revenue v/s low profit - If you have high sales/low profits, it is time to evaluate the margins at product level (if all your products are generating margins) or operational efficiency.

Example 3: Pie Chart – Revenue by Product Category\Category % of Total Revenue

Electronics 40%

Category % of Total Revenue

Furniture 30%

Stationery 30%

Interpretation:

• The biggest revenue driver is electronics. But if it also features lower profit margins (on a different chart), the business has valued volume more than net.

• Opportunity: Reassess pricing strategy or targeting more profitable categories.

Example 4: Region-Wise Bar Chart

Region Revenue (INR) Profit (INR)

East 300,000 80,000

West 500,000 90,000

South 450,000 150,000

Interpretation:

• West has the most revenue, but South has the best profit efficiency (profits as a share of revenues).

• Business Decision: South operations optimization and West cost structure improvement.

Example 5: Customer Segment Table

Segment Avg. Order Value Conversion Rate

Corporate ₹10,000 5%

Small Business ₹6,000 12%

Individual ₹3,000 20%

Interpretation:

• Corporate clients bring high value per order but low conversion.

• People are cheap to convert but low revenue Why would you optimise for the cheapest people when none of them are profitable?"

• Action: Try tiered marketing — re-target the people for volume, while servicing corporate accounts for longer-term growth.

Common Interpretation Mistakes to Avoid

Mistake Why It's Problematic

Misses trends or efficiency insights Only considers total auxiliary loss/Coefficient moins Misses functionality implications only on number of toss-ups heard count only parts/Missing (Re)neg matching/Not considering half negs, etc.

Brushing off outliersMight miss signals of risk or opportunity Conflating correlation and causationCan result in incorrect conclusions

Failure to check the time-based trend Could result in temporal bias

2) Over-dependence on AI suggestions AI assists interpretation but does not replace analysis

Activity

Task: With your customized dashboard in Data Squirrel, answer the following questions.

Which category/segment is doing well? WHY?

What trends can we see over time?

Is there an outlier? What could explain it?

What should management focus on right away?

Based on the dashboard recommend one short-term and one long-term decision.

10.4 Summary

• Excel's Natural Language Queries (NLQ) – it lets you type questions in plain English, and have tables or charts returned as answers – no expressions to be written!

• NLQ is particularly valuable for business users who are not technically savvy, providing fast data insights through conversational requests such as "Show total profit by region.

• ChatGPT and Microsoft Copilot can help automate Excel tasks including writing formulas, cleaning data, creating summaries and recommending charts to make users' lives easier.

• ChatGPT works as a helper on the side — you type in prompts and get formulas or explanations in return; Copilot is built into Excel and gives you real-time, contextually relevant suggestions.

• Common business functions AI in Excel can be used to do include revenue calculations, growth analysis, segmentation or bottoms up planning, forecasting and visual storytelling.

• Excel's "Analyze Data" feature uses AI to find trends, outliers and patterns. It suggests

visualizations and allows users to ask questions of the data via natural language.

• Analyze Data is very useful to students who are examining data sets; it has autosummarization and insight discovery, automatic chart creation, and one-click insertion of summaries and visuals.

• Time series data is chronological, the Data you collect over time and that have elapsed over a period of time Common business like tracking sales, sitevisits and Financial analysis.

• Prediction is the act of forecasting future values based on past observations. Important time-series components are trend, seasonality, cyclicity and noise.

Excel's Forecast Sheet tool helps you build a forecast model without seeing the formulas. It uses exponential smoothing for forecasting future values.

• Students can complete line or column forecast charts by trying different parameters like a time and value column, setting the number of periods to forecast, deadline (or response), confidence interval level and seasonality.

• Data Squirrel – AI-powered dashboarding tool for users to upload their Excel/CSV dataset and get an interactive dashboard automatically generated.

• Post upload, Data Squirrel employs AI to recommend KPIs, visuals (bar, line, pie charts) and layouts that the user can still further customize.

• Students have the ability to filter, rename, resize and reorder visuals to meet their particular business storytelling objectives such as emphasis of trends, comparisons or outliers.

• It takes making that leap from dashboards to take over, essentially, going from observation (what the data says) to insights (why it's happening) and actions (how to change what's happening).

• Hands on activities for every tool focus are based on real world functionality such as sales analysis, marketing effectiveness, HR analytics and operations performance.

10.5 Key Terms

Natural Language Query (NLQ) – Ability to ask questions in natural, plain English with the ability for Power BI to formulate answers on the fly.

