SELF LEARNING MATERIAL

BUSINESS ANALYTICS

M21CM04DC

MASTER OF COMMERCE

SREENARAYANAGURU OPEN UNIVERSITY

The State University for Education, Training and Research in Blended Format, Kerala

SREENARAYANAGURU OPEN UNIVERSITY

Vision

To increase access of potential learners of all categories to higher education, research and training, and ensure equity through delivery of high quality processes and outcomes fostering inclusive educational empowerment for social advancement.

Mission

To be benchmarked as a model for conservation and dissemination of knowledge and skill on blended and virtual mode in education, training and research for normal, continuing, and adult learners.

Pathway

Access and Quality define Equity.

Business Analytics

Course Code: M21CM04DC

Semester - I

Discipline Core Course
Master of Commerce
Self Learning Material

(With Model Question Paper Sets)

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MESSAGE FROM VICE CHANCELLOR

Dear
I greet all of you with deep delight and great excitement. I welcome you to the Sreenarayanaguru Open University.

Sreenarayanaguru Open University was established in September 2020 as a state initiative for fostering higher education in open and distance mode. We shaped our dreams through a pathway defined by a dictum 'access and quality define equity'. It provides all reasons to us for the celebration of quality in the process of education. I am overwhelmed to let you know that we have resolved not to become ourselves a reason or cause a reason for the dissemination of inferior education. It sets the pace as well as the destination. The name of the University centres around the aura of Sreenarayanaguru, the great renaissance thinker of modern India. His name is a reminder for us to ensure quality in the delivery of all academic endeavours.

Sreenarayanaguru Open University rests on the practical framework of the popularly known "blended format". Learner on distance mode obviously has limitations in getting exposed to the full potential of classroom learning experience. Our pedagogical basket has three entities viz Self Learning Material, Classroom Counselling and Virtual modes. This combination is expected to provide high voltage in learning as well as teaching experiences. Care has been taken to ensure quality endeavours across all the entities.

The university is committed to providing you with a stimulating learning experience. The master's programme in Commerce is considered to be an academic progression of the bachelor programme in form and content. It heavily leans on the knowledge level of a normal undergraduate learner. The discussions on the theories and accounting practices are kept integrated with a view to ensure cohesiveness in the understanding of the learner. The worked-out problems and its procedures constitute the conspicuous identity of the programme. Mathematical knowledge is enhanced over the modules. We assure you that the university student support services will closely stay with you for the redressal of your grievances during your studentship.

Feel free to write to us about anything that you feel relevant regarding the academic programme.

Wish you the best.

Regards,
Dr. P. M. Mubarak Pasha 01.12.2023

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01 BLOCK

BUSINESS ANALYTICS

Content

Unit 1

Business Enterprise

Learning Outcomes

After completing this unit, the learner will be able to:

- be aware of the business enterprise with its functions and process
- recognise the importance of Information Technology for business organisations
- familiarise with Customer Relationship Management and Enterprise Resource Planning

Background

Traditionally, businesses used manual processes and paper-based systems to manage tasks such as finance, human resources, marketing, and operations. These processes were time-consuming, prone to errors, and limited in their ability to support corporate development and innovation. The advent of Information Technology (IT) brought about considerable changes in business companies. IT has transformed the way organisations worked and interacted with their stakeholders. It provided automation, process efficiency, greater communication, and enhanced decision making capabilities. The impact of IT on various corporate operations and processes has been considerable. IT revolutionised finance by introducing automated accounting systems, financial analysis tools, and online payment methods. These advancements decreased manual errors, gave real-time financial data, and made secure transactions possible. IT aided human resources by introducing digital personnel management systems, recruitment portals, and online training modules. IT has transformed marketing by enabling data-driven campaigns, client segmentation, and personalised communication. Businesses obtained insights into client behaviour, preferences, and purchasing habits through customer relationship management (CRM) systems, enabling targeted marketing activities. IT enabled substantial advancements in operations, such as supply chain optimisation, inventory management systems, and production planning software. These innovations increased efficiency, lowered expenses, and increased total production. Enterprise Resource Planning (ERP) systems were critical in integrating diverse corporate operations. ERP enabled faster operations and improved cooperation by providing a centralised database for exchang-

ing information across divisions. Artificial intelligence, block chain, and the Internet of Things will enable businesses to boost their agility, innovation, and competitiveness. ERP and CRM systems have been critical in the integration of company processes and the management of customer interactions.

Keywords

Business Enterprise, Business Process, Enterprise Resource Planning, Customer Relationship Management.

Discussion

1.1.1 Business Enterprise

- Profit making

Any form of organisations involved in offering goods or services with the goal of turning profit is referred to as a business venture. Due to its inclusive character, the phrase can be used to describe any form of business or organisation that is focused on making money by selling goods of any kind. It's common to use the terms such as company, firm, and business enterprise interchangeably.

1.1.2 Functions of Business Enterprise

A business enterprise performs various functions. They can be broadly grouped into four functions. Let us learn these functions in detail.

A. Production function

- Raw materials to finished goods

The production function is a process that converts raw materials into finished goods or processes that provide services to consumers. This function oversees the procuring and managing of all the economic resources required for production, such as Land, Capital, Labour, and Entrepreneurship. These economic resources are also known as 'Factors of Production which are explained below.

i) *Land*

In narrow terms, it includes the earth used for agriculture, building factories, and companies where the production

process occurs. However, broadly, it provides everything associated with natural resources, such as minerals and metals found beneath the earth, ocean, and even living organisms such as fish found in sea and rivers can all be considered land. Forest reserves, pools, climate, and beaches used for tourist attractions are also considered under the purview of the factor 'land'.

- Land is natural asset

ii) Labour

Labour means all human efforts exerted into the business to produce and sell goods or services. It covers all types of labour, including physical and non-physical that are invested in the various activities of a company for an economic incentive. Labour is a unique factor of production as it is perishable and inseparable in nature. It cannot be stored for later use and the services rendered by the labourers cannot be separated from themselves, unlike other resources.

- Human efforts

iii) Capital

In the production function, capital represents one of the primary factors of production alongside labour and technology. It encompasses physical tools, machinery, equipment, and structures used to create goods and services. Capital contributes to production by enhancing efficiency, enabling automation, and expanding output capacity. The amount of capital employed influences the production process and output levels; however, its impact is subject to diminishing returns, where each additional unit of capital yields progressively smaller increases in output. Proper allocation and integration of capital within the production process are crucial for optimizing productivity and achieving economic growth. In short, the total assets purchased by an organisation using money are considered the Capital of that organisation.

- Assets purchased

iv) Entrepreneurship

The organisation of the above-mentioned factors, such as Land, Labour and Capital, will make the production function possible. Hence there must be a person or an entity to organise these factors efficiently, along with entrepreneurial skills and the ability to bear risk. This entity is called entrepreneurship, and the person who leads such an entity is called an entrepreneur. The skills required to run entrepreneurship successfully are termed entrepreneurial skills. In return for the entrepreneurial skills and risk, an entrepreneur enjoys profits earned from the entrepreneurial business.

- Organisation of factors

The production function is the most prominent function of a business organisation as it involves significant investment in infrastructure, machinery, and working capital. This function drives all other functions.

B. Finance function

Every business needs money which must be effectively utilised to earn profits. These activities can be broadly classified as follows.

i) Investment decision

- Investments of funds

This decision is related to the investment of available funds in the right assets. The investment decisions can be long-term and short-term. Long-term investment decisions cover the capital budgeting decisions concerned with the investment of funds to procure fixed assets. In contrast, short-term investment decisions cover the working capital decisions concerned with the business's day-to-day activities.

ii) Financing decision

- Procurement of funds

This decision revolves around how a business procures the funds required for its activities. It deals with the optimum capital structure of the company, which reduces the cost of capital. The factors affecting financing decisions are the cost of capital, the risk involved, the cash flow position of the business, and the dilution of control.

iii) Dividend decision

- Retain or distribute profit

A company decides whether to retain the profit earned by the company as 'reserves or retained earnings' or to distribute it among the shareholders as dividend, which is called dividend decision. Earnings, taxation policy, stable dividends, and growth prospects are a few factors that affect the dividend decisions of organisations.

C. Accounting function

- Financial recording

Accounting function covers all activities involved in record keeping of financial transactions. Accounting function is an essential component of financial management in organisations. It includes a variety of tasks that are required for recording, analysing, and reporting financial transactions and information. The accounting function's key goals are to provide accurate financial records, offer appropriate financial information, support decision making, and assure regulatory compliance. One of the primary

objectives of the accounting department is to accurately record financial transactions.

Accounting can be mainly divided in to three branches

i) Cost accounting

It is concerned with accounting for all the costs incurred for producing products or services. This helps to reduce costs by creating cost-cutting strategies and fixing appropriate prices for goods and services. Cost accounting classifies the total costs incurred as Fixed costs and Variable costs. Fixed Costs have little or no control in the short run and Variable Costs change proportionately with the change in units produced. Such categorisation of costs helps managers concentrate on relevant costs and take decisions on Cost-Volume-Profit Analysis, Make versus Buy, Sell versus Continue etc.

- Accounting for costs

ii) Financial accounting

Financial accounting focuses on external stakeholders interested in the company's financial performance and position. The statements prepared under financial accounting include balance sheet, profit and loss account, and cash flow statement. After analysing the companies' financial statements, external stakeholders such as investors, banks, and suppliers decide to invest in the economic resources of the business.

- Assessment of financial health

iii) Management accounting

It is a method of accounting that creates statements, reports and documents aimed at informing management about business operations. The primary function of this accounting is to assist managers in decision making by providing the correct information at the right time. Contrary to financial accounting, management accounting is not governed by accounting standards and does not have a prescribed way of analysing data. The calculations and internal reports are highly customised to the need of the hour. The critical decisions facilitated by management accounting are budgeting, forecasting, and financial analysis.

- Support in decision making

D. Marketing function

This function helps the organisation identify the tastes and preferences of the customers and provides the required goods at the right time. Marketing functions differentiate the products and services of the organisation from its competitors. It works closely with the customers and relentlessly works towards adding value to the customers. It is also entrusted with getting new customers for the products and services offered and retaining

- Focus Customers

existing customers. Traditionally, businesses followed the Production concept of marketing, under which the organisations decided what to produce at what quantity and quality and then market it aggressively. They pushed the product to the customers. However, modern marketing revolves around the customers' tastes and preferences; the production process starts after ensuring enough demand for the product and tries to incorporate customer feedback from the very beginning of the product designing stage itself.

