IT & Systems

**Applications of Information
Technology in Business**

IT & Systems

Block

II

APPLICATIONS OF INFORMATION TECHNOLOGY IN BUSINESS

BLOCK II: APPLICATIONS OF INFORMATION TECHNOLOGY IN BUSINESS

The second block to the course on IT & Systems deals with the uses of information technology in the field of business. The block contains three units. Each unit presents a different area of application of information technology.

The first unit, *Personal Productivity Software*, focuses on applications software that aids in enhancing the productivity of individuals and the operational efficiency of a business, irrespective of the industry or functional area. The unit highlights the key features of widely used applications such as word processors, spreadsheets, and presentation graphics.

The second unit, *Enterprise Collaboration Systems*, deals with the key role played by the Internet, intranet, extranet, and the various groupware tools in facilitating communication, coordination, and collaboration among the members of teams within and across organizations. These systems aid in information sharing, developing strategic relationships, and facilitating coordination in organizations.

The third unit, *Management Information Systems*, examines the key role played by information systems in the various functions of an organization like marketing, manufacturing, human resources, accounting, and finance. Organizations are using these information systems to improve their business processes and to achieve strategic advantage. Organization as a system, management as control system, management decision making process, behavioral issues in decision making, MIS for digital organization, and knowledge based expert systems are discussed in the unit.

Unit 4

Personal Productivity Software

Structure

4.1 Introduction

In Unit 2 of Block I, we have introduced you to software classification. Computer software can be classified into system software In this unit we have discussed system software and application software in detail, which is used by both individuals as well as business.

Application software comprises programs that enable users to carry out certain tasks like creating documents, conducting analysis, making presentations, etc., without writing any code. Word processors, spreadsheets, presentation graphics, etc., are some examples of application software. The use of application software enhances the efficiency in operations. For instance, in a supermarket, generating bills and reports using software is likely to be quicker and more accurate than making manual calculations. There are two types of applications: vertical and horizontal applications.

Vertical applications cater to the specific function in an organization and therefore require special programmers or operators to carry out these. These applications are more expensive than horizontal applications and are used to automate the operations of a particular business function. Accounting software and bill generation software are some examples of vertical applications.

Block 2: Applications of Information Technology in Business

Horizontal applications are general-purpose programs that are common across different functional divisions of business and can be used by anybody in the organization. These applications can be used for writing, carrying out numerical calculations, and data storage by business as well as individual users. Personal productivity software is a popular horizontal application that includes word processing, spreadsheets, and presentation graphics software.

Personal productivity software also called as productivity software, or office productivity software, is an application software which helps in creating documents, databases, worksheets, presentations, audio/video clips etc which helps to increase productivity. It may also include software which prepares graphs and charts, digital paintings or even electronic music. One of the best examples for personal productivity software are office suites which includes word processing capabilities along with spreadsheets and database programs. An office suite is bundled software and are generally distributed together and the various parts of the bundle usually are able to interact with each other. This ability to interact between different programs in one suite made them very popular in a short amount of time. Such office suites gained popularity in the 1980s and they revolutionized the way in which offices work, and increased productivity. Before this most work was done by hand with paper filing and written lists and ledgers. Familiarity with such office suites gradually became an indispensable qualification for anyone wanting an office job. One of the first office suites commercially available was Starburst which came out in 1980. It was a bundle of different programs like WordStar, CalcStar and DataStar which are word processing software, a spreadsheet program, and a database respectively. Many other office suites also were made during this time, and within a decade Microsoft Office, an office suite by Microsoft became the most widely used suite. Microsoft remains at the top position for office suites even to this day.

Some office suites will also include graphics software which helps users to create, edit, and manipulate images. Graphics software can be of two major types, presentation graphics and analytical graphics. Presentation graphics is used to make a presentation of data to others and analytical graphics is used to make numeric data easier to analyze using charts and graphs like bar charts, line graphs, pie charts etc. There are also many graphics packages that specialize in manipulating photographs and there are graphics packaged to create business charts and graphs like flowcharts, 3-D graphics and wireframe models or images.

In this unit, we will deal with the horizontal applications. As part of this, we would discuss about the word processing software, spreadsheet software, and the presentation graphics software.

4.2 Objectives

By the end of this unit, you will be able to:

- Recall word processing using word processing software.
- Apply spreadsheet software.
- Demonstrate how presentation graphics software can be used for making effective presentations.

4.3 Word Processing Software

Word processing software is used for writing, editing, formatting, saving, and printing documents. Though typewriters have been in use for quite some time, they are meant only for writing purpose. Any sort of modification would require retyping the entire document. Using word processing software like MS Word, the user can make alterations to the document without having to retype the entire document.

4.3.1 Writing

Word processor enables one to quickly create quality documents. Writing is made easy using a word processor. Apart from writing, features like word wrapping and autosave also help in document creation. Word wrapping enables the user to automatically move to a new line. Using the enter key at the end of the sentence will enable the user to start a new paragraph. The created document should be saved in a permanent location, as it is initially stored in the Random Access Memory (RAM) of the computer, which is a temporary memory. The autosave feature enables users to save the document automatically at specified time intervals. This feature is mostly useful in case of power failure or an unexpected system failure as it helps in minimizing any loss of data. Dictionary, spell check, document outline, etc., are the other features in a word processor that help in creating documents.

4.3.2 Editing

Prior to word processing software, editing documents was a tedious task. Editing (insertions and deletions) has become faster and easier due to the flexibility of a word processor. Insert mode and type over mode are the features that facilitate typing. In the insert mode, the text moves to the right as the user starts typing so that he/she can insert text in the middle of the document. In the

type over mode, the new text replaces the existing text. The cut and paste option is used to reorganize the document after typing. When a portion of the text is cut, it is stored in a temporary location called clipboard until it is pasted back. Spell checker and grammar and style checker are the two editing tools in a word processing software. The spell checker uses an in-built dictionary to ensure that the words are spelt correctly while the grammar and style checker uses algorithms to detect any grammatical errors.

4.3.3   Formatting

When the content of a document has been written, the user can change the layout and/or style of the printed page using various formatting features of the word processor such as margins, page orientation (landscape/portrait), justification, and line spacing. You can also make use of spelling and grammar checkers which checks the document for misspellings and grammatical errors. A thesaurus can help the user select synonyms to avoid multiple use of a same word, and you can know, how many words the document has; using the word count feature. Most word processing programs also contain mail-merge options which enable the user to print customized form letters. Common word processing software includes Microsoft Word, Corel WordPerfect, and Lotus Word Pro

Formatting relates to the appearance of the document. Apart from the content, it is also important for any document to be presented in a neat and clear format. The word processing software has a default format for margin, tab, and line spacing. However, the user can change the format settings based on the requirements. Document formatting can be done at three levels: character, paragraph, and section levels.

Character formatting allows the user to modify the character size, fonts, emphasis, superscripts, and subscripts.

Paragraph formatting includes justification, line spacing, footnotes and endnotes, automatic hyphenation, tables, table of contents and index, style sheets, graphics, and web integration.

Section level formatting includes formatting or changing the sections in a document, and in turn formatting the entire document. Users can choose headers and footers for the document; set the margins from the top, right, left, or bottom of the page; set the paper size; number the pages; number the lines; insert date; insert page titles; set paper source; set page borders; set vertical alignment; and also set page orientation.

4.3.4   Saving and Printing

After writing, editing, and formatting, the document needs to be saved to enable users to revert to the document sometime later. The document is generally saved in a specific location on the hard disk with a filename. Different operating systems follow different file naming conventions. For instance, DOS allows a

filename with only 8 characters while Mac allows 32 characters. The user can also print the document by using the print option and changing the settings and format as per his/her requirements. The user can choose various options like number of copies, number of pages, type of printing (landscape, portrait), and print quality.

4.3.5 Other Features

Other features in a word processor include hyperlink; drawing/inserting table, charts, pictures; formulae; mail merge; online collaboration; document protection; etc.

Using Hyperlinks you can give fast access to information which is on the web or in any other part of your document. Adding hyperlinks to your Word document is an easy process in most office suites. A word or a phrase in your document may be used as a link to connect to a webpage, just like the links you encounter on websites. You will need to decide which part of the text should be used as the link and you should know the address or URL of the webpage that you want to link to. If a document is very large, you may also use hyperlinks to link to different sections of the text, so the reader doesn't have to scroll through the whole document to reach where they want. For example, you might tell a reader that they'll "find more information on the subject in Part 2"and you can turn that into a hyperlink instead of leaving them to find Part 2 on their own. To do this you have to set up a bookmark in the document. The link will take you to this bookmark. Creating bookmarks is also an easy procedure, place the curser where you want to add the bookmark, and then insert a bookmark. Hyperlinks may also be used to link to email addresses, for example if you are giving your contact information. Hyperlinks can also be used to create a new blank document. Once you have created a hyperlink, it is possible to edit it, in case you want to change something. If you do not want a hyperlink which is in the document, you also have the option of deleting/ removing the hyperlink (the text still remains without the linking effect).

Check Your Progress-1

1. Applications are classified into vertical and horizontal applications. Which of the following is a **true** statement regarding these applications?
   a. Horizontal applications cater to the needs of a particular business function.
   b. Vertical applications are general-purpose programs that can be used for writing, numerical calculations and data storage.
   c. Horizontal applications are less expensive than vertical applications.
   d. Vertical applications are common across different functional divisions of business.

2. What is personal productivity software? To which classification of software does it belong?

3. An accounting software is a _____.
   a. Horizontal application
   b. Vertical application
   c. Word processor
   d. System software

4. What is the function of an 'autosave' utility in a word processor?

5. Which of the following levels of document formatting involves the use of footnotes, tables, and style sheets?
   a. Character level
   b. Paragraph level
   c. Section level
   d. None of the above

6. What is section level formatting?

7. Explain the clipboard feature.

4.4 Spreadsheet Software

In a spreadsheet, data (generally numeric) is represented in a tabular form consisting of rows and columns. Spreadsheets allow users to create information in the form of tables that can be manipulated and represented as graphs and charts. Users can also perform numerical operations and use formulae for making complex calculations. In a spreadsheet, a cell is the intersection of a row and column. When a formula is applied to a cell, the result gets displayed, and the user can only view the final result as the formula is hidden from the user. This makes spreadsheets useful for what-if analysis and other complex calculations. MS Excel (Excel) is an example of spreadsheet software.

Before the invention of spreadsheet software we made use of non-electronic spreadsheets which consisted of grids of rows and columns printed on a special green paper. Such spreadsheets were used by accountants to produce financial projections and reports. In 1978 Daniel Bricklin, a student at Harvard Business School, created the first electronic spreadsheet called Visi-Calc. This electronic spreadsheet allowed users to create tables and financial information by entering data into rows and columns arranged as a grid on a computer screen instead of paper. Spreadsheet software helped in automating many functions of financial

record keeping and data analysis. Spreadsheet software made microcomputers into an essential business tool. Electronic spreadsheets are also used by individuals to track household budgets and balance checkbooks, by business people to create budgets, and by educators to track student grades.

4.4.1 Workbook

In Excel software, a workbook is a file in which data is entered and stored. Each workbook contains a number of worksheets. A workbook can be called as a book and the worksheets as pages in that book. For instance, all the student details in a school can be entered in a workbook and each worksheet can contain the details of students belonging to a specific class in the school.

4.4.1.1 Worksheet

A worksheet is a matrix of rows and columns. The columns in a worksheet start alphabetically from 'A' and the rows numerically from '1.' A worksheet has 256 columns and 65,536 rows. Each cell has an address and the cell currently being used is called the active cell. The contents of the active cell like text boxes, numbers, and formulae, are displayed in the formula bar. Text boxes (or labels) explain the numbers that have been entered in the cell, numbers are values entered in the cell, and formulae are mathematical expressions that are used to perform calculations on the values entered in the cell. The user can simultaneously enter and edit data on several worksheets and can also carry out calculations using data from these worksheets.

The different parts of a worksheet are:

- **Title bar** – The Title bar appears first on the top of the worksheet and displays the name of the worksheet. For example, Microsoft Excel – Data Analysis.

- **Menu bar** – The Menu bar appears directly below the Title bar and displays the menu with the following options: File, Edit, View, Insert, Format, Tools, Data, Window, and Help.

- **Toolbar** – Toolbars provide shortcuts to menu commands and are generally located just below the Menu bar. They consist of the standard toolbar and the formatting toolbar. The standard toolbar displays options for opening, saving files, cut, copy, paste, etc. The formatting toolbar displays options for document alignment and style.

- **Column heading and Row heading** – Column and row headings are used for addressing a particular cell. Cell addresses are useful for cell referencing. For example, A5 refers to the cell in the first column and the fifth row of the worksheet.

- **Window controls** – Window controls enable users to zoom a window, restore a window to its previous position, or hide a window from view.

- **Scroll bars and scroll arrows** – Scroll bars and scroll arrows are used for scrolling the sheet. These are used to move the sheet to view the required portion of the sheet on the screen.

- **Sheet tab** –A user can click on the sheet tab to switch from one sheet to another, when he/she is simultaneously working on more than one sheet. Alternatively, CTRL+PgUp and CTRL+PgDn can also be used.

4.4.2 Effective Worksheets

Worksheets might be used for many purposes and might be targeted at different sets of audiences. Before designing a worksheet, the user has to set out the purpose for which the worksheet will be used and the kind of audience that is being targeted at. Following suggestions help in developing effective worksheets.

- A proper title should be given to the worksheet so that the user gets an idea of what is presented in the worksheet. For example, a yearly sales report for 2007 can have a worksheet title as Annual Sales Report – 2007.

- The purpose of the worksheet should be clearly stated. For example, specific names like analysis report, sales report, information report, etc., should be given.

- The format in which data is entered should be specified clearly. For example, if a person wants the input value to be in dollars, then the input format should be changed to dollars (e.g., $45).

- Cell referencing should be used for applying formulae to data.

- Data entry cells should be different from calculation and output display cells.

4.4.3 Data Types

In Excel, four different types of data can be entered or displayed in the cells. These are: Text, Numbers, Logical, and Error.

- **Text** – Text data type consists of a combination of letters, numbers, and special characters. For example, Nikhil, Class 1, etc.

- **Numbers** – Numbers are aligned to the right by default. Dates and Times are displayed based on the selected format. For Excel to consider a number as text, an apostrophe (') should be placed before the number. An unformatted number will be displayed in a scientific notation if it does not fit in a cell while a formatted number will be displayed as #### if it does not fit in a cell.

- **Logical** – Logical data type consists of values in the form of TRUE and FALSE. Excel gives out these values when certain types of functions are used like Information function ISBLANK. The function verifies whether a

particular cell is empty or not and gives out the result as 'TRUE' or 'FALSE'.

- **Error** – In Excel, errors are displayed as #VALUE. This indicates that the value that has been referred to or used in the formula is not correct.

4.4.4 Operators

Operators specify the type of calculation that the user wants to execute on the elements of a formula. Following are the four types of operators in Excel:

- **Arithmetic operators** – These operators execute the basic mathematical operations like addition (+), subtraction (-), division (/), multiplication (*), percentage (%), and exponentiation (^). They also combine numbers and generate numeric results.

- **Comparison operators** – These operators compare two values and then generate the result in the form of a logical data type, i.e., TRUE or FALSE. Equal to (=), less than (<), greater than (>), less than or equal to (<=, $\leq$), greater than or equal to (>=, $\geq$), and less than or greater than but not equal to (<>, $\neq$) are the various comparison operators.

- **Text operators** – The text operator 'Ampersand' or '&' concatenates text values in two or more cells to generate a single value. For example, cell A5 contains Taj and cell C5 contains Mahal. The command =A5&C5 can be used to combine the text in the two cells. This would produce the result Taj Mahal.

- **Reference operators** – Reference operators combine a range of cells for calculation. Colon (:), comma (,) and space (blank space) are the reference operators. Colon, also called as the range operator, indicates all the cells between and including the given two references. Comma, also called the union operator, combines multiple cell references to form a single reference. Space (blank space), also called the intersection operator, generates a single reference to all the cells that are common to the two given references.

4.4.5 Cell Formats

The data entered in the cell can be formatted either in a word processing format or in a numeric format. In the word processing format, the font, font size, and text alignment are specified while in a numeric format, subscripts are assigned to values to express them in terms of money, percentage, fraction, decimal, and date. For example, the value 50,000 can be formatted as $50,000 or £50,000 and so on.

4.4.5.1 Format Cells Dialog Box

Users can use many options to format cells in a worksheet. To format cells, they have to first select the particular cell or cells that are required to be formatted. They then have to click on the menu bar and select the option Format. A drop-down menu appears from which the option called Cells needs to be selected. A Format Cells dialog box appears with the following tabs.

- **Number tab**: It allows the user to select data types. The various data types that Excel provides are general, number, currency, accounting, date, time, percentage, fraction, scientific, text, special, and custom. If the user wants all the values to be expressed in Dollars ($), then the data type 'Currency' has to be selected. This would in turn list out a set of options like the currency to be inserted and the way it should be depicted.

- **Alignment tab**: It enables the user to modify the position and the alignment of data within the cells. Excel allows the user to change the indent; change the direction of the text; align the text horizontally or vertically; and shrink the text, wrap the text, or merge the cells.

- **Font tab**: It enables the user to change the font size, style, and effects of the text.

- **Border tab**: It allows the user to add borders with different styles and colors.

- **Pattern tab**: It allows the user to add color to the selected cells and change the background style.

- **Protection tab**: It enables the user to lock cells and hide formulas. This option will work only if the worksheet is protected (discussed later).

4.4.6 Freeze Panes

The row headings may disappear as the worksheet is scrolled down. Similarly, the column headings may disappear as the worksheet is scrolled to the right. Freeze panes are used to ensure that the headings appear all the time even when the worksheet is scrolled down or scrolled to the right. To freeze the headings: select the headings (row or column) that need to be frozen, go to the menu bar, select the option Windows, and click on the option Freeze Panes. To undo freeze panes, the frozen headings should be highlighted, the Windows option selected, and the option Unfreeze Panes clicked on. This unfreezes the headings.

4.4.7 Using Formulae

Spreadsheets are used to carry out simple arithmetic operations like addition, subtraction, multiplication, and division as well as apply complex formulae to values and compute results. In Excel, formulae should be entered starting with an 'equal to' (=) sign and then followed by the values or cell references.

If B3 contains 564, B4 contains 258, and B5 contains 387, then to calculate the sum of the range of cells from B3 to B5, one has to type =SUM(B3:B5) in a cell. The calculation gets executed immediately and the result gets displayed in the cell. The formula that was entered to compute the result will be visible only in the formula bar.

In situations where the formula contains more than one operator, the operators are evaluated based on the following priority order: %, ^, * and /, + and -, and &. For example, the formula, =2+3*10 would give the result as 32. The operators that belong to the same order of priority will be evaluated in the formula from left to right. The evaluation order within a formula can be changed using a parentheses. The expression within the parentheses is given priority before all the arithmetic operators. For example, the formula =(2+3)*10 evaluates to 50.

Exercise

A. In Microsoft Excel, the formula, =3 + 5*6 would give

a. 33

b. 48

c. 23

d. An error

4.4.8 Replication

Replication is used when the user wants to apply a formula to values in more than one cell or range of cells. In replication, the formula is copied and applied to a range of cells by dragging the mouse and selecting the cells. This process saves time, eliminates redundancy, and is easy to use.

4.4.9 Cell References

Values when entered directly in the formula might lead to errors as they may be wrong. Also, it would be difficult to identify the error as the formula is visible only in the formula bar. Cell references are used to solve this problem. In cell referencing, the user specifies cell addresses on which the formula needs to be applied. These references enable easy access of data and increase the data validity. There are three types of cell references:

4.4.9.1 Relative Cell Reference

Relative cell references are relative to the position of the formula. In a formula, the cell references are usually based on their position relative to the cell that contains the formula. For example, if cell B2 contains the formula =A1; Excel finds the value one cell above and one cell to the left of B2. When this formula is copied and pasted to the cell below it (B3), the formula in the cell would

change to =A2. This refers to the value one cell above and one cell to the left of B3.

4.4.9.2 Absolute Cell Reference

Absolute cell referencing (or absolute positioning) is used when a user does not want references to change when he/she copies a formula to a different cell. These cell references always refer to cells in a specific location. To ensure that the reference does not change, a $ is inserted before the column letter or a $ before the row number or both. For example, the formula '=A2*B2' multiplies values in cell A2 with values in cell B2. If this formula is copied to another cell, both the references will change. An absolute reference can be created to cell B2 by placing a dollar sign ($) before the parts of the reference (=A1*B2) that should not change. This sign locks the cell location to a fixed position and when it is copied and pasted, it remains exactly the same.

4.4.9.3 Mixed Cell Reference

Mixed cell referencing is a combination of relative and absolute cell references. In this referencing, the formula is partly relative and partly absolute. For example, the formula '=B3+C3+D3' adds cells B3, C3, and D3. All the references will change if the user copies this formula to another cell. A mixed reference can be created to cell C3 by placing a dollar sign ($) before 3 (=B3+C$3+D3) so that those parts of the reference do not change.

Exercise

B. Radha multiplies the quantity in cell A3 with that in cell B3 using the formula '=A3*B3'. She wants to create an absolute reference formula to cell A3 and copy the formula to other cells. Which of the following formulas shows the correct absolute reference to cell A3?

a. = A$3*B3

b. = $A3$*B3

c. = A3*B3

d. = A3*B3

4.4.10 Sorting

Sort Ascending (A-Z) and Sort Descending (Z-A) are the sorting buttons in spreadsheets that sort the data in an ascending or descending order. To sort data based on one column; the cells that need to be sorted should be selected and the ascending or the descending buttons on the standard toolbar clicked on, followed by OK. The cells will automatically get sorted based on the specified column and order.

4.4.11 Filtering

Filtering enables viewing of only those records that satisfy a certain criteria. AutoFilter and Advanced Filter are the two types of filters in Excel.

4.4.11.1 Auto Filter

AutoFilter helps in selecting and displaying only the data that is required. For instance, an employee database contains details about all the employees in the company working throughout India. Using an AutoFilter, it is possible to find out the number of employees working in a particular state, say, Andhra Pradesh, and their details. Following are the steps that a user has to go through for filtering data using AutoFilter.

- Insert data in a worksheet. Select a cell in the table.
- Go to the Data menu, click on the Filter option, and then select the AutoFilter option. With this selection, the AutoFilter option gets activated showing arrow buttons in all the cells with field names.
- To extract the records, click on an arrow button in the column. If the user wants to give any conditions for filtering, he/she can click on Custom and give in the instructions.
- Once setting the filtering criteria, the records that meet the specified criteria will get displayed. These records can also be copied to another location.

To undo AutoFilter, the option should be deselected from the Data menu.

4.4.11.2 Advanced Filter

Advanced Filter option in Excel is similar to the AutoFilter option. However, it provides certain additional features like copying the filtered data to another location; copying only the selected columns in the table to another location; and displaying only those records that meet the specified criteria. The filtering criteria could include multiple conditions that can be applied to a single column as well as multiple columns.

4.4.12 Functions

A function is a special keyword which can be entered into a cell in order to process some data which is appended within brackets. The syntax for using functions is: cell address =Function Name (Data). The arguments passed to a function often include a range of cells. Excel recognizes these functions provided they are preceded by an equal sign and end with brackets. A typical spreadsheet program contains over 100 different functions. These functions are useful in performing simple and frequently used calculations. Some examples are =sum (A1:A4), =average(B2:B6), etc. Following are the different types of functions in Excel.

4.4.12.1 Financial Functions

Financial functions help in conducting simple and complex financial calculations. Some of the financial functions in Excel are DB (for calculating depreciation), FV (for calculating the future value of an investment), IRR (for calculating the internal rate of return), NPV (for calculating the net present value of an investment), RATE (for calculating the rate of interest per period of an investment), etc.