ChatGPT – Assistant AI that can help generate Excel formulas, explain logic and suggest data analysis ideas based on user input.

Copilot -Microsoft's Excel integrated AI assistant that offers contextual, real-time data analysis and automation Saleshub.

Analyze in Excel – A MAR feature that AI automatically extracts insights and visualizes for you.

Time-Series – A collection of data points taken or recorded at equally spaced time increments, for analysis of trends and forecasting.

Forecast Sheet – A native Excel feature that generates visual forecasting models from historical data and uses exponential smoothing.

Data Squirrel – An AI dashboarding solution which automatically turns uploaded data sets in Excel or CSV into visuals and KPIs.

KPI (Key Performance Indicator) – A quantifiable value demonstrating how effectively a company is achieving key business objectives.

10.6 Descriptive Questions

What is the value of NLQ in Excel for business students?

How can ChatGPT help me in writing complex Excel formula and understanding their meaning?

For what kind of analysis is the "Analyze Data" Feature in Excel best used?

Define trend and seasonality s used in time series forecasting?

What are some of the main things that I need to do in order to produce a forecast using Excel's Forecast Sheet?

How are students able to personalize the Dashboards created by Data Squirrel's AI?

How do you read KPI cards such as "Total Revenue" or profit margin" on a dashboard?"

What's the significance of transitioning from data watching to business acting while working with dashboards?

10.7 References

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10.8 Case Study

Visualising the Future — The ShopEase Data Journey

Introduction

Information is more valuable than ever to today's businesses, and yet organizations of all sizes have a common problem: how can they transform raw data into actionable insights? For ShopEase, a medium-sized e-commerce enterprise, an analogous struggle of handling variations in sales reports, inventory mismanagement, and reporting lateness existed. We're including a case study to better illustrate how ShopEase used AI-powered data visualization to create ripe decision making fruit on every level of their IT infrastructure tree.

Background

ShopEase had experienced rapid growth during the pandemic, as demand for online shopping soared. But growth is double-edged—its sales expanded to multiple areas and products, resulting in mountains of transactional and customer data. The organization had been using "dumb" dashboards and reports that relied heavily on manual querying with little predictive insight.

Aware that a smarter system should instead be in place, ShopEase implemented tools that utilized AI such as Power BI and Tableau with AI integrations, along with Google Cloud forecasting services.

Issue 1: The Challenge of Making Data Available to Investors

· Problem: Non-technical managers had challenges gaining insights because it required SQL or a reliance on analysts to us e the current dashboard.

· Resolution: ShopEase Tamampled Natural Language Querying with Power BI Q&A and Tableau Ask Data Managers could now ask questions such as, "Which region saw the greatest sales growth last month?" and receive instant visualisations. That democratized data to be accessed, which led to quicker reports.

Problem 2: Inefficient Inventory Management

· Problem: Stockouts and excess inventories occurred frequently because projections were made from simple historical-based averages, without regard to seasonal demand patterns.

· Solution: These were solved using AI (Prophet and LSTM based) models. These capabilities leveraged seasonality, regional trends and promotional information to provide accurate demand forecasting. Consequently, ShopEase cut the majority of its excess inventory in just six months.

Issue 3: Dead and Overloaded Dashboards

· Problem: Legacy dashboards bombarded users with a host of metrics, without context, leaving them unable to make decisions.

· Solution: For ShopEase, dashboards were redesigned with best practices in mind—well-organized hierarchy, role-specific views and AI-powered narratives. “Executive leadership were looking at strategy type KPIs, with predictive analytics; the operations team had real time monitoring dashboards. Stories from AI made irregularities less abstruse which in turn reduced misinterpretation.

Reflective Questions

How did the use of Natural Language Queries decrease ShopEase’s reliance on technical analysts?

What makes AiYield's AI/ML driven forecasting in inventory planning work better than just historic averaging?

How can design principles for dashboards influence user choices?

What is the difference between executive, operational and analytical dashboards as they apply to various levels of an organization?

What are some of the data quality challenges that ShopEase may encounter by employing AI-based predictive tools?

Conclusion

ShopEase’s journey is a testament that AI driven dashboards can improve access to data, forecasts accuracy and organizational efficiency by leaps and bounds. Through the addition of natural language queries, predictive forecasting and intelligent dashboards, it moved from reactive to proactive decision-making practices. The case provides an example of how to apply intelligent process and innovative design in combination with new technologies, to derive business value from the visualization of data.