E. Human resource function

This function of the business deals with finding the right people, for the right position, at the right time. It takes care of recruitment, selection, orientation, training, and administration of employee benefit programs. This function helps to create a unique competitive advantage for the organisation. In this era of 'war for talent', this function is very vital for a business because only a talented group of contented and loyal workforce can lead a business to success. Employers find it challenging to retain skilled and talented employees. Therefore, it is essential to pick persons fit for the job profile while recruiting to avoid employee attrition. The function is also concerned with professional development to increase the loyalty and productivity of the employee towards the organisation.

- Financial recording

1.1.3 Core Business Processes

Business Process is a series of activities that transform raw materials or inputs into goods or services, and functions are more specific to a particular business area. Business requires several processes to produce the required goods/services. Core business processes are those activities that drive the business. The business model of the company guides these processes. The core business processes are discussed below.

- Crucial process for business

i. ***Quality, process improvement and change management***
It is the most crucial process for any business. It is an ongoing process, reviewing and improving one activity at a time. While doing so, it is essential to plan and implement the changes required in the organisation to ensure a seamless transition from the current state to the desired state.

- Customer-Centric

ii. ***Customer strategy and relationships***
This process caters to the customer's needs and strives to fulfil the needs of the public in the best way possible. Businesses must ensure their core processes revolve around market study to understand consumers' preferences. It surveys to study the market. The survey may collect qualitative

and quantitative aspects of consumers' preferences, tastes, and attitudes. It analyses data to arrive at the proper customer engagement/retention strategies and build long-term relationships with its customers.

iii. Product development

A market survey helps identify customers' needs that are yet not met. The product development process ensures that potential customers derive value from the products and services provided by the business. The process involves idea generation, where brainstorming takes place to develop a new product based on the insights obtained from the market survey. The second stage is defining the scope of the product and refining the idea developed in the previous step. This stage conducts SWOT analysis (Strength, Weakness, Opportunity, and Threat) to differentiate the products from competitors. The next stage is concerned with defining the product features, value proposition, supply chain strategies and marketing strategies. Once the product is determined, the team will start preparing prototypes to check the functional feasibility of the product. Once the prototype is approved, the initial design stage begins. The initial design stage involves all the stakeholders to finalise the design. It may take several iterations before finalising the design. Once the design is completed and approved by the stakeholders, it is validated and tested before starting commercial production. The final stage is commercialisation, launching the product and making it available for potential customers.

- Process of product development

iv. Customer acquisition (Sales)

This is one of the essential business processes concerned with gaining new customers. It is different from the sales process as the latter concentrates on increasing sales; it could also be to existing customers. However, customer acquisition focuses on adding new or unique customers. This helps to increase revenue generation in the long run.

- Gaining new customers

v. Employee development and satisfaction (human resources)

Right talent is the best competitive advantage. Building and retaining the right talent is no easy task in the era of war for talent. Organisations are constantly looking out for talented employees. This employee development process covers the activities that improve the competencies of existing customers. Satisfied employees contribute to the growth of the company. A company with significant capital and assets is worthless if it does not have the right human resources to put the money and help the best use and generate revenue.

- Human capital optimisation

vi. Financial analysis, reporting, and capital management

- Financial reporting

The financial reporting process involves identifying, classifying, recording financial transactions, preparing ledgers, summarising the journal entries, and preparing the financial statements according to the applicable laws and regulations. Once these statements are ready, accountants also undertake the analysis of these financial statements for decision making. Various internal reports are also prepared to aid managerial decision making. It facilitates the evaluation of business projects and budgets. The process involves activities focusing on managing both short term and long-term capital.

vii. Technology management (Computer and IT)

- Technology integration

Technology management can be a vital competitive advantage. Technology must be integrated with the other functions of the business, such as finance, human resource, accounting, marketing etc. This integration would drive the business's technology acquisition and development strategies. The primary activities under this process are to identify, select, acquire, exploit, and protect technology.

viii. Marketing

- Strategic marketing

Marketing is a basic business process that includes activities aimed at promoting products or services to specific clients. Market research, branding, advertising, sales, and customer relationship management are all part of it. Companies can get a competitive advantage in the marketplace by identifying and satisfying client demands, increasing brand awareness, driving sales, and establishing a competitive advantage through strategic marketing activities. In today's highly competitive and dynamic business world, effective marketing tactics are critical for firms to prosper and expand.

ix. Supply chain management

- Efficient supply chain

Supply chain management is a vital business activity that comprises the coordination and administration of activities linked to the sourcing, procurement, production, and distribution of goods or services. It includes the planning, execution, and control of the complete supply chain, from raw material suppliers to end customers. Effective supply chain management promotes efficient operations, optimal inventory levels, on-time delivery, cost reduction, and increased customer satisfaction. It is critical for increasing competitiveness, developing operational excellence, and achieving overall corporate success.

1.1.4 Use of Information Technology for Business Organisations

Information Technology can be described as the devices or tools that make it easy to complete tasks. It involves processing, storing, retrieving, and transmitting data using computers and other related technological tools. The 21st century has witnessed rapid technological interference in all walks of life, and it is still evolving into new facets of critical business activities. We are dependent on technology for our everyday activities, such as production, transportation, communication, health care, education and entertainment. The importance of technology has been recognised globally by governments and businesses alike. They keep a major chunk of money to invest in research and development activities for technological advancement. Technological advancements are instrumental in human progress. Medical and scientific developments have been possible with advanced technology. Advanced technology acts as an enabler to solve complex processes and calculations that would not have been possible by humans. Technology also reduces the risk of human error and increases product performance more efficiently and effectively. Technology also helps to share information along with collaborative research and development work across countries. With the support of automation, cloud computing, robotic technology, artificial intelligence, machine learning, and deep learning, the technology is interminably expanding its spectrum. Information technology uses machines to complete tasks more effectively. The machines aid in storing, retrieving, and processing massive data. However, choosing the right technology and training the employees to optimise the technology is crucial. Organisations invest massively into technological advancements as it is pervasively used in organisations.

- Information Technology propels global business advancement

A few essential applications of IT in business are discussed below.

i. Digital marketing

Marketing is essential to get customers for your products and services. Other modes of marketing have their own geographical limitations and will not be able to reach large audiences. On the contrary, digital marketing helps an organisation reach out to large audiences and is also cost-effective. It helps to reach customers and customise marketing communications according to the target customers' tastes and preferences. This way, it helps to build trust, loyalty, and long-term relationships with the customers.

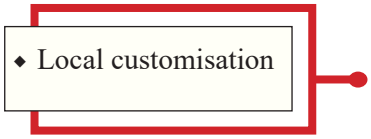
- Digitalisation of marketing

A few benefits that digital marketing provides are:

a) Global reach

Geographical boundaries limit the reach of traditional marketing and are expensive when you plan for an international space. However, with digital marketing, geographical boundaries no longer matter as you can reach every customer across the globe through the internet. This would open international growth opportunities even for a small business start-up.

b) Local reach



Although digital marketing helps in global reach, it also helps in customising the marketing campaign according to the local taste and preferences of the customers. Therefore, digital marketing aids in building loyal and strong customer relationships.

c) Lower cost

Digital marketing provides cost-effective marketing solutions. It is highly beneficial to small businesses as it allows them to compete with large organisations that have deep pockets.

d) Not complicated

Digital marketing techniques are easy to start with. Though it gets complex as the scale of the campaign grows, it is easy to train employees who are already tech-savvy. Digital marketing also offers many strategies so businesses can choose the most appropriate one.

e) Segmentation, Targeting and Positioning (STP)

Organisations build marketing campaigns based on the STP model. The STP model helps in positioning the product or services offered by the organisation in the minds of the target customers and accordingly develop marketing communications to engage different audiences. Digital marketing helps organisations identify the customers' search intent by analysing the search keywords on other platforms. The business can target ads on various social media platforms based on the search intent identified. Email personalisation and on-site personalisation help businesses keep the target audience engaged.

f) Multiple strategies

Integrating various strategies into a marketing campaign with digital marketing is easier. As digital marketing aims to cater to different audiences with different preferences, the use of multiple methods helps in developing effective marketing campaigns. A business can use common types of digital marketing: user search engine marketing, video mar-

keting, forum engagement, social media marketing, email marketing, viral marketing, and influential marketing. It can also choose from various content types available to create effective online marketing campaigns. The most common types of content are blogs, podcasts, visual content, infographics, quizzes, webinars, and social media posts.

g) Analytics and optimisation

The most crucial advantage of digital marketing is that it allows the marketer to analyse the results of digital marketing campaigns. Digital marketing makes marketing analytics accessible to measure the impact of digital marketing campaigns on a real-time basis. This helps the marketer to fix any mistakes at the earliest. It also helps understand how customers respond to different digital marketing strategies and content types that can be used in future marketing campaigns.

- Marketing Analytics

ii. Product development

Rapid technological development and constantly changing customer needs have necessitated organisations to keep innovating their products and services. A business can no longer continue to lead the market with a single product in the long run. Technology helps organisations to reduce the time taken to convert an idea into a product. Technology also adds as an enabler in developing innovative features for products and services. Technology also helps in product development and innovation stages, from end-stage to prototype to pilot testing and final product launch stages.