4.4.12.2 Date & Time Functions

Date & time functions pertain to the date and time values and operations in Excel. Some of these functions are used for displaying the system date, system time, etc., while others are used for changing or manipulating the date and time values that are already stored in the database. Some of the date and time functions in Excel are DATE (that represents date in the Excel format), DAYS360 (that gives the number of days between the starting day and ending day based on a 360 day year), HOUR (that represents the hour as a number from 0-23, i.e., from 12:00 am to 11:00 pm), NOW (that gives the current date and time based on the Excel format), TIME (that converts the hours, minutes, and seconds given in the number format to the Excel format), etc.

4.4.12.3 Mathematical & Trigonometrical Functions

Mathematical & trigonometrical functions enable the user to make certain calculations like finding the square root, finding the sum of a set of numbers, finding the tangent of an angle, etc. Some of the mathematical and trigonometrical functions in Excel are ABS (used for finding the absolute value of a given number), FACT (used for finding the factorial of the given number), SQRT (used for finding the square root of a given number), SUM (used for calculating the sum of a given range of numbers), TAN (used for giving the tangent of an angle), etc.

4.4.12.4 Statistical Functions

Statistical functions help in summarizing, comparing, and grouping data, and finding out the relationships between two sets of data. Some of the statistical functions in Excel are AVERAGE (for calculating the average or arithmetic mean of a given set of numbers), CORREL (for calculating the correlation coefficient between two sets of values), COUNT (for counting the number of cells that contain numbers), MAX (for giving the largest value within the given set of values), PERMUT (for giving the number of permutations in which the given number of objects could be selected from the total set of objects), etc.

4.4.12.5 Lookup & Reference Functions

Lookup & reference functions enable the user to look up for a particular row or column or find a specific reference in the worksheet. Some of the lookup and

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reference functions in Excel are ADDRESS (that generates cell reference as a text based on the given row and column numbers), COLUMN (gives the column number of a reference), HYPERLINK (generates a shortcut for opening a document that is stored in the hard drive, a network server, or the Internet), ROWS (gives the number of rows in the array or the reference), TRANSPOSE (that converts a horizontal range of cells into a vertical one and vice versa), etc.

4.4.12.6 Database Functions

Database functions are specially designed to be used for databases. They are used for a range of values that extend more than one row or one column. Using these functions, a database can be referred to by using the range or cell references. Some of the database functions are DAVERGAE (gives the average of the values in a list or a column of a database based on the specified conditions), DGET (takes out a single record from the database that matches the specified conditions), DMIN (lists the smallest number in the field or the column of the records in the database that match the specified conditions), DPRODUCT (multiplies the values in the field or the column of records in the database that match the specified conditions), DSUM (adds the values in the field or the column of records in the database that match the specified conditions), etc.

4.4.12.7 Text Functions

Text functions are designed to be used for the text data type. These functions can be used for making modifications to the existing text. Some of the text functions in Excel are CHAR (gives the character that refers to the specified code number from the set of characters in the computer), CLEAN (deletes all the non-printable characters from the text), DOLLAR (changes a number to text using the currency format), SUBSTITUTE (replaces the existing string of text with new text), UPPER (changes the given string of text into all uppercase letters), etc.

4.4.12.8 Logical Functions

Logical functions are used to evaluate an expression. The results are displayed in the form of logical operators like TRUE, FALSE, etc. These functions are usually used for making a comparison between two values. The logical functions in Excel are AND (verifies whether the given arguments are true and gives the result as TRUE if all the arguments are true), FALSE (gives the logical value FALSE), IF (verifies whether the given condition is satisfied and gives one value if TRUE and another value if FALSE), NOT (converts TRUE to FALSE or FALSE to TRUE), OR (verifies whether any of the given arguments are true and gives TRUE or FALSE. If all the arguments are false, it gives FALSE), and TRUE (gives the logical value TRUE).

4.4.12.9 Information Functions

Information functions provide information about the various aspects of the worksheet. For instance, these functions are used for finding out information about a particular cell, about the environment in which the user is operating, etc. Some of the information functions in Excel are CELL (gives information about the location, contents, or formatting of the upper left cell in a reference), INFO (provides information regarding the environment in which the user is currently operating), ISLOGICAL (verifies whether the given value is a logical value, i.e., TRUE or FALSE and gives TRUE or FALSE), ISTEXT (verifies whether the given value is a text and gives TRUE or FALSE), NA (gives an error value (#N/A) if the value is not available), etc.

4.4.13 Analysis Tool Pak

Excel provides a set of data analysis tools called Analysis ToolPak as an add-in feature that helps the users to perform complex statistical analyses within a short time. To install the add-ins, the users have to go to the menu bar and click on the Tools menu. A drop-down menu appears from which the option 'Data Analysis' has to be selected. Then, a dialog box appears with a set of statistical analysis tools. Some of the tools available in the Excel Analysis ToolPak are correlation, covariance, regression, t-test, z-test, etc.

4.4.14 Spreadsheet Charts

Spreadsheet charts are diagrammatic representations of the data presented in a spreadsheet. Spreadsheet charts include column charts, bar charts, line charts, and pie charts. Column charts are horizontal bars that show comparison between separate items. These are used to show changes over time, usually known as time series. Bar charts comprise vertical bars that show comparison of items. They are more useful in comparing items than for time series. Line charts are used in time series analysis to show trends or changes over different time periods. Pie charts are used to express the relative percentage of each portion as parts of the whole. In pie charts, values are expressed in percentage terms. For example, the population of Karnataka as compared to that of South India can be represented by a pie chart.

4.4.14.1 Chart Wizard

The Chart Wizard guides the user through the process of creating a chart by asking him/her to provide the various chart specifications like data range, chart type, chart format, chart title, legend, etc. The wizard allows the user to create either an embedded chart or a chart sheet. An embedded chart is placed and saved within the same worksheet where the data is located while a chart sheet is a new worksheet which is kept separate from the worksheet on which the data is given.

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4.4.14.2 *Creatin*\d a PivotChart.

Activity: Following are the details of a number of schools and colleges in South India. Create a column chart based on these details.

State	Number of Schools	Number of Colleges
Andhra Pradesh	1,516	776
Tamil Nadu	1,239	853
Karnataka	1,118	987
Kerala	1,465	829

Answer:

- Select the data and go to the Data menu. A drop-down menu appears from which the option PivotTable and PivotChart Report has to be selected. Alternatively, the user can also click the PivotTable and PivotChart button on the toolbar.

- A PivotTable and PivotChart wizard is displayed. It lists out a series of instructions like the data to be analyzed, the report to be created, the data to be used, and the location of the report.

- After entering all these details, a PivotTable appears along with a PivotTable field list. The user has to drop in the fields from the field list in the table based on row area, column area, page area, and data area.

- After creating a PivotTable, the user can also create a PivotChart. To create a chart, the user has to select the PivotTable that has been created, right click on the mouse, and select the option PivotChart. A chart containing all the details of the table gets displayed automatically. The user can also select the type of chart he/she wants to create.

Block 2: Applications of Information Technology in Business

Activity: The marketing department of Ecstasy Furnitures Pvt. Ltd., collected the following internal data on the furniture sales achieved by the company in three cities (Hyderabad, Chennai, and Trivandrum), based on the advertising method used by the company during the first quarter of the year 2007. Create a single PivotTable to compare the different advertising methods in terms of a) total cost of goods sold (in ₹), b) total sales (in ₹)), and c) total profit (in ₹)).

Month	Method of Advertising Used	City	Cost Incurred per Unit (in ₹)	Quantity Sold (in Units)	Cost of Goods Sold (in ₹)	Sales (in ₹)	Profit (in ₹)
January	Internet	Hyderabad	50	500	25,000	26,000	1,000
January	Newspaper	Chennai	35	650	22,750	25,000	2,250
January	Television	Trivandrum	65	700	45,500	50,000	4,500
January	Radio	Hyderabad	25	450	11,250	12,000	750
January	Direct Sales	Hyderabad	30	350	10,500	12,500	2,000
February	Internet	Chennai	50	500	25,000	26,000	1,000
February	Newspaper	Hyderabad	35	650	22,750	24,000	1,250
February	Television	Chennai	65	700	45,500	46,000	500
February	Radio	Trivandrum	25	450	11,250	15,000	3,750
February	Direct Sales	Trivandrum	30	350	10,500	12,000	1,500
March	Internet	Trivandrum	50	500	25,000	35,000	10,000
March	Newspaper	Trivandrum	35	650	22,750	26,000	3,250
March	Television	Hyderabad	65	700	45,500	52,000	6,500
March	Radio	Chennai	25	450	11,250	13,750	2,500
March	Direct Sales	Chennai	30	350	10,500	12,000	1,500

Answer:

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4.4.15 Macros

Macros are used to automate a frequently carried out task in Excel. A macro is a symbol, name, or key that represents a list of commands. Macros are saved as files on the system and later, when the macro name is entered, the entire set of operations is executed. Using a macro is like recording a song on a tape recorder. When a macro is invoked, the operations carried out in the workbook are continuously recorded until it is stopped. When the macro is run, the operations or the commands which were recorded earlier will be played. Proper care should be taken while recording a macro as even a small mistake in the process would be recorded. Every time a macro is recorded, it is stored as a new module in the workbook. Macros are used for tasks like printing a block of worksheet, copying the formulas to a new row, etc.

4.4.16 What-if Analysis

Using what-if analysis, one can find out how the goal can be achieved after considering the changes that might occur in the variables. Based on the possible changes in the variables, several permutations and combinations can be tried out on the outcome. For instance, if sales forecast is to be done based on the expected demand, various values can be substituted for demand before arriving at the sales figure. What-if analysis can be performed using scenarios, solvers, data tables, and goal-seek analysis.

4.4.17.1 Scenario

A scenario is a specific set of values that can be saved in Excel and which can be automatically substituted in a worksheet. It is used for planning the outcomes of data by modifying various cells in the worksheet. The Scenario Manager is used for entering the values in a worksheet and to forecast the outcome of the data. These values are stored for future use and are stored in a hidden part of the workbook. The Scenario Manager retrieves these values to show the scenario that uses those specific values. Scenarios are generally used for predicting the future values and for conducting a Best Case/Worst Case scenario regarding a situation. For instance, scenarios can be used for budgeting, for finding out the effect of changes in discount rates on the sales, interest rates on loan or investment, etc.

4.4.17.2 Solver

Solver is an optimization and resource allocation tool that helps in finding out an optimal value to a cell called the target cell in a worksheet. The target cell can be set to a certain value and the values in the changing cells can be adjusted to get the result that is specified from the formula in the target cell. The value can also be restricted by adding some constraints. For instance, a solver can be used to find out the effect on the profit due to a change in the advertising

expenses. Solver can be used for scheduling, income maximization, product mix, routing, portfolio management, etc.

4.4.17.3 Data Tables

Data tables consist of a range of cells that displays how changing some values in the formula will affect the final results of the formula. These tables are used for creating multiple versions of a single operation and enable comparison of these versions in the worksheet. Data tables can be one-variable or two-variable. In a one-variable data table, either a row or a column that is part of the formula can be changed to find out the change in the final results of the formula. In this, the input values are either column-oriented (i.e., listed down a column) or row-oriented (i.e., listed across a row). The formula used must refer to an input cell. In a two-variable data table, both a row and a column can be changed to find the change in the final results of the formula. In this, the input values are both column-oriented as well as row-oriented. The two-variable data table uses only a single formula but with two sets of input values, i.e., the formula refers to two different input cells.

4.4.17.4 Goal Seek Analysis

Goal seek analysis is the reverse of what-if analysis. It modifies the variables so that the targets are met. In goal seek, Excel changes the value of a particular cell until the formula which it is dependent on gives the required result. For instance, this tool can be used if the user wants to know the interest rate that gives the required amount of interest. Goal seek analysis can be used for finding out the price of a product based on the given break-even point, for finding out the discount rate on the products to get the required amount of profit, etc.

Activity: A fast food joint is exploring the possibility of opening a new store in one of two prospective locations. It wants to determine which of the locations would attract a greater number of customers and generate more revenues. Claire's supervisor has assigned her the task of analyzing the various scenarios. What are the various spreadsheet features that can be used for conducting this 'what if' analysis? Claire's company has a corporate license for the Microsoft Office suite of products.

Answer:

_____

_____

_____

_____

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4.4.17 Protecting Worksheets

Excel provides a set of security options that helps the users to protect their data in the worksheets. Following are the various options.

4.4.18.1 Worksheet Level Protection

The worksheet level protection protects the worksheet and does not allow any alterations in the worksheet. To protect a worksheet, the user has to go to the menu bar and click on the Tools option. A drop-down menu appears from which the option called Protect Sheet should be selected. A dialog box appears asking the user for which all/one of the following are/is to be protected: contents, objects, and/or scenarios. The dialog box also asks the user for a password (optional). Once the details are entered, the worksheet gets protected. To unprotect the worksheet, the above process should be repeated and the password retyped (if entered earlier).

4.4.18.2 Cell Protection

Cells can be protected only when the entire worksheet is protected. Excel locks all the cells by default. In order to enter data, these cells need to be unlocked. To unlock the cells, select the range of cells in which data is to be entered. Go to the Menu bar and click on the Format option. A drop-down menu appears from which the option called Cells has to be selected. A dialog box called Format Cells gets displayed with tabs. Select the Protection tab. Alternatively, the user can also press CTRL+1. The Protection tab lists two options: Locked and Hidden. The Locked option cannot change the cells after the sheet has been protected while the Hidden option hides the formulas after the sheet has been protected. Deselect the Locked option. Click on the OK button and ensure that the worksheet is protected. Now, the user can enter data into those cells while the others will still continue to be protected.

4.4.18.3 Workbook Level Protection

Though a worksheet is protected, the user cannot prevent copying, moving, or deleting the workbook. Therefore, a workbook needs to be protected. To protect the workbook, go to the menu bar and click on the Tools option. A drop-down menu appears from which the option called Protect Workbook has to be selected. A dialog box called Protect Workbook appears on the screen asking for which all/one to be protected: the structure and/or windows. Once the details are entered, the workbook gets protected. To unprotect the workbook, the above process should be repeated and the password retyped (if entered earlier).

4.4.18.4 File Level Protection

File level protection is the highest level of protection that requires the user to enter a password to open a workbook. To protect a file, go to the menu bar and click on the File option. A drop-down appears from which the option called Save As should be selected. A window appears with a toolbar that has an option called Tools. Click on it and a drop-down menu appears. Select General Options. A dialog box appears asking for the following details: whether to create a backup, a password to open, a password to modify, and whether it should be opened as read-only. After entering the details, click on the Save option and save the file. As the file has already been saved, replace the existing file. With this, the file gets protected. The file can be unprotected by repeating the above process and clearing the passwords given.

Check Your Progress-2

8. What is a spreadsheet?
9. Which of the following parts of the worksheet has options of edit, view, insert, help, etc?
   a. Title bar
   b. Menu bar
   c. Standard toolbar
   d. Formatting toolbar

10. Ampersand (&) is a/an _____.

    a. Text operator
    b. Reference operator
    c. Comparison operator
    d. Arithmetic operator

11. What are comparison operators?

12. Which of the following data types consists of values in the form of TRUE and FALSE?

    a. Text
    b. Error
    c. Logical
    d. Numerical

13. The reference operator 'Space (a blank space)' is also called

14. In Microsoft Excel, which of the following symbols is used to create an absolute cell reference?

    a. *
    b. ()
    c. $
    d. =

15. What are the various Lookup & Reference functions in Microsoft Excel? Explain the function of 'HYPERLINK'.

16. The Format Cells dialog box in Microsoft Excel provides users with many options to format cells in a worksheet. The dialog box contains many tabs. Which of the following tabs allows users to add color to selected cells and change background style?

    a. Pattern tab
    b. Font tab
    c. Alignment tab
    d. Border tab

17. Arjun has to make a presentation on his company's performance in the previous financial year. In his presentation, he wants to display the market shares (in percentage) of the company and its competitors. Which type of chart would help Arjun?

18. What-if analysis can be performed with the help of various tools. Which of the following tools is most appropriate for conducting the Best Case/Worst Case analysis for a given situation?

    a. Solver
    b. Scenario
    c. Data table
    d. Goal seek analysis

19. Match the following:

i. Function	p. A symbol, name or key that represents a list of commands
ii. Macro	q. Used when it is necessary to apply a formula to values in more than one cell or a range of cells
iii. Replication	r. A special keyword which can be entered into a cell to process some data which is appended within brackets

20. Match the following operators with their respective functions.

i. Arithmetic operators	p. Concatenates values in two or more cells
ii. Comparison operators	q. Execute the basic mathematical operations like addition, subtraction, multiplication, and division.
iii. Text operators	r. Combine a range of cells for calculation.
iv. Reference operators	s. Generate the result in the form of a logical data type

21. In situations where the formula contains more than one operator, they are evaluated sequentially based on priority. What is this priority?

22. In Microsoft Excel, Catherine entered a formula in cell A3 as =B3 + C3 and copied it to the three cells below A3. What type of cell referencing has Catherine used?

23. A _____ is a series of dialog boxes that directs the user to create a chart or modify an already existing chart.

    a. Chart sheet

    b. Embedded chart

    c. Chart wizard

    d. Worksheet

4.5 Presentation Graphics Software

Presentation graphics software uses a visual metaphor, i.e., a slide or transparency that is used in making presentations. Each page of a presentation is called a slide. Microsoft PowerPoint is an example of presentation graphics software.

4.5.1 Output Options

Following are the output options in presentation graphics programs.

- *On-screen show* – Using this, the user can use the computer as a medium for making presentation. This is a preferable option for an audience of three or less. With a projector, on-screen show can be used for larger audiences also.

- *Transparencies* – Printing can be done on clear sheets of plastic. These are designed to be used with an overhead projector.

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- *35-mm slides* – These are used for a large audience and require a good slide projector and a light-adjustable room.

- *Audience handouts* – These contain matter written in the slide along with some space left for notes meant for the audience.

4.5.2 Templates

Templates serve as building blocks for making slides for presentation. These are ready-made designs that include an overall layout, font and font-size choices, a color scheme, and other design elements. Without templates, each slide has to be prepared from scratch. This is a very time consuming process, leads to redundancy of tasks, and requires the skills of a graphic designer.

Exhibit 4.1 details some presentation graphics software tools in 2021.

Exhibit 4.1: Presentation Graphics Tools in 2021

1. Piktochart: Piktochart is an online design software that can create a variety of visuals, from infographics to social media stories.

2. Microsoft PowerPoint: most used presentation tool with certain degree of animation

3. Google Slides: fully online, collaborative, and free presentation tool similar to power point

4. Keynote: Apple's version of PowerPoint

5. SlideDog: web-based multimedia presentation tool that lets users combine different types of media to create rich presentations.

6. Haiku Deck: web and mobile application that favors images over text Prezi Business: looks more like a 3D interactive mind map where viewers jump dynamically from one idea to the next.

Source: https://piktochart.com/blog/presentation-software/ -2021

4.5.3 View Options

Presentation can be viewed in different ways. Following are the view options available in Microsoft PowerPoint.

- *Slide view* – In this view, the slides can be viewed one by one. They can also be created and edited.

- *Outline view* – This shows an outline of the presentation's text. It enables the user to build the presentation quickly, in an organized manner.

- *Slide sorter view* – This view displays thumbnails (small graphical images) of each slide, enabling the user to change their order.

- *Notes view* – This view enables a person to add speaker notes to each slide.
- *Master view* – A master slide contains the basic slide layout. It is similar to the master pages in a desktop publishing program.

4.5.4   Slide Options

Varying slide options bring variety into a presentation. These include:

- *Two-column bulleted list* – This option can be used to compare two things or ideas.
- *Table* – A small amount of numerical data can be displayed in the form of tables.
- *Chart* – A chart can be prepared using the numerical data supplied. It can also be directly imported from a spreadsheet package.
- *Text and Chart* – A simple chart can be shown along with text listing the points that need to be made about that chart.
- *Text and Clipart* – Graphical images available in the software can be used along with the text in order to enhance the visual appeal.
- *Multimedia* – Videos, sounds, and animations can be used to change the whole presentation into exciting entertainment.

4.5.5   Making Effective Presentations

A variety of tools help in making interesting and effective presentations. The following tools can add value to a presentation.

- *Transition effect* – Transition effect includes tools like fade, dissolve, and cut-through which can be used when the presenter moves from one slide to another.
- *Expansion effect* – When the presenter wants to present a bulleted list that shows the next three topics to be discussed, the expansion tool automatically creates and inserts three new slides with each slide's title corresponding to the listed items.
- *Build effect* – It is a type of bulleted list in which bulleted items appear one by one. Animation effects can be used to enable the new items to slide in from the side.
- *Automatic presentation* – Automatic presentations (slideshows) can be created that can run on their own. Using this, the presenter can talk to a few

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people from the audience while others can watch the show. The timings for slide expiry should be decided during the preparation. The presentation can be looped continuously for continuous viewing.

Use of productivity enhancement tools has become a part of office work with Microsoft 365 being, by far, the most popular office suite. We explore commonly used office suites for productivity enhancement so as to provide a range of options available to companies and users and help them to choose the best suited tool in terms of cost and features. Exhibit 4.2 discusses some free office software in 2021.

Exhibit 4.2: Best Free Office Software in 2021

- Microsoft Word, Excel, PowerPoint are household names that every computer literate understands and, often uses regularly. These are all a part of the Microsoft 365 suite that also combines cloud backups and

  mobile use to other packages like Publisher, Access, and Outlook. Besides Microsoft 365, there are many other products available that offer users products to help them with their office work. The best part is that some versions of these products can be acquired free of cost and are compatible with Microsoft 365. Given below is a list of some popular office suites besides Microsoft 365:

- The highly popular Google Docs permit cross platform sharing and integration with Google drive besides being available as mobile apps making Google Docs extremely useful when documents have to be updated in parallel by many people/teams. A downside of Google Docs could be the extra effort required for formatting the document for use by other office suites.

- Zoho Workplace provides an alternative to Google Docs with excellent formatting features that help create documents with a professional look besides attractive spreadsheets and presentation features. Zoho Workplace also provides a free version.

- Polaris Office with cross platform features and cloud storage comes as a free version as well as a premium version.

- LibreOffice is a highly developed open-source suite that provides features like Base, Calc, Draw, Impress, Math & Writer with Base, Draw and Math not being available in many other suites.

- These three permit drawing vector diagrams, applying mathematical functions and providing database features making it very attractive

Contd. .....

- The continued focus by an enthusiastic open-source community to improve these products especially in terms of mobile usage.

- Finally, WPS Office Free and FreeOffice are also popular office suites that provide compatibility with Microsoft 365 formats and free as well as premium versions.

Source: *https://www.techradar.com/in/best/free-office-software, July 2021*

Activity: Claire has successfully completed her what-if analysis (refer to previous activity). Her supervisor has reviewed and approved the spreadsheet containing her findings. Now she has been asked to make a half-hour presentation on her findings to the senior management committee which will take a final decision on the choice of location. How can Claire use Microsoft PowerPoint to make an effective presentation? Will she be able to re-use some of the work she did earlier using Microsoft Excel?

Answer:

Check Your Progress-3

24. Which of the following views in Microsoft PowerPoint would allow display of small graphical images of each slide, enabling the user to change the order?

    a. Slide view

    b. Outline view

    c. Slide sorter view

    d. Notes view

25. In Microsoft PowerPoint, _____ are ready-made designs that include an overall layout, font and font-size choices, a color scheme, and other design elements.

26. What is clip art?

27. Which of the following features of presentation software enable the use of options such as fade, dissolve, and cut-through?

    a. Transition effect

    b. Expansion effect

    c. Build effect

    d. Automatic presentation

4.6 Summary

- Application software enables users to perform operations without writing any code. Word processors, spreadsheets, and presentation graphics software are the application softwares used for personal productivity.

- Word processors are used for writing, editing, formatting, saving, and printing documents. Microsoft Word is an example of word processing software.

- A spreadsheet is a collection of worksheets. Data in a spreadsheet is presented in a tabular form that makes it easy to perform mathematical calculations and apply formulae to values. Microsoft Excel is an example of spreadsheet software.

- Presentation graphics software is used for making presentations through slides or transparencies. Microsoft PowerPoint is an example of presentation graphics software.

4.7 Glossary

- **Absolute references:** These are cell references that refer to cells in a specific location. Sometimes, it is necessary to keep a certain position that is not relative to the new cell location. This is possible by inserting a $ before the column letter or a $ before the row number or both.

- **Advanced Filter:** A filtering tool in Spreadsheet software which is similar to an AutoFilter. Compared to an AutoFilter, Advanced Filter provides certain additional features such as copying the filtered data to another location; copying only the selected columns in the table to another location; and displaying only those records that meet the specified criteria.

- **AutoFilter:** A filtering tool in Spreadsheet software that helps in selecting and displaying only the data that is required.

- **Cell:** The intersection of a row and column in a spreadsheet.

- **Freeze panes:** In Microsoft Excel, while working on a large worksheet with data in several rows and columns, the row headings may disappear as the worksheet is scrolled down. Similarly, the column headings may disappear as the worksheet is scrolled to the right. Freeze panes are therefore used to ensure that the headings appear all the time even when the worksheet is scrolled down.

- **Goal seek analysis:** Goal seek analysis is the reverse of what-if analysis. In goal seek, the target is fixed and changes are made to the related variable so that the target is achieved.

- **Horizontal applications:** These are general purpose programs that can be used for writing, carrying out numerical calculations, and data storage and can be used for business as well as for general purposes. Horizontal applications are common across different functional divisions of business and can be used by anybody in the organization.

- **Macros:** These are tools that help in automating a frequently performed task in Microsoft Excel. A macro is a symbol, name, or key that represents a list of commands. Macros are saved as files on the system and later, when the macro name is entered, the entire set of operations is executed. Macros are stored in a separate location in the spreadsheet.

- **Mixed cell referencing:** A combination of relative and absolute cell references in which a part of the formula is relative while some part of it is absolute.

- **One-variable data table:** In this, either a row or a column that is part of the formula can be altered to find out the change in the final results of the formula. In a one-variable data table, the input values are either column-oriented (i.e., listed down a column) or row-oriented (i.e., listed across a row). The formula used must refer to an input cell.

- **PivotTable:** An interactive worksheet table that enables the user to combine and compare large amounts of existing data. The user can rotate the rows and columns of the table to obtain different summaries of the source data. The layout can be changed by providing headings to the rows and columns. A PivotTable can be updated whenever changes occur in the original data.

- **Relative cell references:** Cell references that are relative to the position of the formula. When a user creates a formula, references to cells or ranges are usually based on their position relative to the cell that contains the formula.

- **Replication:** If the user wants to apply a formula to values in more than one cell or range of cells, then replication may be used. Replication is

copying the formula and applying it to a range of cells by dragging the mouse and selecting the cells. This process saves time, eliminates redundancy, and is easy to use.

- **Scenario:** An Excel tool that is used for planning the outcomes of data by modifying various cells in the worksheet. It is a specific set of values that can be saved in Excel and which can be automatically substituted in a worksheet.

- **Sensitivity analysis:** A type of what-if analysis in which the effect of a repeated change in a single variable is examined. Using this analysis, one can find out the impact of a single variable on other variables. It is useful when the user is not sure about the value of a key variable. Sensitivity analysis is used to find out how a continuous reduction in advertising expenditure has an effect on sales. Scenario in MS Excel is used for conducting sensitivity analysis.

- **Solver:** An optimization and resource allocation tool that helps in finding an optimal value to a cell called the target cell in a worksheet.

- **Sorting:** A method of arranging data based on ascending or descending order.

- **Spreadsheet charts:** Diagrammatic representations of the data presented in a spreadsheet. Spreadsheet charts include column charts, bar charts, line charts, and pie charts.

- **Spreadsheet:** An application in which data is represented in a tabular form, i.e., in the form of rows and columns. Spreadsheets allow users to create tables of information which can be manipulated and represented in the form of graphs and charts.

- **Templates:** These serve as building blocks for making slides for presentation. In the absence of templates, each slide will have to be prepared from scratch. This could be very time consuming, besides leading to redundancy of tasks. That is why popular presentation graphics software comes with templates. Templates are ready-made designs that include an overall layout, font and font-size choices, a color scheme, and other design elements. The most popular presentation tools like Microsoft PowerPoint contain a number of templates.

- **Two-variable data table:** In this, both a row and a column can be altered to find the change in the final results of the formula. In a two-variable data table, the input values are both column-oriented (i.e., listed down a column) as well as row-oriented (i.e., listed across a row). This data table uses only

a single formula but with two sets of input values. That is, the formula refers to two different input cells.

- **Vertical applications:** Applications that cater to the specific needs of a particular business function in an organization. They are used to automate the operations of a particular business function, and therefore, require special programmers or operators are required to carry out these applications.

- **What-if analysis:** An Excel feature that allows the end users to make changes in the variables or in the relationship amongst variables and observe the changes. It is used for analyzing the various possibilities and deriving an appropriate strategy for each situation. By performing this analysis, one can find out how the goal can be achieved after taking into consideration the changes that might occur in the variables. Various permutations and combinations can be tried out effortlessly while analyzing the outcome based on possible changes in variables.

- **Word processing software:** A personal productivity software that involves automation of the transformation of ideas and information into a readable form of communication. The software enables the users to write, edit, format, save, and print documents.

- **Workbook:** A spreadsheet file in which data is entered and stored. Each workbook contains a number of worksheets. The user can simultaneously enter and edit data on several worksheets. The user can also perform calculations using the data from these worksheets.

- **Worksheet:** A matrix of rows and columns in a spreadsheet. The columns in a worksheet are named alphabetically starting with 'A' and the rows numerically starting with '1.' Each worksheet has 256 columns and 65,536 rows. Each cell on the worksheet has an address and the cell currently being used is called the active cell.

4.8 Self-Assessment Test

1. Computer software is classified into system software and application software. Outline the basic characteristics and uses of application software.

2. Word processing software is used for writing, editing, formatting, saving, and printing documents. Explain.

3. Spreadsheets allow users to create information in the form of tables that can be manipulated and analyzed. What are the various data analysis features offered by spreadsheet software?

4. Spreadsheets are useful for conducting what-if analysis and other complex calculations. Explain the spreadsheet software features that would enable the users to carry out these calculations.

5. Presentation graphics software enables the user to make presentations using slides and transparencies. Explain the various features that would assist the user to make an effective presentation.

4.9 Suggested Readings / Reference Material

1. Introduction to Information Technology, V. Rajaraman, PHI learning, 2018

2. Information Technology for Management, 2ed: Advancing Sustainable, Profitable Business Growth, Turban, Volonino, Wood, O.P. Wali, Wiley India Pvt Limited, January 2021

3. Introduction to Information Systems - 6th edition, R. Kelly Rainer; John Wiley & Sons, Inc.2016

4. Information Technology: An Introduction for Today's Digital world, Richard Fox, Chapman and Hall/CRC; 2nd edition (August 21, 2020)

5. Information Technology for Management, Efraim Turban, Carol Pollard, Gregory Wood, Wiley, 2018

Additional References:
1. Critchley, L., Where Nanotechnology, the IoT, and Industry 4.0 Meet., https://www.mouser.com/blog/where-nanotechnology-the-iot-and-industry-40-meet, 2019

2. Pan India implementation of HMIS over Indian Railways, Ministry of Railways., http://railministry.com/pan-india-implementation-of-hmis-over-indian-railways/ 2020

3. Vossler, C. How Long Does It Take To Order A New BMW? https://www.bmwblog.com/2020/09/28/how-long-does-it-take-to-order-a-new-bmw/2020

4. Jay, A., 10 New ERP Trends & Forecasts for 2020/2021 – A Look Into What's Next. https://financesonline.com/erp-trends/2019

5. Gingiss, D., How Integrating Social Media Into The Rest Of The Business Will Increase Revenue., How Integrating Social Media Into The Rest Of The Business Will Increase Revenue (forbes.com), 2019

4.10 Answers to Check Your Progress Questions

Following are the answers to the Check Your Progress questions given in the unit.

1. **(c) Horizontal applications are less expensive than vertical applications.**

   Vertical applications are those that cater to the needs of a particular business function. These applications are more expensive than horizontal applications, which are general-purpose programs that can be used for writing, numerical calculations and data storage. These applications are common across different functional divisions of business.

2. Application software is divided into vertical and horizontal applications. Horizontal applications are general-purpose programs used for writing, numerical calculations and data storage. These applications are common across different functional divisions of a business organization. Personal productivity software is a popular horizontal application that includes word processing, spreadsheets and special programs for storing addresses, preparing schedules, etc.

3. **(b) Vertical application**

   Vertical applications are those which cater to the needs of a particular business function. They are used to automate the operations of a particular function. They are more expensive than horizontal applications. Accounting software and bill generation software are vertical applications.

4. In Word Processing software, the 'autosave' feature enables users to save the document automatically at specified time intervals. Autosave is especially useful when there is power failure or unexpected system failure. This feature minimizes loss of data.

5. **(b) Paragraph level**

   Document formatting can be done at three levels: character, paragraph and document level. Paragraph formatting includes justification (the position of the text in the document) and line spacing (the space between lines and indentation). It also includes footnotes and end notes, automatic hyphenation, tables, table of contents, index, style sheets, graphics and web integration.

6. Section level formatting refers to formatting or changing sections in a document. Users can choose headers and footers for the document, set margins from top, right, left, or bottom of the page, set paper size (standard or customized), set page orientation, etc.

7. Clipboard is a feature available in the word processing software. It is a temporary location in which the portion of the text that has been cut is stored until it is pasted.

8. A spreadsheet is an application in which data is represented in tabular form i.e., in rows and columns. Spreadsheets allow users to manipulate and create tables of information that can be manipulated and represented in graphs and charts. Microsoft Excel, Lotus 1-2-3, etc are examples of spreadsheets.

9. **(b) Menu Bar**

   The Menu bar appears directly below the Title bar and displays the menu with the following options: Edit, View, Insert, Format, Tools, Data, Window, and Help.

10. **(a) Text operator**

    Ampersand (&) is a text operator. It is used for combining one or more text values to generate a single piece of text. For instance, cell A3 contains 'South' and cell B3 contains 'India'. The command =A3&B3 can be used to combine text in two cells. This would give the result as South India.

11. Reference operators compare two values and then generate the result in the form of a logical data type i.e., TRUE or FALSE. Comparison operators are Equal to (=), less than (<), greater than (>), less than or equal to (<=, $\leq$), greater than or equal to (>=, $\geq$), and less than or greater than but not equal to (<>, $\neq$). / is an arithmetic operator, which represents division.

12. **(c) Logical**

    Excel allows four different types of data to be entered or displayed in cells. These are: Text, Numbers, Logical and Error. Logical is a data type that consists of values in the form of TRUE and FALSE. Excel gives these values when certain types of functions are used.

13. **Intersection operator**

    Reference operators are used for combining ranges of cells for calculations. Space is a reference operator generating a single reference to all cells common to the two given references. For instance, SUM(B2:B10 C2:C10). It is also called intersection operator.

14. (c) $

Dollar ($) is the symbol used to create an absolute cell reference in Microsoft Excel.

15. The various Lookup & Reference functions in Excel are ADDRESS, HYPERLINK, ROWS, COLUMN, INDEX, TRANSPOSE, etc. The function 'HYPERLINK' generates a shortcut for opening a document stored in the hard drive, a network server or the Internet. The syntax used for HYPERLNK is HYPERLINK(link_location, friendly_name).

16. (a) Pattern tab

The Format Cells dialog box provides various options like Number tab, Alignment tab, Font tab, Border tab, Pattern tab and Protection tab. The Pattern tab enables users to add color to selected cells and change background style. The Border tab enables users to add borders with different styles and colors while the Font tab enables users to change font size, style and effect of the text.

17. Arjun can use a pie chart during his presentation to represent the market shares (in percentage) of the company and its competitors. Pie chart is a type of spreadsheet chart in which data can be diagrammatically represented. Pie charts are used to express the relative percentage of each portion as a part of the whole.

18. (b) Scenario

Scenarios are used for predicting future values. They are used for conducting a Best Case/Worst Case scenario analysis on a situation. With the use of scenarios, the decision-maker can try out different combinations of variables and check the effect on the final results. This way, one can get an idea of the best as well as the worst results.

19. i/r, ii/p, iii/q

Function is a special keyword that can be entered into a cell to process data that is appended within brackets. Macro is a symbol, name or key that represents a list of commands. Replication is used when it is necessary to apply a formula to values in more than one cell or range of cells.

20. i/q, ii/s, iii/p, iv/r

Operators specify the type of calculation that the user wants to execute on the elements of a formula. The various operators are arithmetic operators, comparison operators, text operators, and reference operators. Arithmetic operators execute the basic mathematical operations like addition, subtraction, multiplication, and division.

Comparison operators compare two values and then generate the result in the form of a logical data type. Text operators concatenate text values in two or more cells to generate a single piece of text. Reference operators combine a range of cells for calculation.

21. Following is the correct order of priority based on which operators should be evaluated.

Operators and their Order of Priority

Order	Operator
1	%
2	^
3	* and /
4	+ and -
5	&

The operators belonging to the same order of priority are evaluated in the formula from left to right.

22. **Both relative and absolute cell references**

The cell reference B3 (without the $ sign) is a relative cell reference. When Catherine copied the expression to the three cells below A3, this cell reference would have automatically changed to B4, B5, and B6. The cell reference C3 is an absolute cell reference; it does not change when the formula is copied to other cells. Since the formula entered in A3 is =B3+C3, Catherine has used both relative cell reference and absolute cell reference. This type of cell referencing is also referred to as mixed cell referencing.

23. (c) **Chart wizard**

A Chart Wizard consists of a series of dialog boxes that directs the user to create a chart or modify an already existing chart. The chart wizard allows one to create either an embedded chart or a chart sheet. An embedded chart is one that is placed and saved within the same worksheet where the data is located. A chart sheet is a new worksheet in which the chart is created.

24. (c) **Slide sorter view**

Slide sorter view is the view option available in Microsoft PowerPoint that enables the user to display thumbnails or small graphical images of each slide. Through this, the user can change the order in which he/she wants the slides to appear during the presentation.

25.   **Templates**

A template serves as a building block for making slides for presentation. Templates are ready-made designs that include an overall layout, font and font-size choices, a color scheme, and other design elements.

26.   Clip Art are graphical images readily available in the image-library of the software. These images can be used with the text to enhance visual appeal.

27. (a) Transition effect

Transition effect includes options such as fade, dissolve, and cut-through. This can be used when the presenter moves from one slide to another.

Unit 5

Enterprise Collaboration Systems

5.1 Introduction

In the previous unit, we have discussed about personal productivity software like word processing, spreadsheets, and presentation graphics software that can be used by businesses as well as individual users to perform certain tasks like creating documents, conducting analysis, and making presentations, without writing any code.

In this unit, we introduce you to the enterprise collaboration systems like the Internet, intranet, extranet, and the groupware, which have helped organizations communicate, coordinate, and collaborate both within and outside the organization.

In this unit, we will first discuss about the Internet, intranet, and the extranet. We shall then move on to discuss about enterprise collaboration systems and groupware. Finally, we shall discuss the various types of groupware available to organizations.

5.2 Objectives

By the end of this unit, you should be able to:

- Recognize the role of the Internet in today's world.

- Explain how the intranet helps organizations share information among their employees.

- Explain how extranet helps organizations to communicate with their suppliers, distributors, customers, and partners.

- Classify the application of enterprise collaboration systems and groupware in organizations.

5.3 Internet

The Internet has brought about a crucial change in the way we work, shop, communicate, learn, and play. The use of Internet has benefited businesses as it has helped them in streamlining business processes and has enhanced the speed and efficiency of business transactions. The use of Internet technology for strategic advantage helps organizations improve efficiency and compete globally. The emergence of the Internet has changed every aspect of business, be it customer interaction, relationships with partners, or supply chain management.

The Internet is a collection of millions of individual networks and organizations. These networks direct the Internet traffic based on certain Internet procedures and protocol standards to enable sharing of information among them.

In the 1960s, the Internet evolved as a result of an experiment conducted by the US Department of Defense. The department developed a network called ARPANET (Advanced Research Projects Agency Network) which inter-linked the scientific and academic researchers in the US. This network is regarded as the forerunner of today's Internet. In 1985, the US National Science Foundation (NSF) created NSFNET. Based on ARPANET protocols, the NSFNET created a national backbone service which provided free service to all the research and educational institutions in the US. NSF also coordinated another service called InterNIC which is a body that registered new domain addresses with extensions like .com, .org, .edu, etc., on the Internet.

Initially, the basic purpose of the Internet was to help researchers and scientists collect information pertaining to science and defense. However, with the passage of time, the Internet is being used for various purposes like sending and receiving mails, searching for information and entertainment, etc. However,

one of the greatest problems in this context is that people log on to the Internet using telephone lines having low bandwidth. This problem is being overcome by new technologies (e.g., fiber-optic cables) which provide much faster access to the Internet than telephone lines.

With the arrival of e-commerce, monetary transactions can be done online, without the help of physical currency. All a person actually would have to do when making a purchase is transfer the currency from his/her digital wallet to someone else's.

Another widely used aspect of the Internet is databases. According to experts, that day is not much far away when almost any information about anything or anybody would be available on the Internet.

The Internet plays an important role in facilitating entertainment and education through the use of virtual tools and artificially created environments. Moreover, the advent of Web TV has made life much easier for people who work odd hours. People have the liberty to watch an episode they missed whenever they have little time and can also control what they would like to see, when they would like to see it, and for how long they would like to see it.

5.3.1 The World Wide Web

The World Wide Web (WWW) is the most popular service on the Internet. Though the terms WWW and the Internet are used synonymously, they differ in terms of both meaning and application. The Internet is a network which links computers, whereas WWW incorporates the services on the Internet. The Internet is used as a means for sharing information stored in one computer with another. The WWW provides various services which include retrieving documents, viewing images, viewing programs, animation, video, audio, etc.

WWW is a system for organizing and linking Internet files, resources, and services, and providing access to them. This access is enabled by the hypertext (or hypermedia) approach. Hypertext refers to the on-screen documents in which cross-references are embedded within the documents. The users can move from one place to another in a document in a non-sequential manner. The hypermedia links connect to visuals like graphics, audio, and text. The web supports hypermedia navigation and allows multimedia documents to be stored in a web server.

WWW has several applications ranging from education, entertainment and government, to trade and commerce. Company websites containing information

on various products are placed on the WWW. A user can view these products, review the products offered by a particular company, and compare them with the products of other players and/or competitors. If the user decides to buy a product online, he/she can make the payment either through an electronic transaction or through some other method preferred by the user like credit cards, debit cards, etc.

With changing technology, a concept called Metaverse, could change how users navigate internet or the World Wide Web. It is a disruptive force anticipated to help create digital twins, basically virtual copies of anything, real or not. Exhibit 5.1 presents a concept beyond Internet

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Exhibit 5.1: Metaverse – Beyond the Internet

The Metaverse is a shared virtual 3D world, or worlds, that are interactive, immersive, and collaborative. Just as the physical universe is a collection of worlds that are connected in space, the metaverse can be thought of as a bunch of worlds, too. Massive online social games, like Battle Royale, Juggernaut Fortnite and user-created virtual worlds like Minecraft and Roblox, reflect some elements of the idea. This concept, which is still in its infancy will become a platform that's not tied to any one app or any single place—digital or real. And just as virtual places will be persistent, so will the objects and identities of those moving through them, allowing digital goods and identities to move from one virtual world to another, and even into our world, with augmented reality. The Metaverse could radically alter the way we navigate information and potentially convert the digital world back to something far closer to analog. Rather than web pages, we'll have virtual representations of companies that we will be able to explore as if we were physically there. With the capable Conversational AIs, we can even talk to Decision Engines that help us navigate this new world successfully.

Metaverse can operate at computers' speeds, and help do years of training in a matter of minutes, reducing the AI training time and costs (training stages of robotic development).

Metaverse can help to simulate new product ideas and concepts without incurring the costs of building or physically prototyping them. BMW, for

Contd. .....

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example, is working on designing new factories using NVIDIA's Omniverse tool. NVIDIA Omniverse, a type of Metaverse, allows members of a project team to collaborate in real-time across software applications in a shared virtual world from anywhere. Omniverse is data native (refers to the use of analytics and data- centric applications that run where the data resides, without data movement), making it possible to simulate a product, and also its context.

One could simulate, from creating a racing track to building a football stadium to even visualizing an entire city or a country. The ability to create a digital twin of yourself that can continue long after you are gone is also coming.

It will take us decades to fully understand its potential and will materially change how we learn, work, and perceive the world around us. The Metaverse will become like the Internet was when it matured, a worldwide game-changer.

Source: The Global Analyst, September 2021

Check Your Progress-1

1. What led to the creation of the Internet?

2. _____, created in 1985, comprises a series of networks for research and education related communication.
    a. Internet
    b. InterNIC
    c. NSFNET
    d. ARPANET

3. _____ is a body that registers new domain addresses with extensions like .com, .org, .edu, etc on the Internet.

4. What is World Wide Web (WWW)?

5.4 Intranet

The intranet, similar to the Internet in terms of hardware and software, is a private computer network which is designed for internal use within the organization. It uses the network connectivity, Transmission Control Protocol/Internet protocol (TCP/IP), and telecommunication systems. The hardware and software in intranets and the

Internet include a web server using TCP/IP, installation of the programs on all computers, a homepage in the HTML (Hyper Text Markup Language) format, a database server, and a browser.

However, unlike the Internet which is open for public access, intranets are installed only for the organizational users and are highly secure to ensure that external users cannot access them. Intranets that are connected to the external networks are usually equipped with firewalls which screen incoming data and allow only selected members to access internal data.

5.4.1 Advantages of Intranet

In business organizations, intranets are very useful since they facilitate internal communication within an organization. Some of the advantages of intranets in an organization are:

- Corporate intranets assist information sharing and communication of messages in a secure manner to the employees inside the organization.

- They facilitate cooperation and collaboration among employees on projects.

- They promote ideas and knowledge sharing among the employees.

- They enhance the information management ability of organizations by streamlining the distribution of reports and other documents within the organization.

- The use of intranets results in greater productivity because the employees have better access to accurate/up-to-date information. Moreover, the use of intranet also lowers the cost of acquiring, printing, and distributing information since the employees would also be able to make better use of the existing information.

5.4.2 Disadvantages of Intranet

Apart from the advantages, intranet also has certain shortcomings. They are:

- The top management in an organization may not be willing to use the intranet fearing that the internal secrets would be disclosed to the public.

- The employees within the organization may also not be willing to use the intranet since they would fear unauthorized access and sharing of their information.

- The top management may oppose the idea of installing intranet since it would require expending of funds and recruitment of employees.

> **Activity:** ConsuCare Limited, a fast moving consumer goods (FMCG) company, has been making use of a system which enables the employees within the organization to access all the relevant information pertaining to the company's business strategies, new products the company is planning to introduce within the next few years, the company's plans on pricing these
>
> *Contd. ....*

products, etc. This system is strictly meant for use by the employees of the organization and is interactive and highly secure. What type of enterprise collaboration system is the company using? In what way will this system benefit the company and its employees? What according to you are the limitations of this system?