- Innovation Technology

iii. Operational efficiency

As the business grows, a company struggles to monitor its operations. Technology helps in improving operational efficiency and productivity. It helps optimise supply chain management, cross-team collaboration, and project management by making the processes more efficient and effective. Remote working has been possible because of technological advancements. It also helps in managing and reporting on a real-time basis. A manager can now make quick and timely decisions to make the process more efficient. In a retail store, manufacturing companies can use information systems to efficiently manage the inventory on a real-time basis. The only thing they must do is, ensure the items are recorded through the inventory management systems as soon as it is received. The inventory management system would provide a ready reckoner of the items in the warehouse after each sale. Similarly, a project management information system helps

- Real-time management

to break down the project into a list of small tasks to be completed and delegate it to the team. It also helps monitor the progress of each task in real-time. It eases collaboration between project members. It helps to establish timelines and create a budget for the project.

iv. Online payment transfers

- Digital payments

It has made online payment possible. Small businesses have tremendously benefited from online payments. It helps them to reach more consumers, gain an online presence, increase productivity, and enhance security. Online payment has also boosted e-commerce activities. Digital payments can be made by various methods such as UPI, Credit Cards, Debit Cards, Internet Banking, PayPal etc. Digital payments have become extremely important, especially after the outbreak of the COVID-19 pandemic and social distancing. It also brings transparency of costs and reduces the risks of manipulation and fraud. It also reduces the need for extensive paperwork and tallying of records. Above all, it provides convenience to customers and helps in boosting sales.

v. Relationship with clients

- CRM

The use of the right technology helps the organisation improve customer experiences to boost its growth and profitability. Technology has become inevitable in maintaining strong customer relationships. CRM technologies help organisations collect and analyse the departures behaviour of their customers. It also helps keep track of interactions with the customers and build a solid relationship in the long run.

vi. Online storage

- Cloud storage

Data become the new oil for the business. Data carries substantial economic value for an organisation. Technology has enabled the online repository of voluminous data in databases which can later be retrieved for specific uses. Technology also helps to analyse the data and gain deeper insights which support decision making. Almost every company uses cloud storage to manage its data. Cloud storage services enable the company to eliminate the hardware requirements, physical space and human resources needed to maintain the in-house servers. These savings in capital investment can be channelised into better projects to increase the companies' profits. Cloud storage provides enhanced security to the data stored compared to the physical data storage within the office. It protects a company from data loss due to hardware failures.

1.1.5 Innovative Technologies in Business

A company can only gain a competitive advantage and lead the market if it leverages innovative technologies. From retailers to aviation to healthcare companies, all are heavily investing in technological advancements. The technological advancements are so rapid, and hence it obsoletes rapidly. The following technologies are believed to be game changing that companies cannot afford to ignore.

A. Artificial intelligence (AI)

Artificial Intelligence received a lot of attention recently, although the term was coined in 1956. The ability of a digital computer or computer-controlled robot to carry out actions frequently associated with intelligent beings can be referred to as artificial intelligence (AI). It basically entails the application of intelligent computer software with capabilities similar to those of humans to raise revenue, enhance customer experience, boost productivity and efficiency, and promote corporate growth and transformation. Artificial intelligence uses smart algorithms that enable computers to perform tasks that humans perform without human intervention. Using this technology, machines can now be trained to mimic human intelligence.

- Intelligent computer software

Artificial intelligence can be applied to different business functions such as:

a) ***Customer service***

The first and foremost use of AI is to provide efficient customer services. AI helps in enhancing the overall customer experience within the company. Chatbots are simple use cases of AI in customer relationship management. Chatbots help answer customer queries round the clock, which would otherwise be impossible unless companies hire more customer support executives and work in shift systems. The use of AI reduces the cost of labour and also reduces costs in the long run.

- Customer support

b) ***Targeted marketing***

AI can provide insights into customer buying patterns by scanning and analysing their digital footprints. Through such insights, businesses can now target customers with specific products they wish to buy. Technological advancements have now allowed companies to combine geo facial recognition systems and geospatial software with online browsing history to provide strong insights to match marketing with customer preferences.

- Customer Targeting

c) ***Supply chain management***

- Supply Chain Optimization

Supply chain managers juggle between overstocking and understocking. AI enabled applications would help track the products and estimate the demand to reduce the risk of understocking and overstocking. It also helps businesses to choose the most optimum supply chain alternatives and reduce the time taken to move the products to where they are needed.

d) ***Smarter operations***

- AI in operation

AI is being used in all functions enterprise wide. The users using the applications might not even know that AI is enabling them to perform their work in an efficient manner. For example, the customer support team might not be aware that the software used for routing the customer support calls to the members uses AI enabled algorithm that is trained to route the calls to not just the executive who is free but to the executive who is more experienced in handling the query raised. In retail stores, AI enabled scanners can provide an update on not just the products on shelves but also the freshness of the perishable product on shelf.

e) ***Safer operations***

- Data Monitoring

AI enables collating data from different touchpoints and helps in monitoring a geographically spaced area. It collates data from various devices such as cameras, motion detectors, and weather sensors that can be analysed to identify problems and take preventive/corrective measures. Monitoring illegal and fraudulent activities is easier with the help of AI enabled applications that identify patterns across huge amounts of data from different sources.

B. Analytics

- Data Analytics

The use of technology has led to the collection of data from every data point possible. It is impossible for the human mind to make sense of the large data collected in a short span of time. Technology has enabled analytical software to use deep learning and machine learning to identify patterns that would help quick and quality decision making by the managers. Analytics has changed the way business looks at data. It has created a new horizon not only for business organisations but also for governmental organisations. Analytics has a wide range of applications in business. Some of them are explained below.

a) **Credit and debit transactions**

Credit and debit card transactions provide an ideal way

to make purchases and are a great way to learn more about a customer's purchasing patterns, financial condition, behavioural trends, demographics, and lifestyle preferences.

- Purchasing patterns

b) **Customer Relationship Management (CRM)**

Any business that wishes to maintain client loyalty and survive in business for a long time must have excellent customer relations. CRM systems examine crucial performance factors such as demographics, purchasing trends, socioeconomic data, and way of life.

- Customer profiling

c) **Finance**

The financial world is a volatile place, and business analytics may assist organisations in extracting insights that can help them navigate difficult terrain. Business analysts are hired by corporations to optimise budgeting, banking, financial planning, forecasting, and portfolio management.

- Financial Insights

d) **Human resource management**

Although human resources is frequently the punchline of many office jokes, its importance in ensuring a company's success cannot be ignored. Great companies have great employees, and it is HR's responsibility to locate the best applicants and retain them on board. Business analysts contribute to the process by poring over data that identifies high-performing applicants, such as educational background, attrition rate, average length of employment, and so on. By analysing this data, business analysts may assist HR by anticipating the best matches between the organisation and recruits.

- HR Optimization

e) **Manufacturing**

Business analysts use data to assist stakeholders in understanding the factors that affect operations and the bottom line. Identifying equipment downtime, inventory levels, and maintenance costs assists businesses in streamlining inventory management, risks, and supply-chain management for maximum efficiency.

- Operational Insights

f) **Marketing**

What are the most effective advertising campaigns? What level of social media penetration should a company attempt? What do consumers enjoy and dislike in commercials? By evaluating marketing and advertising indicators, determining consumer behaviour and the target demographic, and analysing market trends, business analysts help answer these and many other questions.

- Marketing Analysis

1.1.6 Enterprise Resources Planning

Businesses often find themselves struggling to survive amidst fierce competition. It is challenging to attract customers and gain loyalty in rapidly evolving markets. To attract and retain customers, a business must have information about its competitors, customer trends, customer preferences, and customer attitudes on a real-time basis. A well-designed information system would aid firms in collecting, organising, and analysing information for strategic decision making on a timely basis. Until recently, businesses would have various information systems based on business processes such as Marketing Information Systems, Human Resource Information Systems, Logistics Information Systems and Accounting Information Systems. Such individual information systems would work well within the respective departments. However, they are less valuable if they do not facilitate information sharing between information systems. Unintegrated information systems could increase costs and inefficiencies. An enterprise-wide integrated information system known as Enterprise Resource Planning (ERP) became necessary to fix these inefficiencies. American Inventory and Production Control System (APICS) defines ERP as "An accounting-oriented information system for identifying and planning the enterprise-wide resources to make, ship, and account for customer orders." In simple words, enterprise resource planning integrates different information systems across the enterprise and facilitates the logical flow of information from one information system to another. It also helps automate collecting, managing, storing, and analysing data and provides a centralised database.

- Integrates information systems

The various benefits of ERP are:

i. Increased efficiency

ERP integrates information systems and facilitates the automation of manual and routine tasks. An integrated information system avoids duplication of data entry into the information system from multiple data points. This enhances the quality of data collected, answering the quality of insights drawn from analysing such data. ERP brings standardisation to business processes across functions. This increases the efficiency of the tasks and frees up the employees' time, which can be utilised for more productive tasks that helps in firms' growth. Increased efficiency would also help accurately forecast demand, streamline production processes, reduce supply chain management uncertainties, and stay ahead of its competitors.

- Better efficiency

ii. Reporting

One of the primary benefits of ERP is that it provides a centralised database. The ERP system enables collecting, storing, organising, and analysing data across functions in one centralised database. As all the data is stored in one place, it's easier to integrate data collected from different business processes and prepare reports on a real-time time basis. Such dynamic reports, also known as dashboards, help the manager monitor the inventory levels, customer buying behaviour, and changing trends and patterns on a real-time basis. Managers can also take quick decisions and capitalise on the opportunities as soon as they pop up.

- Centralized database

iii. Compliance requirements

ERP facilitates standardisation in data collection, storing, organising, and reporting. As the preparation of reports is automated and is not manually prepared, the chances of not meeting compliance requirements are scarce. It reduces the enormous amount of time managers take to confirm the compliance requirements of various reports prepared daily manually.

- Compliance Automation

iv. Business process improvements

ERP captures the logical flow of data across different business functions. It provides a bird's eye view of the business processes. With the help of this, the managers can monitor and identify the bottlenecks in the processes and take action to remove the bottlenecks as quickly as possible, thereby enhancing the efficiency of the processes.

- Enhancing the efficiency

v. Cloud accessibility

Recent developments have enabled cloud ERP systems. The significant benefit of a cloud ERP system is that it reduces the burden of the firm's in house IT team. With cloud ERP systems, the data can be accessed anywhere, and any time, provided there is internet connectivity. This facilitates the virtual collaboration of employees located at different geographical locations. It also protects the data from damage to the hardware resources of the company and ensures that a backup is available at all times. Advanced cloud infrastructure assures the utmost security of the data stored on cloud ERP systems.