Answer:

_____

_____

_____

_____

_____

Check Your Progress-3

5. What is an intranet?

6. Explain the uses of an intranet.

7. Which of the following is/are perceived **disadvantage(s)** of an Intranet?
   i.   Possibility of unauthorized access and sharing of organizational information
   ii. Information and knowledge sharing among employees
   iii. Expenditure of funds during installation
   iv. Streamlining the distribution of reports and other documents within the organization

   a. Only i and ii
   b. Only i and iii
   c. Only i, ii, and iii
   d. Only ii, iii, and iv

5.5 Extranet

Extranets use the network connectivity, Internet protocols (like TCP/IP), and telecommunication systems to assist sharing of an organization's information among its suppliers, business partners, and customers. Extranets enable the various external entities to have access to an organization's selected intranet

websites and databases. Because of this, an extranet requires more privacy and safeguards.

Extranets add value to a business by:

- Enabling the exchange of huge volumes of data using electronic data interchange (EDI)

- Enabling the company to develop strategic relationships with its customers and vendors

- Acting as a means for collaborating with other organizations on research and development activities

- Enabling regular and instantaneous updation of the information shared on the extranet

- Making it possible to share news which may be of common interest among the business partners

- Enabling the business partners to gain knowledge about the company's products and/or services and also place their orders quickly and easily

- Improving the productivity of the organization as the processes that were previously manually run are now automated

- Providing access to the services provided by a single organization to a group of other organizations

Despite the fact that extranets create value addition to business, they have some limitations because of their expenses, lack of face to face contact with the external business entities, and other security concerns.

Activity: ConsuCare Limited (refer to previous activity) has decided to work closely with its suppliers, distributors, retailers, and end customers. The company has decided to share critical information regarding its existing products and those in the pipeline with them. The company also intends to invite their suggestions for future products, and their feedback on improvements to its existing products. For this purpose, the company has plans to install an extranet. How do you think the company is going to benefit as a result of this move?

Answer:

_____

_____

_____

Check Your Progress-3

8. What is an extranet?

9. Which of the following is/are the use(s) of an extranet?

    i. Customers and wholesalers can access the intranet and place orders easily and quickly.

    ii. A company can build strategic relationships with customers and suppliers.

    iii. A company can advertise to any user with an Internet connection.

    iv. A company can offer new kinds of interactive web-enabled services to business partners.

    a. Only i, ii, and iii

    b. Only i, ii, and iv

    c. Only i, iii, and iv

    d. i, ii, iii, and iv

10. Which of the following is **not** an advantage of extranets?

    a. Using extranets, the company can develop strategic relationships with its customers and vendors.

    b. The information shared on the extranet can be updated regularly and instantaneously.

    c. Extranets can be used for sharing news that might be of common interest among the business partners.

    d. Extranets provide face to face contact with external business entities.

5.6 Enterprise Collaboration Systems and Groupware

Enterprise collaboration systems are information systems that make use of a variety of information technologies (in the form of groupware tools, the Internet, intranet, extranet, and other computer networks) which enable communication among the employees. The enterprise collaboration systems essentially support communication, coordination, and collaboration among the members of networked teams and workgroups, thus helping an organization to increase its productivity. It provides software tools for enterprise communication like e-mail and voice mail; enterprise conferencing tools like video conferencing; and collaborative work management tools such as task and project management software.

Groupware

Collaborative software, popularly known as groupware, establishes a platform for collaboration and communication within the organization. Groupware is a combination of electronic meeting systems and e-mail (and a number of additional features). While collaboration focuses on local and ad-hoc groups, communication focuses on information sharing both within and outside the organization. The basic objective behind the creation of groupware is to enable groups of workers working in a common project or task at different geographical locations to communicate with each other for attaining common goals.

Groupware helps in reducing the time and effort required for transferring ideas, views, and documents across workgroups. It is also used to create a 'virtual organization,' i.e., a workgroup or organizational layer that does not appear on a formal organization chart. A groupware can also be useful for making operational, managerial, and strategic decisions.

Groupware products like Lotus Notes, Novell GroupWise, Microsoft Exchange, Netscape Communicator, and Netscape Collaborator allow group collaboration via electronic mail, discussion groups and databases, and audio and videoconferencing. Groupware products today use the Internet, corporate intranets, and extranets to enable collaboration by virtual teams located anywhere in the world on a global scale. Collaborative capabilities are also being added to other software to give them groupware features.

For the success of enterprise–wide groupware implementation, common protocols and infrastructure standards should be developed to allow the members of the organization to communicate with each other. Groupware tools like e-mail have gone a long way in standardizing protocols, but others like video conferencing are still maturing.

Check Your Progress-4

11. What are the various uses of groupware?
12. Which of the following statements is **false** regarding groupware?
    a. Groupware enables communication between groups of workers at different geographical locations.
    b. It provides a common interface in a shared environment to groups of individuals involved in completing a common task.
    c. It facilitates sharing of knowledge and ideas in a workgroup.
    d. It increases the effort required to transfer ideas, thoughts, and documents across workgroups.
13. What is a virtual organization?

5.7 Types of Groupware

On the basis of the level of collaboration and communication, groupware can be classified into three types, namely, enterprise communication tools, enterprise conferencing tools, and collaborative work management tools.

5.7.1 Enterprise Communication Tools

Enterprise communication tools help in sharing documents, files, and messages electronically with others. These tools include electronic mail, faxing, voice mail, instant messaging, web publishing, Internet phone and paging systems, and the Usenet. By using these tools, one can send data files, text, voice messages, or multimedia to others via computer networks.

5.7.1.1 Electronic Mail

Electronic mail, popularly known as e-mail, helps users exchange messages electronically. It refers to both the use of Simple Mail Transfer Protocol (SMTP) as well as the intranet systems. SMTP is used for transferring mails between computers connected to the Internet. The intranet systems within an organization allow the users to mail each other. By using e-mail, data files, software, and multimedia messages and documents can be sent as attachments.

File Transfer Protocol (FTP) is a protocol developed for exchanging files over the Internet. It is similar to the Hypertext Transfer Protocol (HTTP) and SMTP, which are used to transfer web pages and e-mail, respectively. FTP is the most commonly used medium to download programs and other files to the computer from other servers. The user can use FTP to copy, move, rename, and delete files from a server and also for uploading files to a server. Any type of file – whether text, graphic, video, or audio, can be copied/uploaded using this tool.

The other protocols used on the Internet are Post Office Protocol (POP) and Internet Message Access Protocol (IMAP), which are used for reading mails. POP has two versions, namely POP2 and POP3, and is used for retrieving e-mails from a mail server. POP2 requires SMTP for sending messages, while POP3 can be used with or without SMTP.

IMAP is used for retrieving e-mails and also allows the users to retain the mails on the server and organize them in folders. The latest version of IMAP is IMAP4 which is similar to POP3. However, IMAP4 has an additional feature, i.e., one can search and choose the e-mails based on keywords while they are located on the mail server and can then download these messages. The 10 Best Email Marketing Software of 2021:

Active Campaign – small businesses & enterprise, Benchmark – agencies, Sendinblue – transactional emails, Drip – small-medium e-commerce businesses, Omnisend – medium-large e-commerce businesses, Autopilot –

marketing , automation, HubSpot – B2B service companies, MailerLite – personal projects, ConvertKit – bloggers, and EmailOctopus – developers (uses AWS)

5.7.1.2 Internet Fax

Facsimile or fax is a device which scans text or graphic images and converts the scanned data into electrical impulses, to send as a fax. through the Internet.

5.7.1.3 Voice Mail

Voice mail is a communication tool where telephone messages are stored and managed centrally for a large group of people. The voice mail functions in a way similar to an answering machine. It digitizes and stores unanswered telephone messages and plays back the messages to the receiver through a voice messaging computer. However, unlike the answering machine, the voice mail has a much wider scope in terms of functioning. Voice mail may be used for answering many phones at the same time and for storing the voice messages in personalized mail boxes along with the phone number of the sender. Apart from this, voice mails also enable users to forward received messages to another mailbox, etc.

Popular voicemail tools of 2021 include: MyOperator, SmartTel, Dialer 360, 3CX, Leadsrain, Skipio, AVOXI, Five9, TCN, Call Loop, My Call Cloud, etc

5.7.1.4 Instant Messaging

Instant messaging is an online or real time communication tool used by two or more people for communicating through a network like the Internet. The people communicating using this tool, type or enter textual messages in their respective computers and send the message to the other person/s via the Internet.

Highly used messaging tools include: Microsoft Teams, Slack, Jabber, monday.com, Podium, Google Workspace, Webex App, Chatter, Front, Workplace from Facebook

5.7.1.5 Web Publishing

Web publishing is an effective method of communicating among teams and workgroups in an organization. It involves creating a website and placing it on the web server for access by users. A website refers to a collection of HTML pages. If the site has to be accessed, the HTML pages and the essential graphic elements should first be copied onto the server into the appropriate directories. In web publishing, a team member can post a report or other linked documents in HTML directly to the web server of an intranet or extranet for access by the

other team members. Any news or messages pertaining to the project can be transmitted to the mailboxes or screens of the team members.

5.7.1.6 Internet Phone and Paging

An Internet phone can be used over the Internet with the help of a Voice over Internet Protocol (VoIP) terminal. By using the Internet telephony service, telephone calls can be made to another user through the Internet. If the users have a Web camera, they can converse through real-time videoconferencing. However, the quality of this service is not as good as a direct telephone connection. **Most popular web browsers are:** Firefox, Google Chrome, Microsoft Edge, Apple Safari, Opera, Brave, Vivaldi, DuckDuckgo, Chromium and Epic

Paging is a service available through a telecommunication device called the pager. The pager alerts the user by passing on a sensory message, which may be a vibration, an updated display, a flash, or an audible beep. Internet paging, also called buddy list software, is a communication tool that enables sending of messages over the Internet through web paging. These messages are received by a cell phone or a pager. ICQ (I Seek You) is a popular internet paging program. The top 10 Business Instant Messaging Software are: Microsoft Teams., Slack., Jabber., monday.com., Podium., Google Workspace., Webex App. and Chatter.

5.7.1.7 Usenet

Usenet (abbreviated form of User Network), developed in 1979, is a collection of user-submitted notes or messages on various subjects that are posted to servers on a worldwide network. It allows the users to send and receive messages or articles that are similar to the e-mails. Users send messages to a particular server, which are then forwarded to other servers through the store and forward method.

5.7.2   Enterprise Conferencing Tools

With the help of enterprise conferencing tools, people can share information in an interactive way. These tools include teleconferencing, discussion forums, chat systems, and electronic meeting systems.

5.7.2.1 Teleconferencing

Teleconferencing is a group support facility which helps in reaching multiple groups simultaneously. It includes data conferencing, video conferencing, and audio conferencing and is used in sales meetings, employee education and training programs, and in new product announcements.

Data conferencing: Data conferencing is an interactive way of sharing information (which can be a document, a drawing, a graphic, or a digitized

sound or video) among users based at different locations over a network of computers. In data conferencing, two or more users share data online or in real time, using a common workspace on their computer desktops.

Data conferencing is possible with the use of whiteboards and application sharing. A whiteboard is similar to a flip chart or a chalkboard. It is a shared workspace on which the users can draw, write, import, or manipulate real time images. It can be viewed by all the users. The software should be run and controlled by all the users. This is called application sharing. In application sharing, which is similar to remote control software, two or more participants can interact with each other by working on a single application which is loaded onto the system of one of the participants.

Application viewing is similar to application sharing. However, while the latter facilitates sharing of the same computer screen by all the participants, the former allows all the users to view the document but only one person to actually make changes to it.

Data conferencing can be used effectively with audio and video conferencing.

Audio conferencing: Audio conferencing is very similar to conversing on the telephone, the only difference being the quality of audio transmission, which is not very good. These systems make use of loudspeakers and similar devices so that the sound becomes audible throughout the room. Audio conferencing uses hands free audio units with sensitive microphones and echo cancellation software to communicate between groups. These systems use Public Switched Telephone Network (PSTN) lines and analog networks for transmission. Top 10 Free Audio Conferencing Software in 2021 are: Workplace from Facebook., GlobalMeet Collaboration., Spike., PowWowNow., Voximplant., LoopUp., Infinite Connect., and MobileDay

Video conferencing: Using video conferencing, multiple participants located at different sites can share views and documents, and collaborate using their computer networks to transfer data. There are two types of video conferencing facilities, namely, point-to-point video conferencing and multipoint video conferencing.

In point-to-point video conferencing, the participants communicate with each other using video cameras, microphones, and speakers, which are mounted on their computer systems. During a conversation, the voice of one of the participants is carried over the network and is delivered to the other participant. The image that appears on the video camera of one participant appears on the computer screen of the other. For example, desktop-to-desktop conferencing and board-room conferencing are point-to-point video conferences.

On the other hand, multipoint video conferencing allows communication between three or more participants in a virtual conference room. Multipoint

conferencing provides a link between different sites, groups, and divisions of the company. Multipoint conferencing is further classified into local area network (LAN) and multi-control unit (MCU). While LAN provides a link between different sites, groups, and divisions, MCUs are used during conferencing for automatically switching between audio and video signals.

The popular desktop conferencing systems were Creative Labs' ShareVision PC 3000, Winnov's VideumConf Pro, White Pine's CU-SeeMe, and Intel's ProShare Video. For instance, Intel's ProShare Video has a feature called multipoint or group video conferencing which enables conferencing between all the participants who have gathered at different locations at a specific time on a predetermined day. Popularly used videoconferencing software platforms in 2021 are: Zoom, Microsoft Teams, GoToMeeting, Skypefor Business, ez Talks Meetings, StarLeaf, and CiscoWebex

5.7.2.2 Discussion Forums

Discussion forums, also called Internet forums, facilitate communication among employees and students via the WWW. They are used for posting messages and downloading data and program files from online services, and include the Internet and intranet workgroups, discussion groups, and databases. Discussion forum software allows the users to post queries and answers on a particular topic. Discussion forums help in building good relationships with customers, suppliers, and vendors. The members can access the forum at leisure, since they do not require real time communication. Lotus Notes and Netscape Collabra are examples of discussion forum groupware. Highly used groupware platforms in 2021 are: 1- SOGo, 2- Agorakit, 3- Horde, 4- kolab, 5- Tine 2.0, 6- citadel, 7- Kopano Core, 8- EGroupware, 9- Nextcloud, 10- Group Office ,11- Tiki, 12- Simple Groupware, and 13- MAYAN EDMS.

5.7.2.3 Internet Relay Chat (IRC)

Internet Relay Chat (IRC), called chat systems, is an Internet service that allows users to join chat groups, called channels, and get into real-time text-based conversations. Chat systems allow users located at networked computers to carry out online, real-time, text-based conversations. It is an interactive tool in which the users can type their views or ideas using a keyboard and view their responses on the computer screen. Each message starts with the user name of the participant.

Chat systems are very useful in organizations which do not have voice and video conferencing facilities. These systems also facilitate recording and storing of the conversation for other team members to view them later. Chat rooms have been added to the Internet and intranet websites for encouraging collaboration and participation by the employees and/or the customers. These systems also

facilitate one-to-one communication, and can also be used for sending private messages.

5.7.2.4 Electronic Meeting Systems

Electronic Meeting Systems (EMS) facilitate group decision making activities which take place in a computer-based decision-room setting. They are designed for supporting a specific application or task like negotiations between labor and management, and can support anonymous voting during a meeting. These are not common in 2021.

Activity: Alok Mehta is the brand manager at BeautyGlow Limited for the Bold & Beautiful range of skincare products. The Bold & Beautiful brand has not been performing well in the market and has to be relaunched with an aggressive pricing and integrated marketing communications campaign. To prepare the sales force to participate effectively during the brand relaunch, Alok Mehta wishes to have an interactive discussion with his sales managers who are spread throughout the length and breadth of the country. What type of enterprise conference tool/s can he use, given the constraints of time and budget? Briefly discuss the benefits and limitations of the tool/s suggested by you.

Answer:

_____

_____

_____

_____

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5.7.3   Collaborative Work Management Tools

Collaborative work management tools help people manage group activities. These tools include calendaring and scheduling tools, task and project management tools/systems, workflow systems, document sharing, and knowledge management systems.

5.7.3.1 Calendaring and Scheduling Tools

These packages enable the user to use electronic versions of a variety of office tools like the calendar, appointment book, address book, and contact list. They

automatically check the electronic calendar of team members to enquire about the open time slots, propose alternative meeting times, schedule team meetings or appointments, and notify and remind participants by e-mail. The Top 10 Free Online Appointment Scheduling Software in 2021: Doodle, YouCanBook.me, Calendly, HubSpot Sales Hub, Groove, Acuity Scheduling, Cirrus Insight, Revenue Grid,10to8, and Chili Piper

5.7.3.2 Task and Project Management Tools

Project management groupware helps project teams work together and keep track of the deadlines. Some examples of project management groupware are Microsoft Project, Lotus Organizer, and CA – Super Project. These tools produce project schedules and program reports, and also send automatic reminders of due dates for project tasks. They also produce charts for planning and tracking projects. Task and project management software also help in drawing graphs and charts. Project management groupware helps generate Gantt charts and charts that use network methodologies like the PERT (Project Evaluation and Review Technique) and the CPM (Critical Path Method). List of 10 best free project management tools in 2021: Kissflow Project, Trello, Asana, Zoho Projects, Wrike, Monday.com, Proofhub, Clarizen, Airtable, and Kanban Tool

5.7.3.3 Workflow Systems

Workflow systems help users to collaborate with each other for accomplishing and managing tasks within a knowledge-based business process. Groupware like Novell GroupWise, Lotus Notes, and Microsoft Exchange possess these capabilities. Since this is a type of electronic document processing, this is also referred to as document image management. List of Most Popular Workflow Management Software in 2021: #1) monday.com.#2) Nifty.#3) Process Bliss.#4) Wrike. #5) ClickUp #6) Quixy #7) Freshservice ,#8) Process Street #9) Hive,#10) Creatio

5.7.3.4 Document Sharing Tools

Document sharing enables a person to access the files of team members and keep track of their work schedules. Document sharing is a very useful tool, particularly in situations where the team members working on the same project are located at distant places. More complex document sharing tools perform workflow functions. These tools route the documents from one person to another automatically for review or approval. Best file transfer software in2021: 1. Dropbox, 2. Google Drive, 3. WeTransfer, 4. Send, anywhere 5. Hightail, and 6. Slack

5.7.3.5 Knowledge Management Systems

Every organization possesses a large volume of knowledge pertaining to products and services, customers, markets, production, and research. This knowledge may be extensively dispersed across the different divisions and branches of the organization. Knowledge in an organization may be in the form of memos, letters, faxes, databases, spreadsheets, presentations, and documents. Knowledge management is the process by which these resources are identified, accessed, enhanced, and protected through the use of advanced technology and user-friendly portals.

The top 11 best knowledge management software in 2021: Document360, Nuclino, HelpCrunch, Flowlu, Tettra, Bitrix24, Intercom, Zoho Desk, Helprace, ProProfs and Zendesk.

The benefits of a knowledge management system are:

- It eliminates the duplication of tasks.
- It helps organizations fully utilize the knowledge and skills of employees.
- It improves communication, reduces costs, and helps gain competitive advantage.
- It helps in building strong customer relationships and enhances customer loyalty.
- It unlocks the potential of the unique knowledge resources and helps harness their power.

For example, Livelink intranet groupware helps the user to create a document management library at an intranet website. This enables the user to check in and check out project documents of all kinds, and use a browser and search engine to find the required project information. This groupware also has a version control capability which helps team members manage multiple versions of project documents prepared or revised over a period of time.

Collaboration software has gained popularity in recent times due to increasing acceptance of remote working culture across organisations. The number of options in collaborative tools today are enormous and are suited for all types of businesses. Exhibit 5.2 narrates some top rated colloboration products of 2021.

Exhibit 5.2: Top Rated Collaboration Products 2021

The collaboration tools that are available in the market offer wide array of services ranging from video conferencing and calendaring functionalities to project management and workflow management capabilities. Given below is a list of the top-rated collaboration products of 2021:

Liquid Planner: Online project management software mainly meant for very large organizations,

Zoho Projects: Cloud based project management software suited for smaller businesses

Teamwork: Task management and team collaboration software for small and medium size businesses

Miro: A whiteboard application for visual collaboration that allows video calling along with sharing of files, sticky notes and drawings for effective brainstorming and idea sharing. It also includes templates for making charts and diagrams.

Mural: Offers similar functionality as Miro, but allows only audio calling. Includes templates for team building exercises.

Podio: A multipurpose app for team collaboration that offers customised functionality on the basis of business functional area viz. HR, Marketing, IT, Sales, etc.

Asana: Highly flexible, customizable app for better management of workflows, ideas and projects.

Basecamp: An online collaboration app for managing work and communication within the team. Also allows asynchronous communication with external stakeholders.

To-do-list: A to-do-list app that also allows collaboration among the team members by sharing, organising and prioritising tasks.

Airtable: A collaboration software that works like a database. It allows easy data collection, updates, tracking and monitoring of workflows within the team.

Smartsheet: Another collaboration software that works like a database, but with enhanced capabilities of task automation built in the application.

Trello: A Kanban tool that allows quick and easy work management. It helps to create a board that shows the task lists and allows easy tracking of work progress.

Source: https://in.pcmag.com/software/94860/the-best-online-collaboration-software-for-2020

Check Your Progress-5

14. Which of the following is **not** a web browser?

   a. Opera
   b. Internet Explorer
   c. Mozilla Firefox
   d. Lotus Notes

15. What is file transfer protocol (FTP)?

16. _____ is used to transfer mail between computers on the Internet.

   a. Internet Protocol (IP)
   b. File Transfer Protocol (FTP)
   c. Simple Mail Transfer Protocol (SMTP)
   d. Hyper Text Transfer Protocol (HTTP)

17. What is a Usenet?

18. Data conferencing is an interactive way of sharing information among users located at different locations over a network of computers. Application sharing is a term used in data conferencing which

   i. Allows two or more participants to interact with each other by working on a single application that is loaded onto the system of one of the participants
   ii. Facilitates sharing the same computer screen by all participants
   iii. Has similarities with remote control software

   a. Only i and ii
   b. Only ii and iii
   c. Only i and iii
   d. i, ii, and iii

19. How is it possible to conduct audio conferencing?

20. Netscape Collabra is an example of _____, which in turn is a type of _____.

   a. Project management groupware; collaborative work management tool
   b. Discussion forum groupware; electronic conferencing tool
   c. Calendaring and scheduling tool; collaborative work management tool
   d. Desktop conferencing systems; electronic communication system

21. What is Internet Relay Chat?

22. Which of the following tools enables users to use electronic versions of appointment book, address book, contact list, etc?
    a. Calendaring and scheduling tools
    b. Project management tools
    c. Workflow systems
    d. Knowledge management systems

23. Project management software and knowledge management system are _____.

24. Which of the following is **not** a project management groupware?
    a. Microsoft Project
    b. Lotus Organizer
    c. CA – Super Project
    d. Netscape Collabra

25. What is an electronic meeting system? What is/are its drawback(s)?

26. What are workflow systems?

27. Which of the following collaborative work management systems is also known as document image management?
    a. Workflow system
    b. Document sharing
    c. Knowledge management system
    d. Task and project management system

5.8 Summary

- The Internet is a collection of millions of individual networks and organizations. These networks direct the Internet traffic on the basis of certain Internet procedures and protocol standards to enable sharing of information among them. Internet enables electronic commerce (e-commerce).

- An intranet is a private computer network designed for internal use in an organization. They are mostly used for communications and collaboration, web publishing, and managing business operations.