- Cloud ERP

Disadvantages of ERP systems

Like every other product and service, the ERP system also has disadvantages. The company implementing ERP systems must consider the following pitfalls to ensure maximum use of the ERP systems.

i. Huge costs

- Expensive

Implementation of an ERP system involves enormous costs. It is not suitable for small companies with low financial resources. Companies can opt for a cloud-based ERP system that works on a subscription model. The firms under the subscription model are billed frequently or on a regular basis. Contrarily, companies opting to build in-house ERP systems will have to invest heavily in developing the required infrastructure. However, in the long run, the investment in an ERP system is worth it, leading to substantial cost savings.

ii. Training requirements

- Training support

Effective training programs used to train employees in using an ERP system are vital for the maximum benefit of ERP systems. Along with the training programs, constant customer support has to be provided if the employees face a technical issue during the learning period. Business organisations must ensure the availability of comprehensive training resources, manuals, and technical guides to ensure proper support to the employees to get themselves acquainted with the ERP system.

iii. Commitment of top management

- Interest of top management

The implementation of ERP takes time, and the administration starts to see the benefit of ERP only after several months or, at times, even years. During the transition from traditional information systems to ERP systems, it may seem that traditional information systems are more accessible and better than ERP systems. Employees take time to get used to ERP systems and initially find it complicated. The cost savings also take time to be visible. If the top management is not committed to the ERP implementation, they might see it as an additional cost.

iv. Customisation

- Feature utilisation

ERP systems come with many customisable options. If a firm wishes to gain optimum benefit from ERP, it has to be fully customised to the way things are done. This further increases the cost of ERP implementation and might not be attractive to the firm. However, ERP with limited flexibility would not help employees make the most of the ERP features.

1.1.7 Enterprise Resource Planning Systems

As the name indicates, ERP is defined as a system or software that is used to manage all of the enterprise's resources. ERP Systems can handle and track anything from employee payments to a single screw entering the organisation. ERP is a type of cross-functional software that supports all of the organisation's business processes. Usually, an ERP system consists of several components called 'Modules'. These are explained below.

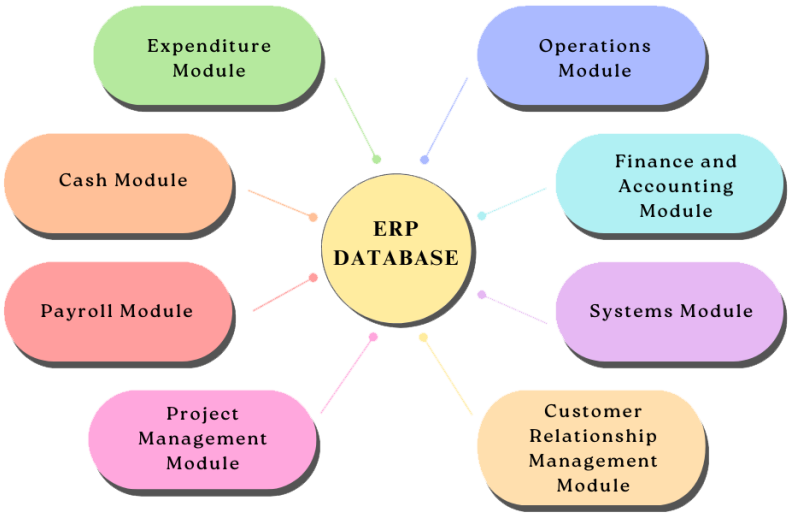


Figure: 1.1.1: The ERP System

i. Cash module

This is the cycle from the time product or service is ordered to the delivery of products or services, billing customers to receive cash for payment. The cycle starts when a company receives an order from a customer. If the customer's credit score is within the acceptable limit set by the company, credit is extended. Otherwise, the customer is asked to make a cash purchase. The order is approved after checking with the inventory manager for sufficient stock in the warehouse. The record for the sale is made after confirming the availability of stock, and a sales order is prepared. The sales order is transferred to the warehouse, where the inventory control manager prepares for dispatch of the required item to the customer. The product is then shipped to the customer with relevant identifying documents. An invoice is sent to the customer along with the product. After the product is delivered, the company records the transaction as a sale with the amount due from the customer. The customer verifies the item and approves it if it is as per the requirement. The customer either pays immediately, or if the purchase

- Cash for payments

is made on credit, the payment is deferred to the due date or earlier. When the company receives payment for the invoice, the accounts receivable account opened in the name of the customer is closed.

ii. Expenditure module

This is the purchase to pay cycle and covers all the activities that are involved in placing orders for the product, receiving delivery of the product, accepting invoices, and making cash payments within the maturity date. The inventory manager alerts the purchasing department when the stock is below the required minimum. Either the inventory manager does this task, or an information system can be used to automatically alert the purchasing department when the stock level falls below the minimum stock level is reached. The purchase requisition is prepared and sent to the supplier, who prepares the goods as per the requirement. The supplier prepares to dispatch the product to the company. The invoice is prepared and sent to the company by the vendor. The company verifies the product on delivery and sends the products to the warehouse, which records the incoming stock. The company makes the payment against the invoice and closes the accounts payable account opened in the name of the vendor.

- Purchase to pay cycle

iii. Operations module

The operations cycle depends on the type of company. If it's a manufacturing company, it includes all the stages from idea creation to product development, manufacturing process to final product creation. If the company is a retail store, the cycle would be similar to the purchase cycle. For a company involved in manufacturing, the following are the stages in the operation cycle.

- Operations cycle

Stage one

Stage one includes product design and development. It is important to record the cost at each and every step of the product development stage. The cost involved in purchasing relevant raw materials, prototyping the created product design alternatives, choosing the most feasible design and documenting the process of manufacturing and function of the product is collated to be later used in the calculation of product price.

- Product development

Stage two

Stage two involves the planning and scheduling process. The production technique to be used is decided in this stage. Also, depending on the demand for the products, the compa-

- Production planning

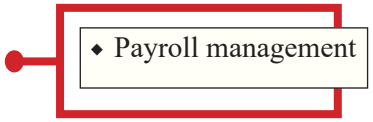
ny decides to manufacture in-house or requires outsourcing of a part of the production. Required invoices are prepared either to purchase produced products from outside or to purchase required raw materials and manufacture in-house.

Stage three

Stage three includes the actual production operations if it is decided to be manufactured internally. The information system can be used to record costs at each stage to arrive at the right unit price of the final product. The last stage is cost management. The cost data prepared at previous stages is now collated to prepare the cost sheet at the end of the production cycle to calculate the cost price and the selling price of the product.

iv. Payroll module

The module allows for capturing and maintaining all the information related to the payroll cycle of the organisation. It starts right through the recruiting, hiring, training and development, and retirement/exit of human resources. As soon as the employee is hired, the master payroll data is updated. The module then provides for recording and maintaining the time clocked in by the employee, against which payment will be calculated. The time may be on hourly basis for wage earners, adjunct workers, freelancers, and a day basis for office workers or based on results for top management. Regardless of the category of metrics used, the module helps systematically collect and maintain the time clocked by different types of employees for periodic intervals like week, month, quarter, or year. The next step is to prepare payroll at periodic intervals. The module also takes care of disbursing the payroll to the employees and taxes to the government.



v. Finance and accounting module

This module updates the general ledger, adjusts entries at the end of the year, prepares financial statements, analyses the financial statements, and provides managerial reports as required for effective decision making. Modules can be programmed to provide non-financial data for managerial decision making along with financial data.

1.1.8 Customer Relationship Management

Customers are the heart of any business. Business is only possible with the customers. Companies continuously strive to understand the customers' needs, customise the products, and provide the features that customers would love to have. Imagine

- Track of customer's information

you are interested in buying a car. You keep browsing a variety of cars in your leisure time. The next day, you receive a call from the nearest automobile dealer, persuading you to come down to their showroom and test drive the car of your choice. To your surprise, the showroom did have not only the car of your choice but also the exact colour you were browsing for and all the accessories you would love to have. They also explain the financing options available as they know you would want to buy the car on EMIs. They offer the car to be delivered to your house after registration in a couple of days. You not only end up buying the car but also the accessories assorted for you by the showroom based on your tastes. As soon as the car is delivered, you have been added to the community, and customer care executives get in touch with you to explain the essentials and tips to keep the car in good condition. They also call you when the service is due and provide 24/7 roadside assistance if you get stuck on a highway without fuel or if the tyre bursts.

- CRM Improves Customer Relationships

Now you wonder, how is this all possible? How did the showroom executives know what colour you liked? What accessories did you want? And how does a company provide customised services to its thousands of customers? Well, here is where CRM comes to play. CRM helps businesses keep track of all the information related to existing and potential customers to build strong relationships with the customers. CRM helps streamline all the communication company has with its customers. The scope of CRM goes beyond the sales function to include the marketing function, product design, customer service, recruiting and supplier relationships. CRM helps in customer-level dashboards that help the manager understand the customer's history, from all previous purchases to buying patterns, order statutes, customer complaints, etc. This aids in the company's timely decisions and better customer service, ultimately leading to customer satisfaction and loyalty.

How does CRM help businesses?

The most crucial areas where CRM helps businesses are:

- Lead conversion

i. Strengthening bottom line

CRM applications are proven to enhance lead conversion. Lead conversion is the process of converting leads into customers. Leads are contacts with prospective customers. Lead conversion can be done using tactics like email nurturing and retargeting, which are effectively done by CRM applications. These tasks can also be automated using CRM applications. This, in turn, increases sales and revenues for the company.

ii. Categorisation

CRM helps in the right categorisation of leads so that the right leads can be followed up and converted into sales quickly by the sales team, and the marketing team can identify the leads that need more persuasion and focus on retargeting and email nurturing. This ensures allocating resources to the right leads.

- Lead categorization

iii. Word of mouth

Effective CRM leads to happy customers, which boosts word of mouth referrals by the customers. It visibly increases repeat purchases by satisfied customers and purchases by new customers. Fighting competition and increasing market share becomes easier. CRM provides a better customer experience through hyper-personalisation, which otherwise wouldn't have been possible. Hyper personalisation is offering products based on each customer's needs, tastes, and preferences in the location the customer is residing and updating the services and products based on recent trends, personalising marketing communications to individual customers.

- Customer satisfaction

iv. Decision making

Advanced CRMs use artificial intelligence to aid faster and better decision making by the managers. Customers use multiple channels to browse, read reviews, purchase, and pay for the product. CRM helps in collating the data from different channels and predicting the marketing propaganda that the customer is most likely to respond.