- Extranets use the network connectivity, Internet protocols, and telecommunication systems to assist sharing of organizational information among its suppliers, business partners, and customers.

- Enterprise collaboration systems are information systems that support communication, coordination, and collaboration among the members of networked teams and workgroups, thus enabling an organization to enhance its productivity.

- Collaborative software, popularly known as groupware, can be classified into enterprise communication tools, enterprise conferencing tools, and collaborative work management tools.

5.9 Glossary

- **Collaborative work management tools:** Tools that help people manage group activities. Calendaring and scheduling tools, task and project management tools/systems, workflow systems, document sharing, and knowledge management systems are some examples of collaborative work management tools.

- **Data conferencing:** An interactive way of sharing information among users based at different locations over a network of computers. In data conferencing, two or more users share data online or in real time, using a common workspace on their computer desktops. The information being shared can be a document, a drawing, a graphic, or a digitized sound or video.

- **Electronic Mail/E-mail:** This is the most widely used service of the Internet and helps users exchange messages electronically. E-mail refers to both the use of Simple Mail Transfer Protocol (SMTP) as well as the intranet systems. Using e-mail, one can send data files, software, and multimedia messages and documents as attachments to others.

- **Enterprise collaboration systems:** Information systems that use a variety of information technologies to help people work together. The enterprise collaboration systems essentially support communication, coordination, and collaboration among the members of networked teams and workgroups. These systems help teams and workgroups work together in a variety of ways. These systems are in the form of groupware tools, the Internet, intranets, and extranets, which enable communication among the employees.

- **Enterprise communication tools:** These tools help in sharing documents, files, and messages electronically with others. Enterprise communication tools

include electronic mail, faxing, voice mail, instant messaging, web publishing, Internet phone and paging systems, and the Usenet. Through these tools, one can send data files, text, voice messages, or multimedia to others through computer networks.

- **Enterprise conferencing tools:** These tools enable people to share information in an interactive way. Enterprise conferencing tools include teleconferencing, discussion forums, chat systems, and electronic meeting systems.

- **Extranet:** An extranet is a private network; it is an extension of the company's intranet to external users such as the suppliers, distributors, customers, and partners of the company.

- **Facsimile/fax:** A device that scans text or graphic images and converts the scanned data into electrical impulses. These impulses can be transmitted to a compatible facsimile device over a telephone or communications network.

- **File Transfer Protocol (FTP):** A protocol developed to exchange files over the Internet. FTP is the most commonly used medium to download programs and other files to the computer from other servers. The user can use FTP to copy, move, rename, and delete files from a server. It can also be used to upload files to a server. Any type of file – whether text, graphic, video, or audio, can be copied/uploaded using this tool.

- **Groupware:** Software that enables coordination, collaboration, and communication within the organization. It facilitates the sharing of knowledge and ideas in a workgroup. It is used to help organization members work together to achieve common goals. Groupware products enable group collaboration through electronic mail, discussion groups and databases, audio and videoconferencing.

- **Hypertext Markup Language (HTML):** A page description language which is used for creating hypertext/hypermedia documents for the World Wide Web and intranet websites.

- **IMAP:** An acronym for Internet Message Access Protocol. IMAP was developed in 1986 at Stanford University and is also used for retrieving e-mails. It is like a remote file server that allows the users to retain the mails on the server and organize them in folders.

- **Internet:** A collection of millions of individual networks and organizations. It is a network of computer networks that runs various protocols which are all unified by a single internetworking protocol called

the Internet Protocol. A common form of an internet is a collection of LANs which are all interconnected by a WAN.

- **Intranet:** A private computer network designed for internal use within the organization. Intranets are installed for a limited set of users (i.e., organizational users) and are highly secure compared to the Internet in ensuring that the external users cannot access them.

- **Knowledge management:** The process by which the knowledge in an organization (which is in the form of forecasts, processes, procedures, reference work, and best practices) is identified, accessed, enhanced, and protected – through the use of advanced technology and user-friendly portals.

- **POP:** Stands for Post Office Protocol. It is used for retrieving e-mails from a mail server.

- **SMTP:** Stands for Simple Mail Transfer Protocol. SMTP is used for transferring mails between computers connected to the Internet. The intranet systems within an organization allow the users to mail each other.

- **Task and project management:** Project management groupware that helps project teams work together and keep track of the deadlines. These tools not only produce project schedules and program reports, but also send automatic reminders of due dates for project tasks. They also produce charts to plan and track projects. Tasks and project management software also help in drawing graphs and charts. Project management groupware helps generate Gantt charts. Charts that use network methodologies like the PERT (Project Evaluation and Review Technique) and the CPM (Critical Path Method) can also be generated.

- Teleconferencing: One of the popular group support facilities that help in reaching multiple groups simultaneously. It comprises of data conferencing, video conferencing, and audio conferencing. Teleconferencing is used in sales meetings, employee education and training programs, and new product announcements.

- **Uniform Resource Locators (URLs):** Paths through which one can access documents or data on the Internet, extranets, and intranets. URLs are addresses of the documents or data that are placed on the World Wide Web.

- **Usenet/user network:** A collection of user-submitted notes or messages on various subjects that are posted to servers on a worldwide network. The Usenet, developed in 1979 by students of Duke University, allows users to send and receive messages or articles that are similar to the electronic mails.

Users send messages to a particular server. These messages are then forwarded to other servers through the store and forward method.

- **Web publishing:** An effective method of communicating among teams and workgroups in an organization that involves creating a website and placing it on the web server for access by users. In web publishing, a team member can post a report or other linked documents in HTML directly to the web server of an intranet or extranet for access by the other team members. Any news or messages pertaining to the project can be transmitted to the mailboxes or screens of the team members.

- **Website:** A collection of HTML (Hyper Text Markup Language) pages. To access the site, the HTML pages and the essential graphic elements should first be copied onto the server into the appropriate directories. Website is located by its universal resource locator (URL), its Web address.

- **Whiteboard:** A shared workspace on which the users can draw, write, import, or manipulate real time images. It can be viewed by all the users. The software should be run and controlled by all the users.

- **Workflow systems:** These systems help users to collaborate with each other to accomplish and manage tasks within a knowledge-based business process. Workflow systems are generally based on rules that govern the flow of tasks.

- **World Wide Web (WWW):** The most popular service on the Internet that incorporates the services on the Internet. The WWW provides various services like retrieval of documents, viewing of images, viewing programs, animation, video, audio, etc. It is a system for organizing and linking Internet files, resources, and services, and providing access to them.

5.10   Self-Assessment Test

1. The World Wide Web (WWW) is the most popular service on the Internet. Explain the concept of the WWW? What are the various applications of the WWW? Also, explain the basic differences between the Internet and the WWW.

2. In business organizations, intranets help in internal communication within the organization. In this context, explain how the intranet adds value to a business. Also, discuss in brief the various limitations of the intranet.

3. Extranets can facilitate the process of marketing and selling of products & services to the customers and conducting business with the partners. Explain in detail how extranets can add value to an organization's business?

4. Based on the level of collaboration and communication, groupware can be classified into three types. What are they? Also, give a brief explanation of each type.

5.11 Suggested Readings / Reference Material

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3. Introduction to Information Systems - 6th edition, R. Kelly Rainer; John Wiley & Sons, Inc.2016

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5.12 Answers to Check Your Progress Questions

Following are the answers to the Check Your Progress questions given in the unit.

1. In the 1960s, the US Department of Defense wanted to create a computer network that would continue to function even in a disaster. It was intended to be flexible so that if a part of the network was damaged

or destroyed, the rest would still work. This led to the creation of the ARPANET (Advanced Research Projects Agency Network), which was used to inter-link scientific and academic researchers in the US. This was the forerunner of the Internet. This led to the creation of the Internet, popularly known as the Net, in 1969.

2. (c) NSFNET

In 1985, the US National Science Foundation (NSF) created NSFNET, an organization comprising a series of networks for research and education-related communication. The NSFNET created a national backbone service that provided free service to all research and educational institutions in the US.

3. InterNIC

In 1985, the US National Science Foundation (NSF) created NSFNET, an organization comprising a series of networks for research and education-related communication. NSF also created another service called InterNIC. InterNIC is a body that registers new domain addresses with extensions like .com, .org, .edu, etc on the Internet.

4. WWW is the most popular service on the Internet with thousands of people accessing thousands of websites. It is a system of Internet servers that support specially formatted documents. Documents are formatted in a script called HTML (Hyper Text Markup Language) that supports links to other documents, as well as graphics, audio and video files. These pages reside on web servers.

5. An intranet is an Internet designed for internal use within an organization. Unlike Internet, the intranet is not accessible by external entities and is meant for internal use. Intranets that are connected to external networks are usually equipped with firewalls that screen incoming data and allow only selected members to access internal data.

6. Intranet is mostly used for communications and intra-enterprise collaboration, web publishing and managing business operations. They are also used to train employees. Training material is provided on the intranet, which employees can access from anywhere in the world.

7. (b) Only i and iii

Intranets enable sharing of information and knowledge among employees in an organization. They also help in streamlining the distribution of reports and other documents within the organization. However, the organization has to expend more funds during the

installation of intranet. Another disadvantage of intranet is the possibility of unauthorized access and sharing of organizational information.

8. An extranet is a private network; it is the company intranet that is extended to external users of the company, such as suppliers, distributors, customers, and business partners.

9. **(b) Only i, ii, and iv**

Customers and wholesalers can access the intranet and place orders easily and quickly. Extranet allow a company to build strategic relationships with customers and suppliers and offers new kinds of interactive web-enabled services to business partners.

10. **(d) Extranets provide face to face contact with external business entities.**

Using extranets, the company can develop strategic relationships with its customers and vendors. The information shared on the extranet can be updated regularly and instantaneously. Extranets can be used for sharing news that might be of common interest among the business partners. However, these networks do not provide face to face contact with the external business entities.

11. Groupware enables creation of workgroups with members who are geographically dispersed and/or working in different time zones. It is also used to create a 'virtual organization', i.e., a workgroup or organizational layer that does not appear on a formal organization chart. Groupware can also be useful in making operational, managerial and strategic decisions.

12. **(d) It increases the effort required to transfer ideas, thoughts, and documents across workgroups**

Groupware establishes a foundation for collaboration and communication in the organization. It has been created to enable groups of workers at different geographical locations to communicate. Groupware reduces the time and effort required to transfer ideas, thoughts, and documents across workgroups.

13. Groupware can be used to create a 'virtual organization'. A virtual organization is a workgroup or organizational layer that does not appear on a formal organization chart.

14. **(d) Lotus Notes**

Netscape Navigator, Microsoft's Internet Explorer, Opera and Mozilla Firefox are examples of web browsers. Lotus Notes is a discussion forum groupware tool.

15.   File Transfer Protocol (FTP) is a protocol developed to exchange files over the Internet. The user can use FTP to copy files from a host computer to the user's computer. It can also upload files to a server. Any type of file - whether text, graphics, video or audio can be copied/uploaded using this tool.

16. **(c) Simple Mail Transfer Protocol (SMTP)**

     Electronic mail (E-Mail) is the most widely used service of the Internet through which users can exchange messages electronically. This is possible with Simple Mail Transfer Protocol (SMTP), which is used for transferring mail between computers on the Internet.

17.   **A collection of user-submitted messages on various subjects, posted to servers on a worldwide network**

     To facilitate communication and information access, the Internet provides facilities like electronic mail, Internet relay chat, Internet telephony, Internet fax, Internet paging, File Transfer Protocols and Usenet. A Usenet is a collection of user-submitted notes or messages on various subjects that are posted to servers on a worldwide network.

18. **(d) i, ii, and iii**

     Data conferencing is an interactive way of sharing information among users at different locations over a network of computers. Application sharing and application viewing are two terms used in data conferencing. Application sharing is similar to remote control software. It facilitates sharing of the same computer screen by all participants.

19.   Audio conferencing is similar to conversing on the telephone. These systems make use of loudspeakers and similar devices so that sound is heard throughout the room. They use PSTN (Public Switched Telephone Network) lines and analog networks for transmission.

20. **(b) Discussion forum groupware; electronic conferencing tool**

     Teleconferencing, discussion forums, and electronic meeting systems are various electronic conferencing tools. Discussion forums facilitate communication among employees and students through the World Wide Web. They are used for posting messages, downloading data and program files from online services and include Internet and intranet workgroups, discussion groups and databases. Lotus Notes and Netscape Collabra are examples of discussion forum groupware.

21. **An Internet service that enables users to join groups and get into real-time text-based conversations**

    An Internet Relay Chat (IRC) is a service that enables a user to join chat groups called channels, and get into real-time text-based conversations. All messages appear on the screen and each is prefaced with the participant's user name.

22. **(a) Calendaring and scheduling tools**

    Calendaring and scheduling tools enable users to use electronic versions of a variety of office tools such as calendar, appointment book, address book and contact list. These tools are included in packages like Novell GroupWise, Netscape Communicator and Microsoft Exchange.

23. **Collaborative work management tools**

    Groupware for enterprise collaboration involves electronic communication, electronic conferencing and collaborative work management tools. Collaborative work management tools are calendaring and scheduling, task and project management, workflow systems, document sharing, and knowledge management.

24. **(d) Netscape Collabra**

    Project management groupware helps project teams work together and keep track of deadlines. Microsoft Project, Lotus Organizer and CA-Super Project are examples of project management groupware. These tools not only produce project schedules and program reports, but also send automatic reminders of due dates for project tasks. Netscape Collabra is a groupware application used for discussion forums.

25. An Electronic Meeting System (EMS) facilitates group decision making that takes place in a computer-based decision-room setting. An electronic meeting begins by stating the problem to be addressed, followed by a brainstorming session in which each comment appears on the workstation without attribution. It makes group communication easy and protects the identity of participants. An Electronic Meeting System (EMS) suffers from the drawback of generating a large number of alternatives. Dealing with them is difficult and time-consuming.

26. Workflow systems help users collaborate with each other to accomplish and manage tasks within a knowledge-based business process. They are based on rules that govern the flow of tasks. Such capabilities are found in groupware like Novell GroupWise, Lotus Notes and Microsoft Exchange.

27. **(a) Workflow system**

   Workflow systems help users collaborate with each other to accomplish and manage tasks within a knowledge-based business process. These systems are generally based on rules that govern the flow of tasks. Workflow systems are a type of electronic document processing. It is also called document image management.

Unit 6

Management Information Systems

Structure

6.1 Introduction

In the previous we have seen how individuals and business users are able to create documents, conduct analysis, and make presentations with the use of personal productivity software, and how enterprise collaboration systems like the Internet, intranet, extranet, and the groupware, have helped organizations communicate, coordinate, and collaborate both within and outside the organization.

In the following unit, we would discuss about the role played by information systems such as transaction processing systems, functional information systems, management information systems, decision support systems,

executive information systems, and online analytical processing in simplifying the way business operations are carried out and in improving the business performance.

For every organization, transaction processing is one of the fundamental activities. Apart from the role played by information systems in supporting management, ensuring control, and undertaking other knowledge-based work, information systems have specific applications in the various functions of an organization like marketing, manufacturing, human resources, accounting, finance, etc.

Marketing information systems support the marketing function whereas manufacturing information systems support the production or operations function. Likewise, human resources information systems maintain records of the details of all employees working in the organization and also that of the new applicants. Accounting information systems record and report the flow of funds and help in producing financial statements. Financial information systems assist in allocating and controlling the financial resources within a business.

Management information system is a management support system which helps an organization in its day-to-day operations. It uses computer-based strategic, tactical, and operational information systems for converting data into information. MIS supports structured decision making.

Decision support systems are information systems which assist managers in taking decisions and are developed by making use of analytical models, specialized databases, and the knowledge and experience of decision makers. They usually support unstructured or semi-structured decision making.

Executive information systems provide online access to relevant information about the internal/external environment to the top management in a comprehensible format. Its basic purpose is to help executives gain knowledge about the organization, its work processes, and its interaction with the external environment. These systems mostly help the top management in taking unstructured decisions.

Online Analytical Processing, popularly called OLAP, is used to analyze data stored in the database. It includes data marts, data warehouses, data mining, and multidimensional databases.

Apart from carrying out business operations, information systems are also used by business organizations for achieving strategic advantage. Some of these advantages include improving business processes, reengineering the business processes, becoming an agile competitor, creating virtual companies, and knowledge management. We would be discussing in detail about these advantages in the following sections.

6.2 Objectives

By the end of this unit, you should be able to:

- State how information systems help organizations to perform various business operations efficiently.

- Analyze the objectives of transaction processing systems and the phases in transaction processing cycle.

- List the various types of functional information systems.

- Explain the evolution of management information systems and its various characteristics.

- Explain the characteristics and types of decision support systems.

- Discuss the implementation process of an executive information system.

- Explain the characteristics and functions of online analytical processing.

- Summarize how information systems can be used by businesses for achieving strategic advantage.

6.3 Organization as a System

An organization is a collection of interactive sub-systems working towards an organizational objective.

People are major components of any organization. They interact with all the sub-systems in the organization. People are arranged in an hierarchical manner as an organizational structure by giving them responsibilities and authority. There are certain reporting rules, norms and regulations. The other sub-systems in the organization include technology, structure, product, processes and culture.

Figure 6.1: Organization as an Interactive System
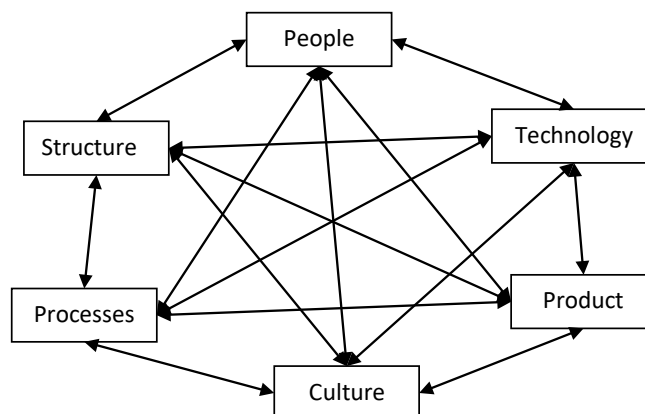
Organizational goals change according to the time. The changing social, economic, political and legal conditions change the organizational goals from time to time. The change in goals impacts the sub-systems of the organization. For example, the technology change can impact the organizational structure. Change in people can modify the organizational culture and structure. The change in structure can lead to change in organizational processes. Thus they are all interconnected.

Every organization under goes the life cycle of introduction, growth, maturity and decline. At different stages of life cycle, organization will have different goals and objectives leading to changes in the organizational sub-systems. All these sub-systems work towards the organizational goal and objectives. The CEO and top management team have major impact on these sub-systems of the organization. Organization works on standard procedures, principle, policies and norms. People have to comply with these norms and procedures. Any changes are to be communicated to all the stakeholders of the organization. For example, the product sub-system internally involves the tasks of the organization. This is because product development can be done with the execution of multiple tasks. Similarly, processes are followed in product development to maintain quality and productivity. These products should be in line with organizational strategy.

6.4 Information Systems for Business Operations

An Information System (IS) is defined as a system that accepts inputs in the form of raw data, processes them, and provides output in the form of information. It is designed to help managers to analyze data and make decisions. Some of the important functions carried out by information systems include accepting input in the form of data resources, processing the data resources into information products, storing the data resources, generating output, and controlling the performance of the system. Information systems help organizations to perform various functions, solve business problems, and pursue business opportunities.

In an organization, the management can be categorized into three levels, namely, top, middle, and lower. The decisions taken by these levels of management can also be classified into three levels, namely, strategic decisions (taken by the top level management), tactical decisions (taken by the middle level management), and operational decisions (taken by the lower level management). Since the nature of decisions taken at different levels is different, the type of information required at each level is also different. Thus, the information being provided should be consistent with the requirement of the organizational level at which it is targeted.

Operational decisions are short-term in nature and usually involve large-scale processing of internal data such as attendance, daily cash flows, sales figures, etc. Accuracy and speed, the two vital aspects to be considered while making operational decisions, are made possible through the use of information systems.

IS applications also help the middle level management in taking tactical decisions (like budget analysis, staff promotion, etc.). These decisions are likely to have a medium to long-term impact on the organization.

Decisions at the strategic level deal with long-term business issues (like diversification, strategic alliances, etc.) and are influenced by information external to the organization. While taking such decisions, several sources of information need to be explored and discrepancies in information reconciled, which necessitate the need for adaptive, flexible, and insightful information systems. They help in arriving at indicators such as demographic preferences, cultural trends, and psychological influences.

At the top management level, the number of decision-makers, as well as the decisions to be taken, is very few. Hence, the quantity of data required or processed at each level also differs.

Usually, the effect of decisions with respect to the time frame can be represented as follows:

Strategic decisions   > 3 years

Tactical decisions   1 – 3 years

Operational decisions   < 1 year

Check Your Progress-1

1. Information systems for strategic information needs of top management are referred to as:
   a. Management support systems
   b. Executive information systems
   c. Decision support systems
   d. Expert systems

2. _____ is developed using analytical models, specialized databases, and knowledge and experience of decision makers.

3. In which of the following options is the type of decision matched with a suitable example?

   a.   Operational decisions – Vendor Rating

   b.   Tactical decisions – Budget analysis

   c.   Strategic decisions – Staff promotion

   d.   None of the above

4. What are operational decisions?

5. Which of the following statements about executive information systems (EIS) is/are **true**?

   a.   EIS is primarily used by top management for unstructured decision making.

   b.   EIS is primarily used by operational executives for unstructured decision making.

   c.   EIS is primarily used by operational executives for structured decision making.

   d.   Both (b) and (c)

6.5 Management as a Control System

Management Control System (MCS) is combination of machines and people working towards organizational objective. That is, the performance of both machines and people has to be organized, planned, analyzed, monitored, discussed and controlled for organizational benefits. Management control system is about performance measurement of both machines and people in the organization with respect to costs, time and quality. The data collected in performance measurement should be used in responsible decision making. The organizational factors such as organizational culture and organizational structure impact the management control system in the organization. For example, performance measurement has got cultural angel as well. In some cultures, measuring individual performance is treated as an offence.

The components of management control system include budgets, performance measurement system, corrective actions, measurements, comparisons, analysis and reporting. The input resources of an organization are processed and output is generated. The quantity of output is to be planned ahead and results are to be compared. Any deviations from planned quantities are to be taken for corrective actions based on the causal analysis. Every manager in the organization is part of the performance measurement system. Thus, by measuring the performance of individual, team, department and machines, organizational performance can be monitored and controlled. It is best practice to take corrective action in case

of deviations from the planned values. This action impacts people, processes and machines in the organization.

6.6 Transaction Processing Systems

Information systems that process data generated from business transactions are called transaction processing systems. Transaction processing systems should capture data and process it with great speed and accuracy. After the data has been captured and processed, the transaction processing system updates the organization's databases and produces a variety of information products for both internal and external use.

 The main objectives of a transaction processing system are:

* Carrying out the organization's day-to-day transactions on a regular basis.
* Collecting, processing, editing, updating, and storing the data, and generating the required reports or documents.
* Supplying the necessary information to the organization which would facilitate proper functioning of the business.
* Providing reports and documents which would facilitate the making of timely decisions.
* Supplying data to other information systems.

There are five distinct phases in a transaction processing cycle. These phases include data entry, transaction processing, database updating, report generation, and inquiry processing.

6.6.1 Data Entry

In the data entry phase, collection of data is done by recording, coding, and editing activities and the data collected is converted into a form which can be directly fed into a computer system. In the transaction processing system, data can be entered in three ways, namely, manual data entry, semi-automated data entry, and fully-automated data entry. In manual data entry, an operator enters data by hand. However, traditional data entry methods are being replaced by more direct and automated methods as entering the data quickly and accurately using manual data entry methods has been a problem.

In semi-automated data entry, data capturing devices (like a scanner) are used for entering the data and it involves some amount of human intervention. The use of such data capturing devices in turn increases the speed of the transaction entry and processing stages. In fully automated data entry, data entry is done by two computers interacting with each other through a computer network and there is complete absence of human intervention. This process is also called electronic data interchange (EDI). The various data automation methods used

for entering data into the computer system include bar-coded tags, magnetic stripe cards, optical character recognition wands, etc.

6.6.2 Transaction Processing

The two ways by which the transaction processing systems process data are real-time processing and batch processing.

6.6.2.1 Real-time Processing

Also known as online transaction processing (OLTP), real-time processing involves processing of transactions as and when they happen, and providing the output immediately to the company and to the end users. The entry of data is done online. The operator has access to a database which is located online, and thus any errors which may arise during the process can be rectified without any delay.

6.6.2.2 Batch Processing

In batch processing, the transactions collected are stored until a satisfactory number is reached. This type of transaction processing involves accumulation of transactions until a certain set of criteria are satisfied, like for instance time period (say monthly, quarterly) or quantity (based on the volume of transactions).

6.6.3 Database Updation

This phase involves updating the database regularly by the organization's transaction processing systems so that any changes in the transactions are immediately reflected in the data records stored in the company's database. In addition to this, data resulting from miscellaneous adjustments also need to be recorded on a file or a database. Sometimes, a database updating log, containing the information on the date, time, etc., of updation, is also maintained.

6.6.4 Report Generation

This phase involves generating information products like reports and other documents. Documents generated by the transaction processing systems are called transaction documents. These documents can be classified into three categories.

6.6.4.1 Information Documents

Information documents (like customer invoices) act as confirmation or proof to their recipients regarding the occurrence of certain transactions.

6.6.4.2 Action Documents

Action documents authorize the recipients to carry out a particular process or take some action.

6.6.4.3 Turnaround Documents

Turnaround documents are output documents generated by a computer, which again become input documents on entering additional data. These documents are designed to first initiate some action and then return for further processing so as to complete the transaction.

Transaction processing system also produces several types of reports which are designed to document and monitor the results of business transactions occurring in a specific time period. Such reports can provide an audit trail for transaction control purposes.

6.6.4.4 Control Listings

Control listings, also called transaction logs, are detailed reports that provide details of each transaction occurring during a particular period.

6.6.4.5 Edit Reports

Edit reports provide details of errors like missing data, invalid account number, etc., which are detected during processing.

6.6.5 Inquiry Processing

Real-time inquiries of online files and databases can be done by periodic batch processing or real-time (online) processing. End users may use various hardware or query languages to make queries and receive reports concerning the results of transaction activity.

Check Your Progress-2

6. Which of the following is **false** regarding real-time processing?
   a. Real-time processing enables transactions to be processed immediately after they are generated.
   b. Errors are corrected immediately while data entry is online.
   c. Monthly payroll processing is an example of real-time processing.
   d. An airline reservation system uses real-time processing.

7. _____ are detailed reports that describe each transaction occurring during a particular period.

8. The following activities are involved in a transaction processing system:
   i. Database updating
   ii. Transaction processing
   iii. Data entry
   iv. Report generation

What is the correct sequence in which the above activities should take place?

9. Which of the following stages in the transaction processing cycle uses data automation methods?

    a. Data processing

    b. Report generation

    c. Data entry

    d. Inquiry processing

10. What is batch processing?

11. A customer invoice is which type of transaction document?

    a. Action document

    b. Control listing

    c. Edit report

    d. Information document

12. _____ contain details of errors that have been detected during transaction processing.

6.6.6 Functional Information Systems

In many big organizations, information systems are combinations of various functional information systems and they support various business processes like product development, production, inventory management, sales, distribution, etc. Information Technology (IT) can also be used for sharing informational resources that would enhance efficiency and effectiveness in business processes. The different cross – functional information systems are:

6.6.6.1 Marketing Information Systems

In an organization, the marketing function oversees the planning, promotion, and sale of products and/or services that are available currently or can be developed for sale in the existing markets or in new markets.

The various components of a marketing information system include:

6.6.6.2 Market Research and Forecasting

Information systems which support market research activities link the end consumer and the marketer through information. Such information systems help to simplify the process of collecting, analyzing, and maintaining a huge volume

of information on several market variables which are always changing. Finally, it communicates the derived results to the management.

Such marketing intelligence would in turn help the marketers to make an analysis of the external environment, understand the behavior of consumers, understand the rationale behind the success or failure of a particular product or service in the market, make better marketing forecasts and marketing decisions, and develop more effective marketing strategies.

6.6.6.3 Sales/Product Management

Computer-based systems can be used for generating sales analysis reports for analyzing sales by product, product line, customer, salesperson, and sales territory. These reports would in turn help the marketing managers to monitor the sales performance of the products and sales people, and develop support programs for improving the sales results.

To plan and control the performance of specific products, product lines, and brands, product managers make use of computer systems for analyzing price, revenue, cost, and growth information for the existing as well as new products. It helps in evaluating the performances of the existing products and also the prospects of the proposed products.

6.6.6.4 Advertising and Promotions

Marketing information systems make use of information from market research for selecting the appropriate media and promotional methods, allocating financial resources, and evaluating the results of various advertising and promotional campaigns. They help the marketing managers to reduce costs of advertising and promotion and at the same time improve sales.

6.6.6.5 Sales Force Automation

In a company, sales force automation can make the sales force highly productive by providing them with portable computers and necessary sales contact management software. The main objective of sales force automation is to streamline all the sales processes within the organization which enhances the efficiency of the business, improves customer satisfaction, saves the amount of time and money spent, and creates a more interactive atmosphere between the sales force and the customers.

6.6.6.6 Interactive Marketing

This type of marketing establishes a two-way interaction between a business and its existing and/or potential customers through computer networks. These customers become partners and indirectly contribute towards creation, purchase and improvement of the products and services of the company.

6.6.7 Manufacturing Information Systems

Also known as operational information systems, manufacturing information systems support the production/operations function in an organization. The various components of a manufacturing information system help in planning, monitoring, and controlling production, inventories, purchases, and other aspects relating to the production of goods and services. These components include:

6.6.7.1 Manufacturing Execution Systems

Manufacturing Execution Systems (MES) monitor, track, and control the five essential components involved in a production process, namely, materials, equipment, personnel, instructions, and production facilities. It enhances the productivity and quality of production processes. MES includes shop floor scheduling and control, machine control, robotics control, and process control.

6.6.7.2 Process Control Systems

The computer systems that control an ongoing physical manufacturing process are referred to as process control systems. They require the use of special sensing devices that measure physical phenomena like temperature, pressure, etc. Process control software uses mathematical models to analyze the data generated by the ongoing process and a comparison is then made with standards or forecasts of required results. The process is managed by the computer by adjusting the control devices such as valves and switches.

6.6.7.3 Computer Integrated Manufacturing

Computer Integrated Manufacturing (CIM) is manufacturing supported by computer systems. In an organization, a variety of manufacturing information systems is used for supporting CIM. The objectives of CIM are:

- Simplifying production processes, product designs and factory organization

- Automating production processes and business functions that support them

- Integrating all production and support processes with the help of computers, telecommunication networks, and other information technologies.

CIM integrates Computer Aided Design, Computer Aided Manufacturing, Computer Aided Process Planning (CAPP), Computer Aided Quality Assurance (CAQ), and Enterprise Resource Planning (ERP). Manufacturing Information Systems help companies to simplify, automate, and integrate many activities which are required for manufacturing products. Engineers can design better products by making use of the CAD and CAM systems. CAM systems automate the production process and monitor and control it through MESs.

Alternatively, this can be done by directly controlling a physical process (Process Control), or a machine tool (Machine Control), or machines with some human-like work capabilities (robots). Materials Requirement Planning system helps in planning the material required for production and is integrated with production scheduling and shop floor operations. It is popularly known as Manufacturing Resource Planning (MRP). Popular software in 2021: CIM project suite 2022, Solid Edge CAM Pro, GibbsCAM, Fusion 360, SOLIDWORKS CAM, and Curtain Call.

6.6.8 Human Resource Information Systems

In any organization, the main objective of human resource function is to make efficient and effective utilization of human resources. It deals with the recruitment, placement, compensation, evaluation, and development of employees.

Human Resource Information Systems (HRIS) help in maintaining track of the details of all the employees working in the organization as well as that of new applicants with the help of a database or a series of inter-related databases. Some of these systems are:

6.6.8.1 Staffing

The basic function of staffing in an organization is to find out and establish a working relationship with both employees as well as prospective candidates by maintaining a personnel database. This database should be revised or updated on a continuous basis due to changes that occur in the job assignments, compensation, hiring, and termination of the employees. Personnel requirement forecasting is another application that can improve the efficiency of staffing by providing the forecasts of the number of personnel required for each job category or for new projects that are being planned by the management.

6.6.8.2 Training and Development

In an organization, information systems which support the training and development function should help human resource managers to effectively plan and monitor the employee recruitment, training, and development programs. These managers need to analyze the successful programs that are currently conducted in the organization and also the career progress of all the employees. Such analyses would help the managers to take a decision on whether any training program and/or periodic performance appraisals should be recommended or not.

6.6.8.3 Compensation Analysis

By making use of information systems, human resource managers can analyze the range and distribution of compensation paid to the employees in the form of

wages, salaries, incentives, and fringe benefits. This analysis in turn would help the company to compare the company's standards with that of the industry and other related economic indicators, and also in making changes in the compensation.

6.6.9 Accounting Information Systems

In an organization, the main purpose of an accounting information system is to accumulate data relating to financial transactions, process it into information, and report it to the concerned external (i.e. creditors, investors, and government agencies for making investment and other decisions) and internal entities (i.e. managers for planning and controlling the business operations, and for decision making) in the organization.

Activity: Computerz Software Inc. (Computerz), a leading software company in India, has successfully implemented an integrated Human Resource Information System (HRIS). In what ways do you think the HRIS can assist the HR managers in Computerz to carry out their tasks effectively? What measures should the company take to make the HRIS user-friendly?

Answer:

_____

_____

_____

_____

_____

6.6.10 Online Accounting Systems

The way in which the accounting information systems monitor and track the activities of a business organization has undergone a significant change because of the use of intranets, extranets, the Internet, and other technologies. Since these networks are interactive in nature, they demand new forms of transaction files, controls, and procedures. Order processing systems and inventory control systems are important since they are directly involved in supplier/customer transactions.

6.7 Financial Information Systems

In an organization, financial information systems help managers to take financial decisions. Financial information systems can be classified as:

6.7.1 Cash Management

Cash management involves collection of information on all cash receipts and payments within a company on either real time or periodic basis. This helps the managers to take quick decisions on whether to invest or deposit excess funds in the short term; if yes, where to do so, and would such steps result in an increase in the income of the organization. Daily, weekly, or monthly forecasts of cash receipts and payments are also generated for predicting the future deficit or surplus of cash.

6.7.2 Investment Management

Investment management is defined as the professional way of managing an organization's securities and other financial assets for catering to the investment requirements of the organization on one hand and benefiting the investors on the other. Some of the portfolio management software packages available in the market are Cornerstone PowerBroker, Asset Management Software, etc.

6.7.3 Capital Budgeting

Capital budgeting is defined as the process of evaluating an organization's profitability and the financial impact of its proposed capital expenditures. Capital budgeting application involves the use of spreadsheet models which incorporate present value analysis of expected cash flows and probability analysis of risk for determining the optimum mix of capital projects for the business.

6.7.4 Financial Planning

With the help of electronic spreadsheets and financial planning software, the present as well as the projected financial performance of a business can be evaluated. Apart from this, these tools can also be used to determine the financing needs and alternative ways of financing.

Check Your Progress-3

13. How does the information obtained from market research aid in For advertising and promotions, Marketing Information Systems use the information obtained from market research to:

    i.   Select appropriate media and promotional methods
    ii. Allocate financial resources to promotional campaigns
    iii. Evaluate results of various advertising and promotional campaigns

    a.   Only i and ii
    b.   Only i and iii

c. Only ii and iii

d. i, ii, and iii

14. _____ are operational performance-monitoring systems that monitor, track and control five essential components in a shop floor: materials, equipment, personnel, instructions, and production facilities.

15. What are process control systems?

16. Match the following applications with the corresponding information systems.

i.	Compensation analysis	p.	Manufacturing Information System
ii.	Sales force automation	q.	Financial Information System
iii.	Cash management	r.	Human Resources Information System
iv.	Computer Aided Process Planning	s.	Marketing Information System

17. _____ are information systems that record and report business transactions and flow of funds through an organization. They also produce financial statements.

18. Which of the following applications of financial information systems involves the use of present value analysis of expected cash flows and probability analysis of risk?

a. Cash management

b. Investment management

c. Capital budgeting

d. Financial planning

19. _____ is an application of the financial information system that helps managers decide whether to invest or deposit excess funds in the short term.

6.8 Management Information Systems

Barry E. Cushing defined Management Information Systems (MIS) as "a set of human and capital resources within an organization which is responsible for the collection and processing of data to produce information which is useful to all levels of management in planning and controlling the activities of an

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organization." MIS makes use of manual procedures, computer hardware and software, models, and a database for analyzing, planning, controlling, and taking decisions. Despite the fact that information is required at all levels within a business organization, its scope, content, and presentation varies from one level to another. Based on the level at which it is used, information is classified as operational, tactical, and strategic information.

Operational information: This information consists of information for transaction processing, status inquiries, etc. It comprises information resources to support day-to-day operations and control.

Tactical information: This information consists of information system resources that help in tactical planning and decision making for management control.

Strategic information: This information consists of information resources for supporting strategic planning and policy making by the top management.

Each level of management makes use of data provided by the lower levels, although some new data may also be included.

6.8.1 Evolution of MIS

The evolution of MIS has been driven by the development of new theories in management and accounting, changes in the methods of production and distribution, development of management sciences, and the use of computers for data processing. With business becoming more complex due to rapid industrialization and globalization, there was a need for systems that were more efficient in terms of speed, quality, accessibility, and presentation. MIS, as it is known today, helps an organization to make use of the benefits of IT for improving organizational efficiency. In simple words, it transforms data into information. MIS is a combination of various academic disciplines like managerial accounting, operations research, management and organizational theories, and computer science.

Some of the concepts which are regarded as extensions of MIS are online transaction processing, decision support system, and executive information system. MIS is still evolving and its benefits are yet to be understood by managers since even today they are perceived to be instruments of control rather than as means for achieving organizational efficiency.

6.8.2 Characteristics of MIS

The salient features of an MIS are:

6.8.2.1 Management Oriented

MIS has been developed for increasing organizational efficiency and hence it should focus on the requirements of the managers and the organization's overall objectives.

6.8.2.2 Management Directed

MIS can be costly and time consuming. Thus, it is essential for the top management to understand their importance in increasing organizational efficiency, which would lead to quicker implementation of decisions.

6.8.2.3 Integrated systems

MIS is based on five factors, namely, men, money, material, machines, and methods (or processes). An MIS is a combination of functional and activities subsystems and hence, it is important that MIS be viewed as an integrated system.

6.8.2.4 Common data flow

Under MIS, activities like data gathering, storage, retrieval, and data capturing are performed only once. All data is collected from the original source. The system tries to minimize data processing and maximize the generation of output by establishing a common data flow. Such integration helps in building an effective MIS.

6.8.2.5 Planning

Implementing MIS needs meticulous planning, design, and implementation. The design should be such that there is perfect synchronization between hardware, software, data processing, information presentation, and feedback.

6.8.2.6 Subsystem concept

MIS consists of several subsystems interacting with each other. It helps perform specialized tasks that may be integrated into the total system.

6.8.2.7 Common database

A common database acts as an integrator between the different functional subsystems in the organization. It permits access to different tables by different functional subsystems. As the requirement of data varies for different levels of management, the system supports one or more databases.

6.8.2.8 Flexibility

MIS is flexible and can be modified easily. Computerization is also simple because of the structure and comprehensive nature of the system.

6.8.3 Functions of MIS

There are three main functions of MIS, namely, data collection, data storage and processing, and information presentation. Since the requirement of information in organizations is large and the sources are also different, organizations should define their requirements before selecting their sources of information. The sources of information could be internal (like company records and reports compiled by managers) or external (like trade publications,

customers, and consultants). Databases usually contain data collected from different sources. After collecting the data, it is stored on magnetic tapes or on hard disks which makes retrieval of information easy for users. Information is usually presented in standardized reporting formats.

6.8.4 Importance of MIS

In organizations, managements are yet to realize the importance of MIS since they are often of the view that developing and implementing information system involves huge amount of money and time and requires complete organizational transformation. This transformation, they believe, would result in employees being reluctant to agree to a change in their working style and the work culture. The role and importance of information systems in management are:

- designed information systems make decision making much easier and faster.

- They help in categorizing information as per the requirements at different management levels.

- They ensure timely availability of information to the top management to facilitate decision making.

- Since they are collections of subsystems, they eliminate redundancy.

- As they are flexible in nature, they can be easily modified according to current requirements. They help in improving management processes.

6.8.5 Management Reporting Systems

Management reporting systems are information systems which provide support to the management of an organization by providing them with various types of reports. These reports are prepared on the basis of the inputs received from the transaction processing systems; data collected from suppliers, customers, and business partners; and external data collected through the Internet and other sources. The four types of reports that are available to managers are:

6.8.5.1 Periodic Scheduled Reports

These reports follow a predetermined format. They are used to provide information to managers on a regular basis.

6.8.5.2 Exception Reports

These reports are generated only in exceptional situations and not on a regular basis.

6.8.5.3 Demand Reports and Responses

Also called ad hoc reports, these reports are generated as and when they are required by the manager. Managers use queries and report generators for such reporting.

6.8.5.4 Push Reports

These are the reports through which information is sent to the networked workstation of the manager.

Activity: Piyush Bhattacharya, a manager with Credit Financial Corporation, noticed that there has been a sudden spurt in the number of defaulters in the personal loans category. He has asked the accounts department to prepare a report containing the list of defaulters, the loan amount taken, and the modalities to be followed for taking necessary action against these defaulters. Critically analyze the importance of management reporting systems in this case.

Answer:

_____

_____

_____

_____

Check Your Progress-4

20. Which of the following statements is **false** regarding Management Information System (MIS)?

   a. MIS helps organizations leverage benefits of IT to increase organizational efficiency.

   b. MIS is a combination of various academic disciplines like managerial accounting, operations research, management and organizational theories and computer science.

   c. Online transaction processing, DSS and EIS are concepts considered to be extensions of MIS.

   d. MIS is not useful for management control

21. What is a management information system?

22. _____ are generated as and when managers require them. The manager uses ad hoc queries and report generators for _____ .

    a. Periodic scheduled reports; ad hoc reports

    b. Action documents; ad hoc reports

    c. Ad hoc reports; demand reports

    d. Information documents; demand reports

6.9 MIS for Digital Organization

Digital organization is one which uses extensive technology in its day to day business operations. It uses digital technology for both internal and external operations. There are many advantages of using management information systems in digital organizations. They increase individual and organizational productivity, reduce processing time, reduce delays and increase customer satisfaction. Digital organizations use technologies such as high speed networks, hardware, servers, computers, laptops, smartphones and other digital devices. They use Internet to communicate with external stakeholders such as customers, suppliers and vendors.

The MIS in digital organizations makes use of databases and data marts. Their business intelligence is based on their data warehouses. The digital organizations make use of both structured and unstructured big data in getting useful and applicable insights and foresights for the organization. The management information systems in digital firms include Enterprise Resource Planning (ERP), Supply Chain Management (SCM), Customer Relationship Management (CRM), Enterprise Content Management (ECM), Enterprise Project Management (EPM) and Enterprise Knowledge Management (EKM) systems. All these systems use the organizational databases and generate useful reports for the management's responsible and actionable decision making.

The digital firms make use of Internet, e-commerce and m-commerce. They make use of mobile and social technologies in interacting with customers. There are many social and psychological factors impacting digital organizations. The advantages with digital organizations include reduced transportation costs, travel costs, reduced response time, reduced time to market, increased operational efficiency, increased innovation, increased productivity, better decision making and competitive advantage. Example of digital firms include Google and Amazon.

6.10 Decision Making Process

Decisions are of two types. They are strategic decisions and operational decisions. Strategic decisions have long term impact. Whereas, operational decisions are short-term oriented and deal with day to day organizational business operations. Strategic decisions are taken by top and senior management. Whereas, operational decisions are taken by middle managers and supervisors. A decision has to be taken in order to solve a problem or to reach specific goal. Every manager in the organization takes many decisions and solves many problems every day. The decision taken has got lot of impact on the people, process, organizational structure and stakeholders. The decision may have both financial and non-financial impact on the organization. The right decision yields revenues and profits to a business organization. It improves the team climate and creates positive environment in the organization.

Decisions in the organization can be taken by the individuals or groups. Group decision making is more effective than individual decision making. There are pros and cons with this. Better solution comes out of group decision making because of multiple perspectives. The disadvantage is group may dominate individuals and individual may feel guilty for group thinking. The decision making process in an organization (as shown in figure) includes steps such as: identifying the goal or problem, finding out alternatives, analyzing each alternative, selecting best approach and implementing the solution. Then, taking feedback and implement change management in the organization.

Figure 6.1: The Decision Making Process
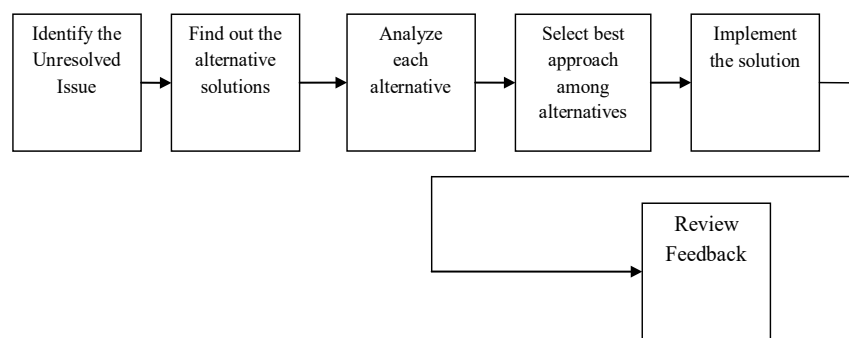
The alternative solutions for a problem can be generated using techniques such as brainstorming and Delphi technique. In brainstorming, multiple alternatives can be generated. In Delphi technique, moderator generates alternatives by collecting solutions from all participants. Each generated alternative is to be assessed with its pros and cons. It involves finding out the feasibility, financial and non-financial impact of the alternative on the organization. Next select the

alternative returning more pros and few cons and implement the same in the organization.

6.11 Decision Support Systems

Decision Support Systems (DSSs) are computer-based interactive systems and subsystems which help the decision-making group of the organization to effectively use organizational knowledge and various technologies to make decisions. A DSS provides access to all the information assets of the organization, compares the data figures, forecasts figures based on new data and hypotheses made, and evaluates the various decision alternatives considering the past experiences.

In business organizations, DSSs are widely used for providing support in activities like financial planning, forecasting, risk assessment, etc. A DSS may make use of inquiry, analysis, models, or accounting systems for arriving at a rational solution. They are very useful when complex manipulations and different techniques of analysis are needed to find a solution.

Basically, there are two types of decisions, namely, programmable decisions and non-programmable decisions. Decisions that are based on predetermined rules and can be computerized are called programmable decisions. Non-programmable decisions, on the other hand, are those that are based on situations and do not follow any fixed rules.