- AI-enhanced marketing

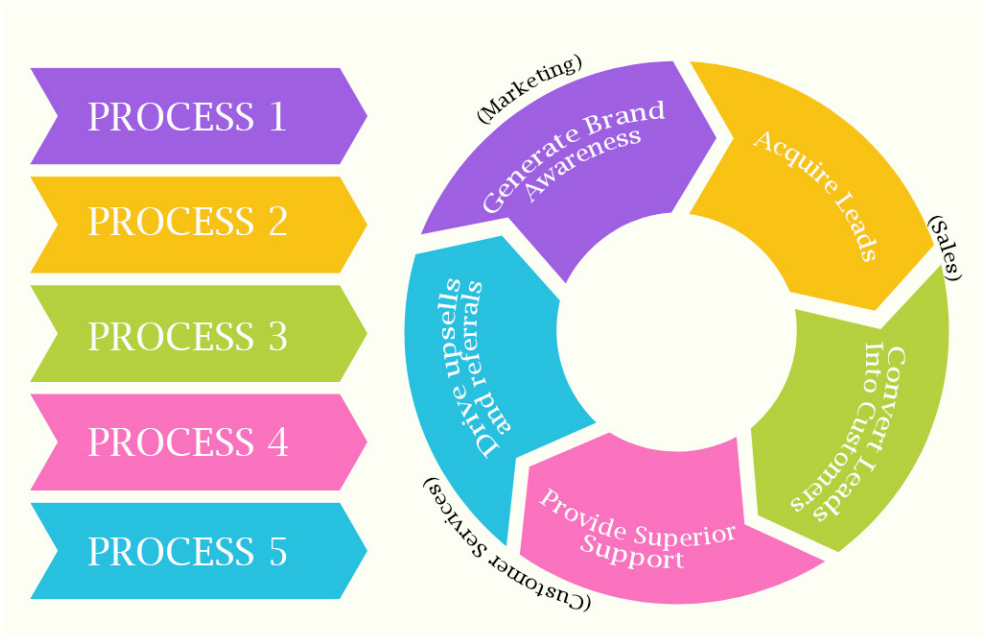


Figure 1.1.2 CRM Process

1.1.9 Customer Relationship Management Process

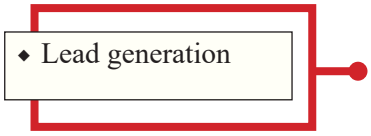
CRM process focuses on understanding the needs of every customer and providing them with personalised services. CRM process follows a systematic series of steps as explained below.

i. Generate brand awareness

This is the first step in the CRM process. In this step, the goal is to create brand awareness amongst the prospective customer about the product or service. The awareness can be created through a multichannel marketing campaign. The uses of the product or service and its significant features are highlighted to position the product or service in the minds of the customers. CRM helps to understand which channel customers using your products are mostly likely to use. It also aids in understanding the demographic categorisation of target customers. Brands can create suitable awareness campaigns based on the data collated by CRM applications. For example, brand awareness for products catering to the youngster can be done using trending hashtags on Twitter, Instagram and other social media platforms.

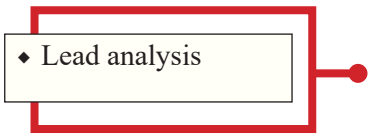
ii. Acquire leads

The second step of the CRM process is to find the right leads. Brand awareness campaigns might just help to create that initial curiosity or interest about the product or service. The next step is to get the customer engaged in more details about the product, which would take one further step towards the final buying decision. CRM applications collect data such as the customer's email id and phone number so that the marketing team can send weekly newsletters, attractive offers, and more details about the product or service. Artificial Intelligence integrated CRM applications would engage visitors through chatbots option on their website. The chatbots would provide answers to frequently asked questions by the customer. These features of CRM help in understanding the customer's needs in more detail and create customised offers to persuade purchase decision.



iii. Converts leads into customers

CRM helps analyse historical purchase data and helps sales executives determine if the leads are interested enough to make the purchase decision. CRM applications provide a lead score that quantifies the lead's purchase intention. CRM studies have found that customers want to hear at least three to five times before making the final decision. Therefore, the sales representatives will have to send reminder emails to the leads to keep their interest in the product or service until



they purchase it.

iv. Customer Service

Once the customer is acquired, it is important to provide the customer with the best possible service. Companies may underrate the importance of customer service. A brand might help you acquire a customer; however, it is the customer service of the brand that determines if the customer would make a repeat purchase and recommend others to buy the product or use the service. Because CRM applications provide the firm with useful insights about the customer, providing personalised and timely service is no more a daunting task for customer relationship managers. CRM applications can be programmed to send useful tips based on their usage, send reminders of service due, book an appointment with the customer support executive, wish them and send personalised offers on important dates such as birthdays, anniversaries, send them information about new products launched, new offers and so on. This would keep the customer engaged even after the purchase is made and can help build a strong community.

- Customer retention

v. Drive upsells and referrals

Drive upsells persuading existing customers to upgrade to products and services of higher value and cost. The constant monitoring made possible by the CRM applications helps identify the right time to release product upgrades to the customers. Companies can learn about the changing lifestyle, changing usage patterns, changing workstyle and sending offers of suitable upgrades through emails or check-in calls. The companies also persuade you to refer the product or service to others and get a discount on their next purchase or win goodies. CRM can identify the customers who are influencers on social media and provide exclusive offers to persuade their followers to buy the product or service.

- Upselling strategy

Summarised Overview

Business enterprises are intricate organisations comprising diverse functions that collectively drive their success. These functions include finance, production, accounting, and marketing, each serving a pivotal role in the enterprise's operations and growth. The finance function involves managing financial resources, allocating budgets, making investment decisions, and ensuring the availability of funds for day-to-day activities and strategic initiatives. Production function is responsible for overseeing the creation of goods or services, optimising processes for efficiency, and maintaining quality standards. Accounting function is concerned with recording financial transactions, preparing financial statements, and providing insights into the enterprise's financial health. Marketing function revolves around understanding customer needs, designing products/services to meet those needs, and implementing strategies to attract, engage, and retain customers. Business processes transform inputs into goods/services, while functions cater to specific business areas. Core processes driven by the business model include quality improvement, customer engagement, product development, sales acquisition, employee development, financial analysis, technology management, marketing, and supply chain control. These processes ensure customer-centricity, operational efficiency, financial stability, and technological integration, collectively advancing business success. Information technology (IT) is a fundamental enabler in this modern business landscape. IT tools streamline communication, automate tasks, and enhance decision making across functions. IT systems facilitate efficient production processes, enable data-driven marketing campaigns, ensure accurate financial reporting, and foster collaboration among departments. Enterprise Resource Planning (ERP) systems exemplify this integration of functions through technology. ERPs centralise data, offering real-time insights into operations, finance, and customer interactions. They streamline workflows, improve data accuracy, and facilitate informed decision making. ERPs allow businesses to manage resources holistically, optimising efficiency and agility. The functions of business enterprises are interconnected and interdependent, and their efficiency is enhanced through the integration of information technology. Enterprise Resource Planning systems encapsulate this integration, serving as a technological backbone that enables enterprises to operate cohesively and thrive in dynamic market environments.

Self Assessment Questions

1. Can you explain the role of marketing in creating customer awareness and driving sales?
2. How does market research help a business identify its target audience and tailor its products or services accordingly?
3. What are the key responsibilities of the finance function within a business?
4. How does financial analysis aid in decision making and long-term planning for a company?

5. What role do human resources play in recruitment, training, and employee development?
6. How can a positive organisational culture impact employee satisfaction and overall business success?
7. How does the product development process transform an idea into a market-ready product or service?
8. What steps are involved in ensuring that a new product meets customer needs and aligns with business goals?

Assignments

1. Choose an Indian Company of your choice listed in National Stock Exchange and identify the core business processes of the selected company.
2. Make a brief research about the available ERP systems for Jewellery Companies and critically comment on each of the ERP system identified.
3. Explain the use of CRM for e-commerce companies. Also suggest ways to improve CRM of the e-commerce companies.

Suggested Reading

1. Turban, E., Aronson, J. E., Liang, T. P., & Sharda, R. (2007). *Decision support and Business Intelligence Systems* (8th ed.). John Wiley & Sons.
2. Ohlhorst, F. J. (2012). *Big Data Analytics* (1st ed.). Wiley.
3. Harts, D. (2008). *Microsoft Office 2007 Business Intelligence - Reporting, Analysis, and Measurement from the Desktop*. TATA McGraw-Hill Edition.
4. Shmueli, G., Patel, N. R., & Bruce, P. C. (2010). *Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner*. Wiley Publication.

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1. Bhima Sankaran Pochiraju and Sridhar Seshadri. (2016) *Essentials of Business Analytics*, Springer.
2. Christian Albright S and Wayne L Winston (2017). *Business Analytics – Data Analysis and Decision Making (6th Edition)* Cengage Learning
3. Watson, H. J., & Wixom, B. H. (2017). *Business Analytics: The Art of Modeling with Spreadsheets.* John Wiley & Sons.
4. Turban, E., Sharda, R., Aronson, J., & King, D. (2009). *Decision Support and Business Intelligence Systems (9th ed.)*. Pearson Education.

Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

Unit 2

Analytics

Learning Outcomes

Upon the completion of this unit, the learner will be able to:

- demonstrate knowledge of basic concepts in analytics
- identify and differentiate different types of data
- identify various types of analytics to business scenarios

Background

Have you ever understood how much data we generate every day? Forbes research (2018) says it's about 2.5 quintillion bytes of data, and the rate will accelerate in the years to come. The research goes on to find that there are 3.7 billion humans active on the internet, and there are around 5 billion searches every day across the globe. As the world is becoming "datafied", it is intriguing to learn the use of such a vast amount of data that gets created every minute and every day. Can this data be of service to the organisations? The answer is Yes. Data Science is a field that has emerged to help organisations use the data to derive useful insights that help them to better steer their companies. Data is often regarded as the new oil. Data scientists are on a constant quest to answer numerous business questions using the data. They apply theoretical and practical ideas to specific business needs and answer questions like how to improve the profitability of the business, how to improve the recommendation engine, how to develop more inclusive marketing campaigns, how to create more personalised advertising to reach to right users, how to better predict demand location wise to aid efficient inventory management. All these are possible only when data scientists are capable of making sense of the data collected and provide insights in an effective and timely manner to improve the decision making process. This is where analytics come into play.