DSS Examples: GPS route planning determines the fastest and best route between two points by analyzing and comparing multiple possible options, Metrics such as sales results, inventory turnover and revenue growth, Diagnostic information that digs a bit deeper to reveal results and explains reasons for past performance as measured by descriptive analytics, BI solutions allow users to develop and run queries that are used to guide and support decision-making, User-configurable dashboards that allow managers to monitor a variety of performance indicators.

6.11.1 Characteristics of a DSS

A DSS enables its users to solve a particular problem using the what-if analysis. It is used for analyzing the various possibilities and deriving an appropriate strategy for each situation. The characteristics of a DSS are:

- They are computerized information systems that are interactive in nature and can be used by decision makers for controlling the order of operations performed.

- They provide support to those decision making activities or processes that are specific in nature.

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- They can be independent systems or subsystems of a more integrated and larger IS. As independent systems, they can collect or reproduce data from other information systems.

- They enhance the accuracy, quality, relevance, and the overall effectiveness of a specific decision or a set of related decisions, and can be used again and again.

- A DSS is flexible and can support semi-structured and unstructured information. This is an important characteristic since decisions are always based on assumptions.

- They are popular because of the simplicity of the models used. Decision makers select models on the basis of the complexity of the decisions.

- A lot of information may be required for making decisions. In order to provide meaningful information to the decision makers, it is necessary to store the information in databases, which makes data access easy and quick.

6.11.2 Types of DSS

The four types of DSS are:

6.11.2.1 Data Analysis Systems

Data analysis systems are developed using simple data processing tools and business rules. They rely on comparative analysis, application of formula, and use of algorithms. They are usually used for conducting cash flow and funds flow analyses.

6.11.2.2 Information Analysis Systems

Information available to the management has to be analyzed to arrive at a result. The analyzed data is printed in the form of reports for the perusal of the decision maker. This helps the decision maker in taking decisions. Such systems are used for generating sales analysis reports, market analysis reports, etc.

6.11.2.3 Accounting Systems

Accounting systems track information pertaining to cash, inventory, and personnel. Most of these systems make use of predetermined standards. A comparison is made between the actuals and the standards and the results obtained help the management in exercising control in the organization and arriving at a decision.

6.11.2.4 Status Inquiry Systems

Some decisions in the operational and middle management level do not require any elaborate computation, analysis, selection, and can be taken easily if the current status is known.

6.11.3 Applications of DSS

A DSS is very useful in analytical modeling. There are four basic types of analytical modeling supported by DSS. They are:

6.11.3.1 What-if Analysis

What-if analysis is used by the end users to make an analysis of the various possibilities and derive an appropriate strategy for each situation.

6.11.3.2 Goal-seek Analysis

In goal-seek, the target is fixed and changes are made to the related variable for achieving the target. MS Excel is generally used for conducting goal-seek analysis.

6.11.3.3 Sensitivity Analysis

Sensitivity analysis may be regarded as a type of what-if analysis. It examines the effect of repeated change in a single variable. It is useful when the user is not sure about the value of a key variable. There are a few DSS packages that automatically and repeatedly make minor changes to the variables. Scenario in MS Excel is used for conducting sensitivity analysis.

6.11.3.4 Optimization Analysis

Optimization analysis is a complex extension of goal seek analysis. In optimization analysis, the target is not fixed and it has to be determined after taking into consideration the constraints involved in achieving the targets. In this analysis, one or more variables are changed after taking into account the constraints until the best alternative or the optimal value is found. Optimization analysis requires special purpose software and techniques like linear programming or DSS generators. Solver in MS Excel is used for conducting optimization analysis.

6.11.4 Geographic Information Systems

Geographic Information Systems (GIS) are a special kind of DSS designed for integrating computer graphics and geographic databases with other features of DSS. A GIS consists of computer hardware, software, and geographic data which are used to gather, organize, evaluate, and exhibit all forms of information that is geographically oriented. Organizations use GIS to integrate the data stored about various geographical locations and analyze it to make critical decisions.

GIS are used by many companies for identifying new store locations, optimizing distribution routes and performing demographic analysis of their target customers. These information systems support such decisions which have

their influence on the people and other resources that are distributed geographically. Companies like Levi Strauss, Arby's, and FedEx use GIS packages to integrate maps, graphs, etc., with business data from spreadsheets and other statistical packages. Some of the GIS softwares are MapInfo and Atlas. GIS also supports decision making by integrating mapping capabilities in spreadsheet packages like Lotus 123 and Microsoft Excel. These systems are time and again used along with Global Positioning System (GPS) devices.

Check Your Progress-6

23. _____ are used along with Global Positioning System (GPS) Devices.

    a.   Geographic Information Systems

    b.   Transaction processing systems

    c.   Expert systems

    d.   Online Analytical Processing (OLAP)

24. _____ are used in business organizations to provide support in activities like financial planning, forecasting, risk assessment, etc.

25. What is sensitivity analysis?

26. Which of the following is **true** about optimization analysis?

    a.   It always involves data mining.

    b.   The problem definition includes a fixed target of the decision variable.

    c.   It requires consideration of constraints involved in achieving targets.

    d.   Complex techniques like linear programming are not required.

27. Match the following:

i. Airline reservation availability	p. Information analysis system
ii Funds flow analysis	q. Status inquiry system
iii. Sales analysis	r. Data analysis system

28. Decision support systems generally support which types of decision making?

6.12 Behavioral Issues in Decision-Making

There are many behavioral issues in decision making process in organizations. Particularly in case of group decision making, the individuals can face domination of specific individuals, involving in conflicts, misunderstandings, lack of trust and ignorance of some individuals. This leads to immediate behavioral changes in the individuals such as anger, frustration, exploitation, desperation, affection, compassion and loss of temper. This further impacts the rest of the decision making process resulting into ineffective or improper decision for the organization. Thus, the group has to maintain cordial relationships and understand each others' concerns while taking a decision. They have to keep organizational objectives, strategy and purposes in mind while taking decisions.

Decisions taken in a hurry may not be effective. The impact of the decision needs to be assessed in detail and decision taken. If an organizational decision is against an individual's wishes it can lead to health related problems in the individual such as high blood pressure, heart attack and other psychological and behavioral changes. Hence, the management or the manager in picture has to take a responsible decision and communicate it in an effective and right way.

Similarly, the organizational decisions may impact the behavior of teams, employees, customers, and suppliers. For example, an organization has taken decision to change its office timings. Immediately there will be some behavioral changes in some employees. Also the organizational culture and organizational structure can impact the decision making in the organization. Top management can also impact the decisions in the organization. Employee behavior in the organization can impact the decision taken by the manager. Also individuals and groups and their emotions can impact the organizational decision making. Hence, the managers have to take the stakeholders concerns also into consideration while taking decisions.

6.13 Executive Information Systems

An Executive Information System (EIS) is a computerized information system designed to provide internal as well as external information (that are significantly important for making decisions) to the top management for meeting the strategic objectives of the organization.

EIS combines the various features of the MIS and DSS. It can be regarded as a logical extension or form of decision support systems. EISs are designed to draw inferences based on examples or make decisions on the basis of predetermined logic or business rules.

These systems are aimed at supporting managerial learning about the organization, its work process, and the impact of external environment. In EIS, information is provided in a simplified form that enables executives in easy decision making. Reports in EIS are user-friendly and are mostly presented in the form of simple graphs or diagrams. EIS has wide applications in areas like crisis management, strategic planning, employee relations, internal and external monitoring of resources and events, and decision making at the executive level.

6.13.1 Pre-requisites of a Successful EIS Implementation

The pre-requisites of a successful EIS implementation are:

6.13.1.1 Find an appropriate project leader

The EIS systems are successful when the top management agrees with the project leader. For a project leader, it is crucial to understand the requirements of the management, their work styles, and current channels of obtaining information.

6.13.1.2 Deliver a simple prototype quickly

An effective EIS is one which is designed based on the executives' requirements. The quality of an EIS is judged by its user-friendliness and the relevance of the information presented.

6.13.1.3 Involve the IS department

While making plans and decisions, managers should take the help of the Information System personnel regarding where to find relevant information. Else, the effectiveness of decisions may be hampered since managers may have omitted some vital and relevant information.

6.13.2 Guidelines for Preparing an Effective EIS

Some of the guidelines for preparing an EIS are:

- The information included in the EIS should be easy to collect and understand and should be available readily to the managers.

- The information represented in the EIS should reflect an organization's objectives in the areas related to productivity, resource management, quality, and customer service.

- The variables should be free from bias and all executives should be given due credit for their contribution.

- EIS should promote team-work and cooperation and at the same time create healthy competition to achieve organizational goals.

- Everyone in the organization should be able to access the information stored in EIS.

- The system should be flexible enough to incorporate any changes without any difficulty.

6.13.3 Artificial Intelligence

Coined by John McCarthy in the mid 1950s, the term Artificial Intelligence (AI) is that branch of computer science which deals with the development of systems which possess the ability to reason, discover meaning, generalize, or learn from past experience. AI is designed for solving complex problems.

AI deals with the process of creating such machines which can learn and adapt to intelligent behaviors which were restricted only to human beings. However, they are not substitutes for human beings. The methods used by an AI system are symbolic processing, social reasoning, scientific reasoning, and conceptual modeling. AI has wide applications in the fields of planning, control, scheduling, speech recognition, handwriting recognition, facial recognition, diagnosis, playing games, expert systems, etc.

The three basic categories of artificial intelligence are cognitive sciences, robotics, and natural interface applications.

Some of the capabilities that AI is attempting to replicate are:

- Capability to think, imagine, and reason, and demonstrate creativity

- Apply reasoning to solve problems and handle other complex situations

- Collect information and apply it to solve problems

- Take immediate and effective action to new situations

- Try to learn and understand from past experiences

- Identify the various elements in a situation and give relative importance to them

- Try to handle information which is vague, inadequate, and inaccurate

Exhibit 6.1 presents an AI tool highly beneficial for business decisions

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Exhibit 6.1: AI Based Agent Modeling for Improving Business Decisions

Agent-based Modeling [1] is an effective simulation modeling process to be used in different types of applications including real world business problems. Agent-based modeling (ABM) is a collection of autonomous decision making entities, also called agents, and defining a relation between them. Each agent individually assesses its situation and makes decisions on the basis of a set of rules. Agents may execute various behaviors appropriate for the system they represent like producing or selling. Repetitive and competitive interactions between agents are a feature of agent-based modeling. A wide range of AI tools such as neural networks, machine learning techniques and evolutionary algorithms are used in agent based application to parse information. Thus AI-based Agent model offers a real-time application which beneficial for every industry. Its flexible implementation is an underlying reason for its popularity.

ABM uses a natural description of a business

ABM makes the model seem closer to reality. ABM also makes it possible to realize the full potential of the data a company may have about its customers. For example, it is more natural to describe how their customers react to a discount offer.

ABM provides a framework for testing strategy

ABM provides a flexible framework for answering questions like why is this happening, what if these trends continue, what will happen next, what is the best that can happen.

ABM helps develop an improved platform to discover influence on customer churn and offer better strategies for customer retention. ABM is more than a simulation tool. ABM helps to reduce operational risk and to develop ideas for building or rebuilding the organization strategies.

Source: https://icfaibytes.in/2021/08/05/ai-based-agent-modeling-for-improving-business-decisions/

6.13.4 Expert Systems

Expert Systems are an important area of application of AI. These are information systems based on knowledge. They use knowledge about a specific area to act as expert consultant to the users. These systems acquire knowledge from an expert and use this knowledge for making decisions. The knowledge base of the system comprises facts, procedural steps, and rules that determine how the data is related to the solution and other relevant information. Rules are framed based on the methods used by professionals to solve problems.

The expert system consists of a program called inference engine which allows the expert system to evaluate the rules in the knowledge base. It determines the set of rules that will be invoked on the basis of the nature of the problem. The process in which the expert knowledge is acquired, documented, and incorporated as software is called knowledge engineering.

Examples of expert systems:

- MYCIN: based on backward chaining and could identify various bacteria that could cause acute infections.

- DENDRAL: Expert system used for chemical analysis to predict molecular structure.

- PXDES: An Example of Expert System used to predict the degree and type of lung cancer.

Check Your Progress-7

29. What is artificial intelligence?

30. _____ is the process in which expert knowledge is acquired, documented, and incorporated as a software.

31. What is an expert system?

6.14 Online Analytical Processing

Online Analytical Processing (OLAP), regarded as an extension of DSSs, designates a category of applications and technologies which allows collecting, storing and reproducing multidimensional data. Multidimensional analysis is the analysis of data based on more than one factor.

Dimensions and measures are the two basic components of OLAP. The dimensions included in the analysis are time, location, product, and customers, whereas measures are the quantitative representation of dimensions. The main task of an OLAP is to transform relational or non-relational data into a highly explorable structure called cubes or Power Cubes, which means that data can be broken down into small units for deriving meaningful information.

OLAP helps managers, analysts, and executives. It supports multidimensional data analysis and makes data access easier and faster. Moreover, the ability to view data in different formats makes the system flexible. OLAP is becoming popular because many companies are migrating to relational databases. In a relational database, data is stored in the form of rows and columns. Data

warehousing is confined to relational databases whereas OLAP provides multidimensional analysis.

The three basic functions of OLAP are drilling, slicing and dicing, and changing displays.

6.14.1 Drilling

Drilling involves breaking up data into smaller dimensions for making the analysis easier. It involves representing the data in a detailed form.

6.14.2 Slicing and dicing

Slicing and dicing is defined as the process of changing the dimension of analysis for suiting the requirements of the analysts. The database is examined from different standpoints.

6.14.3 Changing displays

Information may be available in tabular form but it can be transformed into charts and graphs if required.

OLAP is used across functional divisions. In the finance department, OLAP may be used for budgeting, activity based costing, analysis of financial performance, and financial modeling, whereas in the marketing department, it can be used for conducting market research, customer analysis, forecasting sales, segmentation, etc. Similarly, in the production department, OLAP can be used to track the material requirements, the number of units produced, and the inventory details.

6.14.4 Characteristics of OLAP

Apart from helping in multidimensional view of data, OLAP also provides complex modeling and time intelligence.

6.14.4.1 Multidimensional views

All business models have a minimum of three dimensions, namely, time, location, and product. The number of dimensions may vary according to the nature of analysis being done. Managers should be flexible enough to use the data for analytical processing irrespective of the design of the database, and should be able to analyze data at any level without any difficulty. Managers with no knowledge of database concepts or programming should also be able to access data with ease. Moreover, the time taken by OLAP system to process user requests should be consistent.

6.14.4.2 Complex modeling

The ability of OLAP to perform complex calculations is regarded as its most important use. The OLAP software should provide powerful but simple tools for complex calculations. The methods used for computation should be clear

and non-procedural to enable the users to use the system without any assistance. OLAP systems are rated based on their ability to create information from data.

6.14.4.3 Time intelligence

Time is an important and unique factor in analytical processing since it is the only dimension that follows a sequence. Business analysis is usually done over a period of time, say, monthly, quarterly, etc. The use of time hierarchy differs from other hierarchies.

6.14.5 Benefits of OLAP

OLAP software, particularly with respect to data management, can be very useful to an organization. Some of the benefits provided by OLAP are:

- A well designed OLAP increases productivity.

- Complex modeling becomes easier.

- Software designed specifically for OLAP may be useful in developing applications quickly and providing better service.

- Faster application development would lower application backlog.

- The query drag option helps in reducing network traffic in transaction processing and data warehousing.

- It helps the organization to make prompt response to market demand by modeling real business problems and making efficient utilization of human resources.

Check Your Progress-8

32. Which of the following refers to the ability to look at a database from different viewpoints?

    a. Consolidation

    b. Drill down

    c. Slicing and dicing

    d. Expert system

33. Online Analytical Processing (OLAP) is used to transform relational or non-relational data into highly explorable structures, which are commonly referred to as _____.

34. Which of the following consists of data marts, data mining, data warehouses, and multi-dimensional databases?

    a. Online analytical processing

b.   Database management system

c.   Decision support system

d.   Knowledge management system

35. What is drilling in online analytical processing (OLAP)?

6.15 Information Systems for Strategic Advantage

In businesses, information systems can be used for achieving strategic advantage by improving the methods of production and by developing new products and services. The strategic advantages that can be gained by an organization by using information systems are:

- It enhances the efficiency and effectiveness of business operations.

- It creates entry barriers to other competitive firms.

- It encourages the suppliers to do business with an organization and attracts customers to buy that organization's products and/or services.

- It strengthens an organization's relationship with the suppliers.

- It helps enhance the existing products and/or services, customize them, and helps develop innovative products and/or services on a regular basis.

- It helps in maintaining an information database about the customers, target the customers on the basis of their previous purchases, and sell this information to other retailers.

- It helps the organization to expand globally.

A detailed discussion of some of the other advantages reaped by organizations by making use of information systems is mentioned below.

Improvement in Business Processes

In an organization, information systems help in streamlining the operational and managerial processes. By improving the business processes, the organization can reduce costs, improve quality and customer service, and develop innovative products. The manufacturing process can be automated; computers are used in design, production, and engineering, in addition to the management of resources. Organizations can use intranets, extranets, Internet, and other networks for interacting within and outside the organization.

Re-engineering Business Processes

Business Process Re-engineering (BPR) is defined as the radical changes made in the design of business processes for improving the performance and efficiency of the organization. Such redesigning would bring about

improvements in terms of costs, quality of goods and services, speed of delivery, and the service being provided.

There is a difference between BPR and business improvement. Whereas BPR deals with complete redesigning of the business processes, business improvement is carried out to bring about improvements in the existing processes. Business improvement usually is carried out for any process, whereas only the strategic business processes are reengineered. Moreover, unlike in business improvement, the risk of failure and level of disruption is very high in BPR.

In business organizations, information systems play an important role in implementing BPR. It can help in making improvements in the procurement function in an organization, and also ensures greater collaboration and communication within the organization. The three levels in BPR are:

- The first level, in which the activities that are time consuming and/or performed inefficiently are identified.

- The second level, in which the internal business activities are connected with the external entities like the suppliers, the customers, and other business partners so as to do away with redundancy and redeploy the inventory.

- The third level, in which the principles of reengineering are applied by looking for answers to questions like - What will be the effect of eliminating a particular step? Can this eliminated step be used in combination with another process? Can an IT tool enhance efficiency? In order to adapt to the transformation, the existing processes are completely discarded and a new process design is developed.

Features of BPR

The objective of BPR is to achieve drastic improvements in performance in those areas which are important to the customers and other stakeholders. The features of BPR are:

Process orientation: In an organization, process orientation allows the average employee to view the business as a series of connected processes and the business processes are defined in such a way that most employees know how they work. The organization is designed around flexible/networked processes by eliminating the unnecessary activities and replacing outdated processes with cross-functional processes that support parallel processing.

Project goals: The implementation of BPR is both expensive and disruptive. Therefore, the BPR project goals must be able to justify high costs and risks involved. All the people working on the project should be aware of the project plans, including assignments, responsibilities, deliverables and schedules, so that they know the importance of their contribution to the entire project. The milestones should be monitored and adjustments to the schedule and plan must be made as required. The goals and objectives selected for BPR projects should be measurable and meaningful for employees. Moreover, the more radical the BPR goals are, the more important it is to associate process improvement efforts with strategic and business objectives.

Rule breaking: In the context of BPR, the skill of rule-breaking is often as important as rule-making. The focus of reengineering efforts could be on internal processes or on external customers and their interactions with the organization. With respect to the former, the organization needs to understand the existing business process, including its justification, its decisions, and its actions, and study the value, efficiency, and effectiveness of business rules as they relate to the organization's business processes. While in the latter case, the focus is on being inventive, in that it seeks to develop, discover, or improve existing markets by emphasizing on the customer perspective. Rule-breaking entails learning. One must learn the existing rules, why they exist, and how to break or improve them to meet specific business goals.

Creative use of technology: One of the key features of BPR is that it stimulates significant changes in how a business operates. Outdated processes introduced in paper form are updated to incorporate today's global data access technology. For this reason, BPR is typically accompanied by the development of new internal technology systems. Technology has been recognized as a major force in reengineering, and is used to streamline business operations. It is typically identified as an enabler of the changes required. The leadership must have the vision to drive customer-centric IT investments and technology must be used creatively to deliver on-demand customer service.

Combining several jobs into one: The planning stage of BPR gives insights into the activities that should be performed, the people who would perform them, and how one activity interacts with another. If a function is redundant, it could be eliminated. Similarly, jobs involving routine tasks can be removed or combined so as to enrich the resulting job.

Decentralization of decision-making authority: BPR supports the decentralization of decision-making authority. Workers have the decision-making power and their jobs are enriched since they deal with multiple tasks.

Processes have multiple versions: BPR prescribes multiple versions of processes so as to enable an organization to handle various circumstances.

Checks and controls are reduced: BPR improves the quality of work and reduces the number of external contacts. This allows an organization to reduce the number of checks and controls. This in turn provides economic benefits to the organization.

A single point of contact for a customer: Since BPR focuses on the customers, technology is used for creating a single database which can be accessed by a case manager who will act as a point of contact for customers. *ering/default.asp.*

However, despite the fact that BPR can bring about huge improvements in efficiency, its acceptability is expected to be low since it is viewed as a threat to an organization's authority and job security.

Transforming into an Agile Competitor

From the view point of business, an agile competitor is one who is flexible enough to adapt to the rapidly changing business environment. The attributes that best describe an agile company include wide range of products, customized products, short product life cycle, and quicker processing of orders in large quantities. There are four fundamental strategies of agile competition. They are:

- Producing products and services that cater to the requirements of the customer. The pricing of the products and services should be based on the value it provides to the customer and not on the cost of production.

- Maintaining cordial relationship within the organization as well as with competitors which would be useful in bringing out new products at regular intervals.

- Maintaining flexible organizational structure so as to adapt changes without any delay.

- Fostering entrepreneurial skills and empowering employees by rewarding them for good performance, which, in turn, would improve employee adaptability and creativity.

Toward Creation of a Virtual Company

Virtual companies are created by linking people, assets, and ideas, using IT. Its success vests upon its adaptability and ability to exploit opportunities. These organizations have a network structure. In an organization, the various cross-functional teams within the organization are linked with each other through intranets. On the other hand, the organization is linked to external entities like customers, competitors, and subcontractors through extranets.

Knowledge Management Systems

Knowledge management systems, also called adaptive learning systems, promote learning within the organization and help in creating knowledge bases. These systems should be simple and easy to use and should provide quick access to information. Knowledge here refers to forecasts, processes, procedures, reference work, and best practices. The key technologies used for knowledge management include groupware, data mining, and video conferencing and these technologies are used for collecting, editing, evaluating, and disseminating information within the organization.

The benefits of a knowledge management system are:

- It provides feedback to the knowledge workers.

- It helps employees to adapt themselves to the change.

- It improves business performance.

- It helps to integrate knowledge in products, processes, and services.

Check Your Progress-9

36. Which of the following is **not** associated with an agile competitor?
    a. Producing/customizing products and/or services that serve customer requirements
    b. Pricing based on cost of production rather than value to customer
    c. Maintaining a flexible organizational structure
    d. Fostering entrepreneurial skills and empowering employees

37. _____ are also known as adaptive learning systems.

38. Which of the following statements is **false** regarding business process reengineering and business improvement?
    a. Business process reengineering deals with complete redesigning of business processes while business improvement is carried out to improve existing processes.
    b. Business improvement is carried out for any process while only strategic business processes are reengineered.
    c. The risk of failure is very high in case of business process reengineering while it is low for business improvement.
    d. The level of disruption is very high in case of business improvement while it is low for business process reengineering.