Keywords

Data, Types of Data, Analytics, Data Analytics, Analytical Software

Discussion

1.2.1 Concept of Data

Data may help organisations to increase their bottom lines, better understand their customers, and optimise their advertising campaigns and content personalisation. Data has numerous benefits, but you can't take advantage of them without the right methods and tools for data analytics. Although unprocessed data has a lot of potential, data analytics is required to fully realise its potential for corporate expansion. The development of the idea of data in computing is credited to American mathematician Claude Shannon, a pioneer in information theory, who presented this idea in his paper "A Mathematical Theory of Communication" in 1948. By "data," we mean the facts or numbers describing a thing, a location, or the activities occurring within an organisation. Data themselves are meaningless, but they become meaningful when analysed and processed to reveal their inherent significance. For enterprises, the data may include recent information gathered for a specific project or historical data. They could also collect it from other businesses or directly obtain data from their clients and website visitors. Information a business gathers about its own clients is called First-party data, while second-party data is the information a business acquires from another well-known company, and third-party data is compiled information a business purchases from a market. Information regarding a target audience's demographics, interests, behaviours, and other details may be included in the data

- Data analytics

1.2.2 Characteristics of Data

i. They are recordable facts obtained by reading, observation, counting, measuring and weighing, etc.

ii. Data are derived from external and internal sources of the organisation.

iii. Data may be produced as an automatic by-product of some routine but essential operation, such as the production of an invoice.

iv. The source of data needs to be given considerable attention because if the data is wrong, the resulting information will be worthless.

1.2.3 Formats of Data

The data are stored and processed by computers. They are:

i. Text which consists of strings of characters.

ii. Numbers.

iii. Audio, namely speech and music.

iv. Pictures – monochrome and colour.

v. Video is a sequence of pictures such as movies or animation. Usually, video data has an accompanying soundtrack synchronised with the pictures.

1.2.4 Data Classification

It arranges data into homogeneous (similar) groups according to common characteristics. Raw data cannot be easily understood, and it is not fit for further analysis and interpretation. The arrangement of data helps users in comparison and analysis. For example, the population of a town can be grouped according to gender, age, marital status, etc.

- Grouping of data

1.2.4.1 Objectives of Data Classification

The primary objectives of data classification are:

- **Simplification:** It helps to present data concisely. Hence, it becomes more convenient to analyse data.
- **Improves utility:** Classification brings out the similarity in different sets of data, which enhances its utility.
- **Brings out individuality:** Classification of data in statistics helps in grouping them in various subheads. This process brings out the uniqueness of each data and assists in its better study.
- **Aids comparison:** It facilitates easy comparison with a substantial volume of data.
- **Increase reliability:** Classification is a scientific process, and its effectiveness is proven. Therefore, this process increases the reliability of a specific set of data.
- **Make it attractive:** One of the main objectives of data classification is to make it more attractive and enhance its presentation value.

1.2.5 Information

Information is defined as data that has been transformed into a form that is meaningful and potentially helpful to humans. Information is data that has been understood, organised, structured, or presented in a way that makes sense or is valuable. Information can be recorded as signs or communicated as signals. Information is made from organised, structured, and processed data in a specific context. Any type of occurrence that influences the state of a dynamic system that can comprehend the information is referred to as information. Information is conceptually the message being delivered. As a result, information might be defined as "knowledge given or received concerning a certain event or circumstance. "Information may be defined as "Data that has been turned into a meaningful and useful form for specified objectives". Data that has been processed to give it meaning and utility is known as information. Information is the purpose that a person gives data through the application of accepted conventions in its representation. Information is created through analysing, arranging, and processing data to broaden the understanding of the recipient. Information might be facts, items, ideas, or anything else pertinent to the subject at hand.

- Data + Meaning = Information

1.2.6 Characteristics / Functions / Quality of Information

- **Reliability** – It should be verifiable and dependable.
- **Timely** – It must be current and it must reach the users well in time, so that important decisions can be made in time.
- **Relevant** – It should be current and valid information and it should reduce uncertainties.
- **Accurate** – It should be free of errors and mistakes, true, and not deceptive.
- **Sufficient** – It should be adequate in quantity so that decisions can be made on its basis.
- **Unambiguous** – It should be expressed in clear terms. In other words, it should be comprehensive.
- **Complete** – It should meet all the needs in the current context.
- **Unbiased** – It should be impartial, free from any bias. In other words, it should have integrity.

- **Explicit** − It should not need any further explanation.
- **Comparable** − It should be a uniform collection, analysis, content, and format.
- **Reproducible** − It could be used by documented methods on the same data set to achieve a consistent result.

Table 1.2.1 Difference between Data and Information

Basis of difference	Data	Information
Nature	Qualitative/ Quantitative variables that present themselves with the potential to be developed into ideas or analytical conclusions	Data that is structured and collated to further its meaning and contextual usefulness
Format	Data follows the form of either letters, numbers or characters	Information follows the format of either ideas or references
Meaning	Data doesn't serve any purpose unless further processed	Data when interpreted and assigned with some meaning derived out of it, gives information
Interrelation	Data is information collected	Information is data processed
Features	Data is raw and doesn't contain any meaning unless analysed.	Information is data collated and produced to further a logical meaning.
Interdependence	Data doesn't depend on information	Information can't exist without data.
Unit	Data is measured in bits and bytes.	Information is mostly measured in units like quantity, time et al.
Use for Decision Making	Data alone doesn't pertain to the qualities to help derive decisions	The information contains analytical coherence to help derive a decision
Use for Researchers	Data acquired by researchers might become useless if they have no analytical inferences to make.	Information adds value and usefulness to researchers since they are readily available.

1.2.7 Analytics

- Data analysis

The word 'analytics' came into existence towards the end of 16 Century from Greek word "analytikos" which means 'involving analysis'. Analytics is "the study of analysis". According to Niall Sclater, analytics is "the analysis of data, especially large sets of data, by the use of mathematics, statistics and Computer Software". As per the definition by Dimitris Bertsimas, "Analytics is the science of using data to build models that lead to better decisions that in turn add value to individuals, companies and institutions". Businesses can gain a lot of value from data, but they need the analytics component to realise that benefit. Businesses will get an insight through analysis of available data that can help them operate better. It can assist a business in enhancing its understanding of clients, advertising campaigns, budget, and more.

1.2.8 Data Analytics

- Data-driven decision making

Data can help organisations increase their bottom lines, better understand customers, and optimise their advertising campaigns and content personalisation. Data has numerous benefits, but you can't take advantage of them without the right methods and tools for data analytics. Although unprocessed data has a lot of potential, data analytics is required to fully realise its potential for corporate expansion. The practice of analysing datasets to make conclusions about the information they contain is known as data analytics. You can take raw data and use data analytical tools to find patterns and gain insightful conclusions from them. Many data analytics techniques today incorporate automation, machine learning algorithms, and other capabilities using specialised hardware and software. Techniques for data analytics are used in research by data scientists and analysts, and companies also utilise it to guide decision making. Companies may build products, analyse their advertising efforts, customise content, and create content strategies with the aid of data analysis. Data analytics can ultimately help firms increase performance and boost their bottom line.

1.2.8.1 Types of Data Analytics

Analytics starts with an objective. The data analyst has to have some goals in mind when analysing the data. The absence of a clear objective or goal can often get the analyst lost in voluminous data. Based on the objectives, there are four types of analytics.

a. Descriptive analytics

Descriptive analysis is the initial kind of data analysis. It serves as the basis for all data insight. It is the most basic and typical kind of data analysis. Descriptive analysis summarises historical data, typically in the form of dashboards, to provide an explanation of "what happened." Using both recent and old data, descriptive analytics seeks out patterns and connections. Because it only describes trends and associations without going any further, it is frequently referred to as the most basic type of data analysis. In descriptive analytics, the analysts try to summarise the data using simple statistics such as counts, sums, averages, minimum, maximum, percentages etc. Descriptive analytics mainly aims to summarise the metrics and report what has already happened. Metrics that are most often summarised in descriptive statistics are the number of photos, number of products sold, number of followers, likes and subscribers. When describing change over a period of time, descriptive analytics is particularly useful. It uses patterns as a jumping off point for additional analysis to inform decision making.

- Explanation of "what happened"

Examples of descriptive analytics:

i. If an organisation tracks engagement in the form of social media analytics or web traffic, they are using descriptive analytics.

ii. Descriptive analytics can also be used to identify trends in customer preference and behaviour and make assumptions about the demand for specific products or services.

b. Diagnostic analytics

While descriptive analytics merely summarises the metrics and states what happened, diagnostic analytics tries to find out the rationale behind what happened. The technique of analysing data to identify the reasons for trends and connections between different variables is known as diagnostic analytics. It tries to answer the question of why it happened. Diagnostic analysis can be done manually, using an algorithm, or with statistical software such as Microsoft Excel. Descriptive analytics, find only the relationship between numbers and take an intuitive or calculated guess as why it could happen. But usually, companies need to be given more emphasis on the why part. Going by the insights gained through descriptive analytics, without trying to understand what could be causing it might prove to be a costly mistake for the business.

- Cause analysis

Example;

Investigating the reasons for a decline in website traffic by examining data on website performance, user behaviour, marketing campaigns, and search engine rankings to uncover the issues impacting the traffic and make necessary adjustments to improve the situation.

c. Predictive analytics

This is the most popular type of analytics carried out by organisations. The analysts try to predict what will happen in future. The term predictive analytics refers to the use of statistics and mathematical modelling techniques to make predictions about future outcomes and performance. Predictive analytics looks at current and historical data patterns to determine if those patterns are likely to emerge again. This allows businesses and investors to adjust where they use their resources to take advantage of possible future events. Predictive analytics can also be used to improve operational efficiencies and reduce risk. Predictive analytics is a form of technology that makes predictions about certain unknowns in the future. It draws on a series of techniques to make these determinations, including Artificial Intelligence, Data Mining, machine learning, modelling, and statistics. For instance, data mining involves the analysis of large sets of data to detect patterns from it. Text analysis does the same, except for large blocks of text. Predictive models are used for all kinds of applications, including:

- Future prediction

- Predicting future

- Weather forecasts
- Creating video games
- Translating voice to text for mobile phone messaging
- Customer service
- Investment portfolio development

Example:

Demand Forecasting: Companies in various industries use predictive analytics to forecast product or service demand. By considering historical sales data, market trends, seasonal factors, and other variables, businesses can optimise inventory levels, production planning, and supply chain management.

d. Prescriptive analytics

Prescriptive analytics is a process that analyses data and provides instant recommendations on how to optimise business practices to suit multiple predicted outcomes. Prescriptive analytics takes the "what we know" (data), comprehensively

understands that data to predict what could happen, and suggests the best steps forward based on informed simulations. Effortlessly map the path to success. Prescriptive analytic models are designed to pull together data and operations to produce the roadmap that tells you what to do and how to do it right the first time. Artificial intelligence takes the reins of business intelligence to apply simulated actions to a scenario to produce the steps necessary to avoid failure or achieve success.

- Decision guidance

e. Cognitive analytics

Cognitive analytics is a subfield that blends cognitive computing technology with data analysis approaches to acquire insights into human cognition. It entails analysing diverse data sources, including structured and unstructured data, to comprehend and analyse patterns in human behaviour, thought processes, and decision making. Cognitive analytics can extract meaning and context from complicated data sets by utilising modern technologies like natural language processing, machine learning, and artificial intelligence. Cognitive analytics aims to provide important insights into human cognition, emotions, feelings, and preferences. It goes beyond typical analytics by factoring in human psychology and behaviour factors. Sentiment analysis, customer profiling, recommendation systems, fraud detection, and personalised marketing are just a few of the uses for cognitive analytics. Organisations can use cognitive analytics to make data-driven decisions based on a better understanding of their customers, staff, and stakeholders. It enables them to improve business operations, improve consumer experiences, and detect new trends and possibilities. Finally, cognitive analytics enables organisations and researchers to get a thorough understanding of human cognition and apply that information to drive innovation and achieve their objectives.

- Combines cognitive computing technologies with data analysis

1.2.9 Analytical Softwares

Data generated by an organisation is voluminous. Therefore, it is popularly called big data. Big data is unique from just a large volume of data. The unique characteristics differentiating big data from other data is that it has 5Vs – Volume, Value, Variety, Velocity, and Veracity.

Volume – The big data size is enormous. The volume of data generated is very large.

Velocity – The speed with which data is accumulated. Large

volume of data is generated at short span of time such as per minute or day.

Variety – Big data consists of a variety of data – photos, tweets, posts, videos, audio, text and so on.

Veracity – Veracity stands for inconsistencies and erroneous data. As big data is collated from various data points and comes in a variety of forms, the data is generally characterised by incompleteness, the presence of errors, outliers, and missing values.

Value – data doesn't carry much value in its raw form. However, once the data is cleaned, organised, and analysed, it helps in generating valuable insights for the business.

To analyse such data manually is an impossible task. Big data is analysed using advanced and specialised software. A few of them include Hadoop, Talend, PowerBI, Knime, Tableau, Python and R.

Summarised Overview

Data is important in organisations because it provides chances to improve profitability, customer knowledge, and advertising strategies. However, in order to realise its full potential, data must be analysed using appropriate methodologies and tools. Claude Shannon established the idea of data in 1948, referring to facts or statistics that characterise various aspects of an organisation. Data is meaningless unless it is analysed and processed to show its importance. Data can be gathered by businesses from a variety of sources, including their own clients, other businesses, and the market. Data can be categorised based on similarities, allowing for comparison and analysis. Data becomes information when it is turned into a meaningful and useful form. Data that has been comprehended, organised, and structured to bring value and insights to humans is referred to as information. Reliable, timely, relevant, accurate, and thorough information is critical for making decisions and improving comprehension. Analytics is the practice of analysing data in order to identify trends and develop insights, eventually influencing corporate performance and success. Different forms of analytics, including descriptive, diagnostic, predictive, and prescriptive analytics, serve distinct functions in data analysis and decision making processes. Descriptive analytics summarises historical data to explain "what happened," using statistics such as counts and averages. Diagnostic analytics goes a step further by determining the causes of data trends and linkages. Predictive analytics makes forecasts about future outcomes based on current and historical data trends using statistics and mathematical modelling. Prescriptive analytics examines data and makes recommendations for improving company practices based on various projected outcomes. Cognitive analytics is the application of cognitive computing technologies and data analysis to gain insight into human cognition, behaviour, and decision making.

Self Assessment Questions

1. How do analytical software tools enhance data analysis processes in businesses? Provide an example of popular analytical software and its application.
2. What are the key features to consider when selecting analytical software for a company's data analysis needs? How does the choice of software impact the decision making process?
3. Define cognitive analytics and explain how it goes beyond traditional data analysis methods.
4. How can cognitive analytics assist companies in extracting meaningful insights from unstructured data sources like customer reviews or social media posts?
5. Describe the main objective of prescriptive analytics and how it differs from predictive analytics.
6. Provide a real-world business scenario where prescriptive analytics could help a company make strategic decisions for optimal outcomes.
7. What is the primary goal of predictive analytics, and how does it leverage historical data to forecast future trends?
8. Give an example of how predictive analytics can be used to anticipate customer preferences in e-commerce, leading to targeted marketing campaigns.
9. Explain the role of diagnostic analytics in identifying root causes behind specific business challenges or outcomes.
10. Provide a scenario where diagnostic analytics could be employed to understand the factors contributing to a decline in website traffic.
11. Define descriptive analytics and elaborate on its significance in presenting historical data patterns.

Assignments

1. Describe the applications of analytics in various fields with examples.
2. Critically analyse the usefulness of each type of analytics for different business scenarios.
3. Give examples of companies dealing prominently with unstructured data.

Suggested Reading

1. Turban, E., Aronson, J. E., Liang, T. P., & Sharda, R. (2007). *Decision support and Business Intelligence Systems (8th ed.)*. John Wiley & Sons.
2. Ohlhorst, F. J. (2012). *Big Data Analytics (1st ed.)*. Wiley.
3. Harts, D. (2008). *Microsoft Office 2007 Business Intelligence - Reporting, Analysis, and Measurement from the Desktop*. TATA McGraw-Hill Edition.
4. Shmueli, G., Patel, N. R., & Bruce, P. C. (2010). *Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner*. Wiley Publication.
5. Jeffrey D Camm, Jame J Cochran, Michael J Fry and Jeffrey W Ohlman. (2015) *Essentials of Business Analytics*. Cengage Learning

Reference

1. Bhima Sankaran Pochiraju and Sridhar Seshadri. (2016) *Essentials of Business Analytics*, Springer.
2. Christian Albright S and Wayne L Winston (2017). *Business Analytics – Data Analysis and Decision Making (6th Edition).* Cengage Learning
3. Watson, H. J., & Wixom, B. H. (2017). *Business Analytics: The Art of Modeling with Spreadsheets.* John Wiley & Sons.
4. Turban, E., Sharda, R., Aronson, J., & King, D. (2009). *Decision Support and Business Intelligence Systems (9th ed.)*. Pearson Education.

Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

02 BLOCK

DIGITAL DATA AND PROCESSING

Content

Unit 1

Digital Data

Learning Outcomes

After completing this unit, the learner will be able to:

- learn about the types of data in big data World
- comprehend the meaning and importance of OLAP, OLTP
- get an awareness of the relevance of digital dashboards and similar tools

Background

In today's rapidly evolving world, digital data has revolutionised how we collect, store, and analyse information. The concept of digital data stems from the increasing digitisation of various aspects of our lives, including business operations, communication, entertainment, and social interactions. Digital data is information stored and delivered in binary code in a digital format. It includes a wide range of data kinds, such as text, photographs, videos, audio, and numerical values, and it is critical in many parts of modern life, ranging from commercial operations to scientific study. With the advent of advanced technologies, such as the internet, mobile devices, and sensor networks, a vast amount of data is generated every second, creating a need to study and understand this digital data. The vast volume and complexity of digital data provide valuable insights into consumer behaviour, market trends, operational efficiency, and scientific discoveries. By analysing digital data, organisations can make informed decisions, develop targeted strategies, and gain a competitive edge in the market.

Keywords

Data Types, OLAP, OLTP, MOLAP, Dashboard

Discussion

2.1.1 Digital Data

Digital data is information that is stored, transmitted, and processed digitally. It is the current information age's cornerstone, allowing for the quick exchange and manipulation of massive volumes of data. Binary code, which uses combinations of 0s and 1s to represent digital data, is quickly processed by electrical devices. Text, photos, audio, video, and other types of data are all included in digital data. It is very adaptable and is simple to copy, change, and distribute without losing quality. The production and consumption of digital data have increased exponentially as a result of the widespread use of digital devices like computers, smartphones, and the Internet. In a variety of fields, including business, education, science, and entertainment, digital data is essential. It enables effective information storage, retrieval, and analysis, empowering businesses and people to take well-informed decisions. Digital data has completely transformed every part of our lives in the new world, reshaping how we communicate, collaborate, and connect. It encourages the development of new technologies like the Internet of Things, machine learning, and artificial intelligence, enabling customised interactions and creative answers.

- Digital revolution

2.1.2 Structured Data

Information arranged according to a predetermined format and data model is called structured data. It is well organised, frequently kept in databases, and is searchable. Fixed fields and clearly defined relationships in structured data make storing, retrieving, and analysing data easier. Relational databases, spreadsheets, and standardised formats like XML or JSON are some examples of structured data. Traditional commercial applications that require consistency and precision, such as accounting, inventory control, and customer records, frequently employ this kind of data.

- Tabular data

2.1.3 Unstructured Data

Unstructured data is information that isn't organised or has a specific structure. Emails, social media postings, documents, and multimedia files are just a few examples of text-heavy material frequently found in this data because it does not follow a specified data model. Compared to structured data, unstruc-

- Unorganized information

tured data is often harder to process and analyse. To extract useful information, one needs sophisticated methods like machine learning algorithms and natural language processing. Because it contains insightful customer feedback, sentiment analysis, and unfiltered user-generated content, unstructured data is incredibly useful.