39. Using investment in technology to keep other competing firms out of an industry is termed:
    a.   Reducing risks
    b.   Increasing funds
    c.   Raising barriers to entry
    d.   Business Process Reengineering (BPR)

40. Expand BPR. Also explain it.

41. Which of the following statements is **false** regarding knowledge management systems?
    a.   Knowledge management systems deal with organizational learning and business know-how.
    b.   Knowledge management systems aim to create, organize, and make available important information.
    c.   Knowledge management systems provide feedback to knowledge workers and help employees adapt to change.
   d.   Knowledge management systems do not facilitate creation of knowledge.

6.16 Knowledge Based Expert Systems

Expert System is a software system which acts as a human expert in specific areas or domains. Expert systems are useful where it is expensive to get a human expert or human expert is unavailable. For example, doctor availability is low in rural areas. There expert systems can be used. Expert system architecture has components such as knowledge base, inference engine and user interface as shown in following figure. Knowledge base is the collection of facts and rules. Inference engine acts a search engine over knowledge base and returns the results for a query. User Interface is the component using which users send their questions, send search queries and get responses or solutions displayed. Prolog (Programming on Logic) can be used to develop expert systems.

The application areas of expert systems include medical diagnosis, automobile diagnosis, oil and water drilling, chess game, financial advice and identifying things such as animals, plants and rocks. The advantages with expert systems is that they do not make mistakes as human beings do. For example, forgetting is a human error. The disadvantages with expert systems is that they are difficult to use for non-experts, difficult to adapt and they do not have common sense.

Figure 6.2: Expert System Architecture
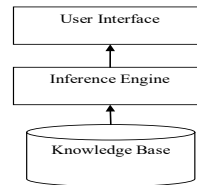
AI systems are built by well designed expert systems and one of the most used application system is AI based facial recognition. Exhibit 6.2 discusses some challenges in such applications.

Exhibit 6.2: AI-based Facial Recognition and Challenges

Facial Recognition (FR) is a direct application of Artificial Intelligence (AI). The challenges are identified as:

Technical Challenges:

Facial recognition software uses Deep Convolutional Neural Networks (DCNN). The facial images in datasets are labelled, and the evaluation of datasets is done via a loss function. It requires a vast amount of data without any bias to be trained on, with large datasets containing enough variation to generalize all unseen samples. Face recognition might not be accurate for people with darker skin tones because the dataset used is inherently biased with the data of people with white skin tones. For instance, Amazon's facial Recognition software (Rekognition) once identified Oprah Winfrey as a man.

Facial Recognition Algorithms may give different results due to changes in appearances, caused by:

Illumination: An image of the same person in different light intensity can show more differences.

Expressions and facial blockers: Different facial Expressions of the same person, facial hair, mask, or hat can make the algorithm futile.

Pose variation: The algorithm fails to identify when the same person's face comes in a different posture or at a completely different angle.

Most facial recognition algorithms exhibit demographic characteristics that can deteriorate the accuracy of software based on race, gender, and age. (Source: NIST)

Non-Technical Challenges:

There are non-technical challenges such as threats to privacy, violations of rights and personal freedoms, potential data theft, and other crimes.

Contd. ……

Future developments
As facial recognition technology improves, its challenges will decrease. Stanford has recommended that Public or Private Datasets be updated for each FR software release and include changes to training data, training algorithms, parameters, fairness constraints, and any other aspects that might influence performance.

Source: ET Prime/ Prime Vantage Sept 11,2021prime vantage news letter

6.17 Summary

- An Information System is a system that accepts inputs in the form of raw data, processes them, and provides output in the form of information. It is designed to help managers to analyze the data and make decisions.

- Information systems that process data generated from business transactions are called transaction processing systems. The main objectives of a transaction processing system include carrying out the organization's day-to-day transactions; collecting, processing, editing, updating, storing the data, and generating the required reports or documents; supplying the necessary information to the organization which would facilitate proper functioning of the business; providing reports and documents which would facilitate in making timely decisions; and supplying data to other information systems. The five distinct phases in transaction processing cycle include data entry, transaction processing, data updation, report generation, and inquiry processing.

- Functional information systems support various business processes like product development, production, inventory management, sales, distribution, etc. The different cross-functional information systems are market information systems, manufacturing information systems, human resource information systems, accounting information systems, and financial information systems.

- Management information system (MIS) makes use of manual procedures, computer hardware and software, models, and a database for analyzing, planning, controlling, and taking decisions. The three main functions of MIS are data collection, data storage and processing, and information presentation.

- Decision Support Systems (DSS) are computer-based interactive systems and subsystems which help the decision-making group of the organization to effectively use organizational knowledge and various technologies to make decisions. There are four types of decision support systems, namely,

data analysis systems, information analysis systems, accounting systems, and status inquiry systems.

- An Executive Information System is a computerized information system designed to provide internal as well as external information that are significantly important to the top management for making decisions in order to meet the strategic objectives of the organization. It combines the various features of MIS and DSS.

- Online Analytical Processing (OLAP) is regarded as an extension of decision support systems. It refers to a category of applications and technologies which allows collecting, storing and reproducing multidimensional data. OLAP helps managers, analysts, and executives in data analysis. It supports multidimensional data analysis and makes data access easier and faster.

- Information systems can be used by businesses for achieving strategic advantage. Some of the benefits of using information systems in business include improving business processes, reengineering of business processes, agile competition, creating virtual companies, and knowledge management.

6.18 Glossary

- **Accounting information systems:** Information systems that record and report financial transactions, the flow of funds through an organization, and produce financial statements. The main purpose of an accounting information system is to accumulate data pertaining to the financial transactions, process it into information, and report it to the concerned external and internal entities in the organization.

- **Artificial Intelligence (AI):** A branch of computer science that deals with the development of systems which possess the ability to reason, discover meaning, generalize, or learn from past experience. AI is designed for solving complex problems.

- **Automation:** The automatic transfer and positioning of work by machines or the automatic operation and control of a work process by machines, that is, without significant human intervention or operation.

- **Batch processing:** In this, the information gathered is stored but not instantly processed. Batch processing involves accumulation of transactions until a satisfactory number is reached. Based on the volume of transactions accumulated, the processing of transactions is done in batches on a daily, weekly, or monthly basis.

- **Business Process Re-engineering (BPR):** It refers to radically changing the design of business processes to improve the performance and efficiency

of the organization. Such redesigning will enable improvements in terms of costs, quality of goods and services, speed of delivery, and the service being provided.

- **Computer Integrated Manufacturing (CIM):** A method of manufacturing that supports the user of computer hardware and software to simplify, integrate and automate all facets or production.

- **Decision Support Systems (DSS):** Computer-based information systems that support the decision making activities of the managers. DSS are developed using analytical models, specialized databases, and the knowledge and experience of decision makers.

- **Drilling:** It refers to breaking data up into smaller dimensions to facilitate analysis. Drilling involves representing the data in a detailed form.

- **Electronic Data Interchange (EDI):** Bilateral information systems that allow two organizations to exchange information electronically. Typically, EDI links an organization to its customers or suppliers.

- **Executive Information System (EIS):** A computerized information system which is designed to meet the informational requirements of the top executives of the organization. These information systems provide internal as well as external information that are significantly important for making decisions in order to meet the strategic objectives of the organization.

- **Expert systems:** Programs designed to provide users with the expertise of professionals in a particular field. These are knowledge-based information systems that use knowledge about a specific area to act as an expert consultant to the users. These systems gain knowledge from an expert and apply this knowledge to make decisions.

- **Financial information systems:** Information systems that assist managers in taking financial decisions. These include providing finance to the business, allocating and controlling the financial resources within the organization, etc.

- **Functional Information System:** Information systems within a business organization that support the organizational functions like production, human resources, marketing, accounting, and finance.

- **Geographic Information Systems (GISs):** A special kind of Decision Support System (DSS), which are designed to integrate computer graphics and geographic databases with other features of DSS. A GIS consists of computer hardware, software, and geographic data which are used for

gathering, organizing, evaluating, and exhibiting all forms of information that is geographically oriented.

- **Human Resources Information Systems (HRIS):** These information systems help in keeping track of the details of all the employees working in the organization as well as new applicants. Such information tracking is generally done with the help of a database or a series of databases that are inter-related.

- **Knowledge engineering:** The process in which the expert knowledge is acquired, documented, and incorporated as software.

- **Knowledge management systems:** Also known as adaptive learning systems, these systems deal with learning within the organization and business know-how. Knowledge management systems aim to create, organize, and provide access to important information. These systems should be simple and easy to use and provide quick access to information.

- **Management Information System (MIS):** An integrated, user-machine system for providing information to support managerial, operational, and decision-making functions in an organization. MIS is a management support system that facilitates day to day operations in an organization. MIS makes use of computer-based systems for converting data into information. MIS supports structured decision making, i.e., those decisions which can be described in detail.

- **Manufacturing Execution Systems (MESs):** Performance-monitoring systems for shop floor operations. MESs are used by organizations to measure and control the production activities or processes. These systems enhance the productivity and quality of production processes. MESs monitor, track, and control the five essential components involved in a production process namely, materials, equipment, personnel, instructions, and production facilities.

- **Manufacturing information system:** These systems support the production or operations function in an organization. The production function includes the planning, monitoring, and controlling production, inventories, purchases, and other aspects relating to the production of goods and services. Manufacturing execution systems, manufacturing resources planning, and process control systems are the various components of a manufacturing information system.

- **Online Analytical Processing (OLAP):** It is considered as an extension of decision support systems. OLAP is used for analyzing data stored in the database. OLAP includes data marts, data warehouses, data mining, and multidimensional databases. OLAP designates a category of applications

and technologies that allow the collection, storage, and reproduction of multidimensional data. Multidimensional analysis is the analysis of data based on more than one factor.

- **Online Transaction Processing (OLTP):** A real-time transaction processing system.

- **Operational decisions:** These decisions are short-term in nature and usually involve large-scale processing of internal data such as attendance, daily cash flows, sales figures, etc. Accuracy and speed are the two most important aspects to be considered while making operational decisions and these are made possible through the use of information systems.

- **Process Control Systems:** Computer systems that control an ongoing physical manufacturing process. Process control software uses mathematical models to analyze the data generated by the ongoing process and compares them with standards or forecasts of required results. The computer manages the process by adjusting control devices such as valves and switches.

- **Slicing and dicing:** The process of changing the dimension of analysis to suit the analysts' requirements. It involves examining the database from different standpoints.

- **Status inquiry systems:** Some decisions in the operational and middle management level do not require any elaborate computations, analysis, selection, etc. These decisions can be taken easily if the current status is known. A status inquiry system provides such type of information. The system displays the status based on availability.

- **Strategic decisions:** These decisions are concerned with long-term business issues such as diversification, expansion of capacity, and strategic alliances. External information influences the strategic decisions in an organization. It is usually difficult to get clear-cut information and the decision-making situation is often unstructured and uncertain.

- **Tactical decisions:** These decisions are likely to have a medium to long-term impact on the organization and are made by the middle management. Tactical decisions should be supported by organizational information. The quality of data processing has a major impact on the profitability of the organization.

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- **Transaction Processing System (TPS):** Information systems that process data generated from business transactions. The main job of a transaction processing system is to collect data generated from the transactions, store it, and, at times, control the decisions that are taken arising out of the transactions. Such transactions can be in the form of purchases, sales, deposits, withdrawals, etc.

- **Transaction processing:** Basic or primary method of collecting data used by organizations. The data obtained through this method is generated from business transactions. This data is raw in nature and needs to be processed and integrated. Information in ledgers, payrolls, and financial reports are all the outcome of transaction processing.

6.19 Self-Assessment Test

1. Transaction processing systems process the data generated from business transactions. There are five distinct phases in a transaction processing cycle. Discuss these phases. Also discuss the basic objectives of these systems.

2. In many large organizations, information systems are combinations of various functional information systems and they support several business activities. In this context, briefly discuss some of the cross-functional information systems.

3. Management Information Systems help organizations make use of IT for improving organizational efficiency. What are the features and functions of these systems?

4. In an organization, a decision support system (DSS) helps the decision-makers to make effective use of the various communication technologies and knowledge gathered to make decisions. What are the different types of DSS? Briefly describe some of the analytical models that are supported by DSS.

5. What are the prerequisites for successful implementation of an EIS? What are the guidelines that should be considered while preparing an EIS?

6. In business organizations, information systems can be used to achieve strategic advantage. In this context, discuss the strategic advantages that an apparel marketing company in India can gain by using information systems.

7. Business Process Re-engineering (BPR) often involves the complete redesign of business processes. In this regard, discuss some of the characteristics of business process re-engineering.

6.20 Suggested Readings / Reference Material

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4. Jay, A., 10 New ERP Trends & Forecasts for 2020/2021 – A Look Into What's Next. https://financesonline.com/erp-trends/2019

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6.21 Answers to Check Your Progress Questions

Following are the answers to the Check Your Progress questions given in the unit.

1.   (b) Executive information systems

> Executive Information Systems (EIS) are designed to meet information requirements of top executives of the organization. These enable online access to relevant information to top management in a comprehensible

format. The purpose of an EIS is to help executives learn about the organization, work processes and interact with the external environment.

2.   **Decision support system**

Decision Support Systems (DSS) are information systems that help managers in decision-making. They are developed using analytical models, specialized databases, and knowledge and experience of decision makers.

3.   **(b) Tactical decisions – Budget analysis**

Tactical decisions have a medium to long-term impact on the organization. They are made by middle management and are supported by organizational information. Decisions pertaining to budget analysis, vendor rating, staff promotion, etc are taken at the tactical level. The effect of these decisions is seen within a time frame of one to three years.

4.   Operational decisions involve large-scale processing of internal data like attendance, daily cash flows, sales figures, etc. Accuracy and speed are two important aspects considered while making operational decisions.

5.   **(a) EIS is primarily used by top management for unstructured decision making.**

Executive Information Systems (EIS) enable online access to relevant information (related to the external environment) to the top management in a comprehensible format. These systems provide timely, accurate, and relevant information to the management. The basic purpose of an EIS is to help executives learn about the organization, its work processes, and its interaction with the external environment. These systems mostly help the top management in taking unstructured decisions.

6.   **(c) Monthly payroll processing is an example of real-time processing.**

Real-time processing involves processing of transactions immediately after generation. This also enables error correction while entering data online. Real-time processing or online entry and processing gives instant results. They provide immediate output to end users. For instance, an airline reservation system would require a real time processing of transactions. On the other hand, an employee payroll

system would require a batch processing system based on the payroll frequency.

7. (b) Control listings

Control listings, also known as transaction logs, are detailed reports that describe each transaction during a particular period. A payroll register that lists every paycheck printed on a specific pay-day is an example of a control listing.

8. iii-ii-i-iv

Transaction processing systems are information systems that process data generated from business transactions. A transaction processing cycle consists of: Data entry, Transaction processing, Database updating, Report generation. In addition to this, the system also supports ad hoc inquiry processing.

9. (c) Data entry

In the data entry stage, data is captured or collected by recording, coding and editing activities. Data has to be then converted into a form that can be fed into a computer system. Data automation helps reduce or eliminate the effort of entering data through traditional methods. These direct methods help get data onto a computer accurately and quickly.

10. In batch processing, the information that is gathered is stored but is not processed instantly. This type of transaction processing involves accumulation of transactions until a certain set of criteria are satisfied – such as time period (say monthly, quarterly) or quantity (based on the volume of transactions).

11. (d) Information document

Information documents serve as confirmation or proof to recipients that certain transactions have occurred. Customer invoices, sales order confirmations, etc., are examples of information documents.

12. Edit reports

Edit reports are reports providing data regarding errors detected during processing. Missing data, data pertaining to invalid account numbers, etc., are presented in edit reports.

13. (d) i, ii, and iii

Marketing Information Systems use information from market research to select appropriate media and promotional methods, allocate financial resources to promotional campaigns, and evaluate results of various advertising and promotional campaigns. This aids marketing managers to not only reduce the costs of advertising and promotion, but also improve sales.

14.   Manufacturing Execution Systems (MES)

Manufacturing Execution Systems (MES) monitor, track and control materials, equipment, personnel, instructions and production facilities. Being performance monitoring systems for shop floor operations, MES includes shop floor scheduling and control, machine control, robotics control, and process control.

15.   Process control systems direct ongoing physical manufacturing processes in an organization. They require the use of special sensing devices that measure physical phenomena such as temperature, pressure, etc. Process control software uses mathematical models to analyze data generated by the ongoing process and compares it with standards or forecasts of required results.

16.   i/r, ii/s, iii/q, iv/p

Compensation analysis, employee skills inventory and personnel requirements forecasting are all part of human resources information systems. Interactive marketing, sales force automation, advertising and promotion and market research are all part of marketing information systems. Cash management, credit management, investment management, capital budgeting and financial forecasting are part of financial information systems. Manufacturing resources planning, manufacturing execution, process control, and computer aided process planning are part of manufacturing information systems.

17.   Accounting information systems

Accounting information systems are responsible for recording and reporting business transactions and other economic events in an organization. They record and report business transactions, flow of funds through an organization and produce financial statements. They also generate forecasts of future conditions such as projected financial statements and financial budgets.

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18. (c) Capital budgeting

The process of capital budgeting involves evaluation of profitability and financial impact of proposed capital expenditure. The capital budgeting application involves the use of spreadsheet models that incorporate present value analysis of expected cash flows and probability analysis of risk to arrive at the optimum mix of capital projects for a business.

19. Cash management

Cash management involves collection of information on all cash receipts and disbursements within a company on real-time or periodic basis. This information helps managers decide whether to invest or deposit excess funds in the short term. It will lead to increase in income generated by deposited or invested funds. The daily, weekly or monthly forecasts of cash receipts are also generated to predict future cash deficits or surpluses.

20. (d) MIS is not useful for management control.

Management Information System (MIS) helps organizations leverage benefits of IT to increase organizational efficiency. It transforms data into information. MIS is a combination of various academic disciplines like managerial accounting, operations research, management and organizational theories and computer science. Concepts like online transaction processing, DSS and EIS are considered an extension of MIS. The benefits of a well designed MIS are perceived to be instruments of control rather than means to achieve organizational efficiency.

21. Management Information System (MIS) is management-oriented and management-directed. MIS is based on five factors – men, money, material, machines and methods. An MIS is a combination of subsystems. MIS is therefore viewed as an integrated system that is a combination of functional and activities sub-systems.

22. (c) Ad hoc reports; demand reports

Ad hoc reports, also called demand reports and responses, are generated as and when managers require them. Demand reports and responses are generated as and when managers require them. Queries and report generators are used for such reporting.

23. (a) Geographic Information Systems (GIS)

A GIS supports decision making by integrating mapping capabilities in spreadsheet packages like Lotus123 and Microsoft Excel. These systems are useful for companies that have global operations. GIS are used along with Global Positioning System (GPS) devices. GPS is a navigation system that is used to facilitate navigation around the world with the use of satellites. This system is being used for making maps, surveying, studying the occurrence of earthquakes, making weather predictions, locating an object, etc.

24.   Decision support systems

Decision support systems are widely used in business organizations to provide support in activities of financial planning, forecasting, risk assessment, etc. It is an information system that utilizes decision models, a database, and a decision maker's own insights in an interactive analytical, modeling process to reach a particular decision.

25.   Sensitivity analysis can be considered as a type of what-if analysis in which the effect of a repeated change in a single variable is examined. Using this analysis, one can find out the impact of a single variable on other variables.

26. (c) It requires consideration of constraints involved in achieving targets

Optimization analysis is a complex extension of goal seeking. The target is not fixed. Rather, it has to be arrived at after taking into consideration constraints involved in achieving targets. In this analysis, one or more variables are changed after taking into view constraints, until the best alternative is found. Optimization analysis would require special purpose software and techniques like linear programming or DSS generators.

27.   i/q, ii/r, iii/p

Status inquiry decisions are taken if the current status is known. Railway reservations, airline reservations, etc., are examples of status inquiry decisions. Data analysis systems are developed using simple data processing tools and business rules. Cash flow and funds flow analyses are examples. Information analysis systems are developed to analyze information available to the management and arrive at a result.

Decisions are taken by the management based on results obtained. Sales analysis and market analyses are examples of information analysis.

28. Decision Support Systems (DSS) are information systems that help managers in decision -making. DSS are developed using analytical models, specialized databases, and knowledge and experience of decision makers. They support decisions that are semi-structured and unstructured, i.e., decisions that cannot be described partially or completely.

29. **Artificial intelligence**

AI deals with the process of creating machines which can learn and adapt to intelligent behaviors that are a characteristic of human beings. The applications of AI are in the fields of planning, control, scheduling, speech recognition, handwriting recognition, facial recognition, diagnosis, playing games, expert systems, etc.

30. **Knowledge engineering**

Expert systems are programs designed to provide users with the expertise of professionals in a particular field. These are knowledge-based information systems that use knowledge about a specific area to act as expert consultant to users. Systems gain knowledge from an expert and apply it to make decisions. The process in which expert knowledge is acquired, documented, and incorporated as software is called knowledge engineering.

31. An expert system is a computer-based information system that uses its knowledge about a specific, complex application area to act as an expert consultant to users. It consists of a knowledge-based software module that arrives at inferences on knowledge and communicates answers to a user's questions.

32. (c) **Slicing and dicing**

Online analytical processing consists of three functions – drilling, slicing and dicing, and changing displays. Slicing and dicing refer to the process of changing the dimension of analysis to suit the analysts' requirements. It involves examining the database from different standpoints. For instance, region-wise monthly sales report can be converted into monthly sales report.

33. Cubes

The main task of an OLAP is to transform relational or non-relational data into a highly explorable structure, which means that data can be broken down into small units to derive meaningful information. These explorable structures are commonly called cubes or Power Cubes.

34. (a) Online analytical processing

Online Analytical Processing (OLAP) is used for analyzing data stored in the database. It includes data marts, data warehouses, data mining, and multidimensional databases.

35. Drilling is the process of breaking up data into smaller dimensions to facilitate analysis. For example, an analyst may use monthly, weekly or daily sales information in a quarter to perform quarterly sales analysis.

36. (b) Pricing based on cost of production rather than value to customer

Agile competition is associated with pricing based on value to customer rather than on cost of production. So option (b) is false. Options (a), (c), and (d) are true.

37. Knowledge management systems

Knowledge management systems promote learning within the organization and facilitate the creation of knowledge bases. For this reason, these systems are alternatively called 'adaptive learning systems.' Using various technologies, knowledge management systems collect, edit, evaluate, and disseminate information within the organization.

38. (d) The level of disruption is very high in case of business improvement while it is low for business process reengineering.

Business Process Re-engineering (BPR) refers to radically changing the design of business processes to improve performance and efficiency of the organization. Redesigning will enable improvements in terms of costs, quality of goods and services, speed of delivery and the service being provided. BPR is different from business improvement. While BPR deals with complete redesigning of business processes, business improvement refers to small improvements in existing processes. The risk of failure and level of disruption is very high in case of BPR while it is low in case of business improvement.

39. (c) Raising barriers to entry

> Information technology is used by businesses to achieve strategic advantage by improving production methods and developing new products and services. Technology can be used to enhance efficiency and effectiveness of business operations, strengthening supplier relationships, global expansion, raising barriers to entry, and maintaining customer information.

40. Business process re-engineering (BPR) refers to radically changing the design of business processes to improve performance and efficiency. It is the process of restructuring and transforming a business process by fundamental rethinking and redesigning to achieve dramatic improvements in costs, quality, speed, etc. It is different from business improvement.

41. (d) Knowledge management systems do not facilitate creation of knowledge

> Knowledge management systems essentially deal with organizational learning and business know-how. The aim is to create, organize and make available important information. These systems should be simple and easy to use and provide quick access to information. They promote organizational learning and facilitate knowledge creation. It provides feedback to knowledge workers, helps employees adapt to change, improves business performance and integrates knowledge on products, processes and services, thus fostering an agile company.

IT & Systems

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