2.1.4 Semi-Structured Data

Semi-structured data is a type of data that exists between structured and unstructured data. It has some organisational structure but does not strictly adhere to a fixed format like structured data does. Tags, metadata, and other indicators that give some amount of organisation or context are common in semi-structured data. XML documents, HTML web pages, and some sorts of data provided by sensors or Internet of Things (IoT) devices are examples. Semi structured data allows for greater flexibility when dealing with information that does not fit cleanly into structured formats. It enables the retrieval and analysis of specific data pieces while accommodating structural or schema changes between diverse sources.

Table 2.1.1 Differences between structured, semi-structured and unstructured data

Organisation	Structured data is highly organised and adheres to a set format, whereas unstructured data is disorganised. Semi-structured data comes somewhere in between, displaying some level of organisation but not precisely adhering to a rigid format.
Format	Structured data is usually kept in databases and follows a specified data model. Without a specified format, unstructured data can comprise text, photos, audio, and video. Semi-structured data may contain organisation elements such as tags or metadata.
Analysis Complexity	Structured data is easier to analyse since it has a specified structure. Unstructured data analysis necessitates advanced approaches such as natural language processing and machine learning algorithms. In terms of analysis complexity, semi-structured data falls somewhere in the middle.
Data Integration	It is easier to integrate structured data with other structured datasets. Specialised tools and procedures are required to handle various formats and extract useful information from unstructured data. Because of its organised features, semi-structured data can be relatively easier to incorporate.

Schema Flexibility	Structured data must tightly adhere to a pre-set schema, limiting flexibility. There is no defined schema for unstructured data. Semistructured data provides flexibility by allowing for differences in structure or format across multiple sources.
Application Usage	Structured data is frequently utilised in traditional business applications such as finance, inventory management, and customer relationship management. Sentiment analysis, social media mining, and content analysis all use unstructured data. Semi-structured data is utilised when data has some structure but also requires flexibility in dealing with different sources and formats.

2.1.5 OLTP and OLAP

Companies in today's data-driven economy have a higher chance of success if they utilise data to make more informed decisions and swiftly adapt to changing consumer preferences. Data like this allows for studying emerging markets and tracking retail-enabled systems, including ride-sharing applications (e-commerce and store transactions). In data science, online analytical processing (OLAP) and online transaction processing (OLTP) are two data processing systems. The former makes use of knowledge gleaned from data, whereas the latter relies on precision in its operations. Yet, both methods may be useful in fixing data issues in real life situations. It's not so much a question of which processing method to utilise as it is of how to optimally mix them.

- Data-driven success

2.1.5.1 OLAP

Online Analytical Processing (OLAP) is a data processing technique that enables the multidimensional analysis of enormous volumes of data. OLAP systems provide a systematic and efficient mechanism for users to study data from several perspectives, allowing them to obtain useful insights and make informed decisions. OLAP works with a data collection called an OLAP cube, which organises information into dimensions and measures. Dimensions are the various elements or categories that can be used to analyse data, such as time, geography, or product. Measures, on the other hand, are the numerical quantities or metrics under consideration, such as sales revenue or client count.

- Analysis of data on a multidimensional scale.

OLAP provides numerous advantages in corporate reporting and data analysis. It enables organisations to evaluate performance, detect trends, and prepare for the future by providing powerful financial analysis, budgeting, and sales forecasting features. Businesses can obtain deeper insights into their data,

- Empowers with valuable insights

spot patterns, and reveal valuable relationships that can drive strategic decision making by utilising OLAP. OLAP also aids data mining and business intelligence tasks by extracting relevant information from large datasets. Because OLAP is multidimensional, users can perform advanced analytical computations such as computing ratios, percentages, or aggregations across numerous dimensions.

- Data organization

An OLAP cube is a way to organise and summarise data for analysis. It takes large amounts of data and arranges it in a structured manner. Think of it like a three-dimensional spreadsheet, where each axis represents a different aspect of the data. This structure allows for quick and efficient querying and reporting. With an OLAP cube, businesses can easily explore and analyse data from different angles, such as by time, product, or geography. It helps businesses make better decisions by clarifying trends, patterns, and relationships within the data. The graph below displays an OLAP cube of sales data broken down into many dimensions by location, quarter, and product.

2.1.5.2 OLTP

- Fast, accurate, concurrent transaction processing.

Online Transaction Processing (OLTP) is a type of data processing that focuses on managing individual transactions in real time. It is commonly used in systems that handle day-to-day operations, such as e-commerce websites or banking applications. OLTP systems are designed to efficiently process a high volume of small and frequent transactions, ensuring data integrity and reliability. Unlike OLAP, which is used for analysis and reporting, OLTP emphasises the accuracy and speed of transactional operations. It enables tasks like adding, updating, or deleting records in databases, allowing businesses to carry out their operational activities smoothly and ensure the consistency of their data.

2.1.5.3 Difference between OLAP and OLTP

- Purpose

i. OLAP (Online Analytical Processing) is primarily used for data analysis and reporting, while OLTP (Online Transaction Processing) focuses on real-time transactional operations.

- Data Structure

ii. OLAP utilises multidimensional structures, such as OLAP cubes, to organise and analyse data, whereas OLTP typically uses relational databases with row-by-row structures.

- Data Volume and relative scale

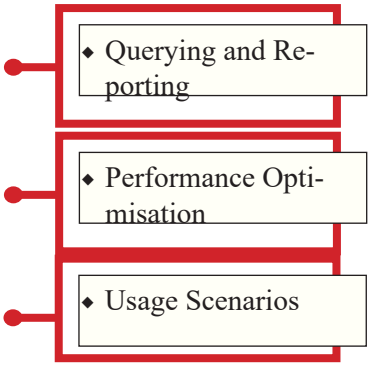
iii. OLAP deals with large volumes of historical and aggregated data, allowing for high-level analysis and trend identification. In contrast, OLTP handles small and frequent transactions with a focus on individual data records.

iv. OLAP supports complex queries and ad-hoc reporting for

business intelligence purposes, whereas OLTP primarily supports simple, real-time transactional queries.

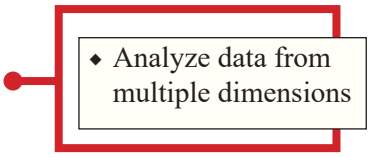
v. OLAP prioritises query performance and response times for analytical tasks, while OLTP emphasises transactional processing efficiency and concurrency.

vi. OLAP is commonly used in decision making, strategic planning, and trend analysis, while OLTP is essential for operational processes, such as order processing, inventory management, and customer transactions.



2.1.6 MOLAP (Multidimensional OLAP)

MOLAP (Multidimensional OLAP) is a data processing approach that enables organisations to analyse and explore their data from numerous perspectives. It involves organising data in a multidimensional arrangement, similar to that of a data cube, with each dimension representing a different property or characteristic of the data. MOLAP allows users to drill down into the data, slicing and dicing it to gain deeper insights. They can explore the data from different perspectives, pivoting and rotating the cube to analyse trends and patterns. This flexibility enables users to analyse complex relationships and answer business questions effectively. One of the primary advantages of MOLAP is its ability to give quick query response times. This is accomplished by pre-aggregating the data, allowing for rapid retrieval and analysis. As a result, it's ideal for interactive data exploration and real-time decision making.



2.1.6.1 Key Points for MOLAP

i. MOLAP refers to Multidimensional Online Analytical Processing, a data processing approach for analysis and reporting.

ii. MOLAP tools facilitate the design of multidimensional databases specifically tailored for analysis purposes.

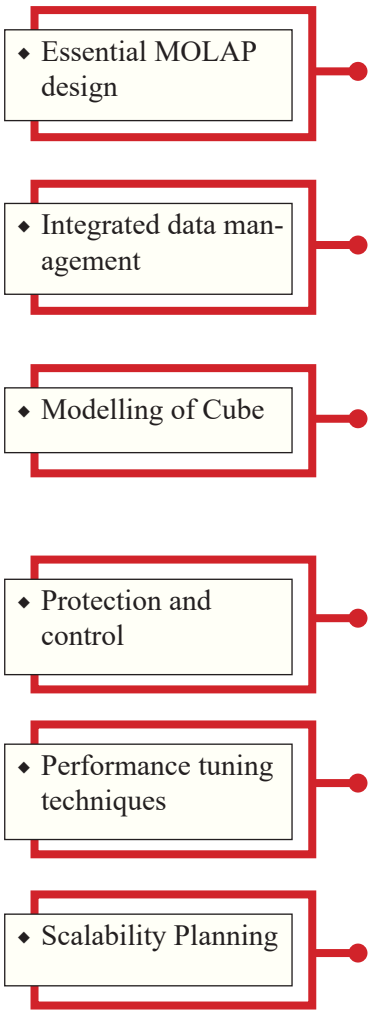
iii. MOLAP tools offer fast response times for processing information, regardless of the level of data summarisation.

iv. Sparse data collection can result in lower storage utilisation in MOLAP systems.

v. MOLAP allows the querying of facts using dimensions in multidimensional arrays.

vi. MOLAP servers employ a storage representation that efficiently manages dense and sparse data collections.

2.1.6.2 Important Factors to be Considered when Implementing Multidimensional OLAP (MOLAP).



i. Data modelling: Proper data modelling is crucial in MOLAP implementation. Designing dimensions, hierarchies, and measures that accurately represent the business domain is essential for effective analysis.

ii. Data integration: MOLAP relies on integrated and consistent data from various sources. Data integration processes, such as ETL (Extract, Transform, Load), should be implemented to ensure data accuracy and completeness.

iii. Cube design: Careful cube design is necessary for optimal performance and efficient data storage. Determining appropriate levels of aggregation, defining calculations, and establishing relationships between dimensions are key considerations.

iv. Security and access control: Implementing robust security measures to protect sensitive data and managing access control at various levels of the cube are critical to maintain data integrity and confidentiality.

v. Performance optimisation: Performance tuning techniques, such as indexing, partitioning, and caching, should be applied to enhance query response times and overall system performance.

vi. Scalability: Consider the scalability of the MOLAP system to handle increasing data volumes and user demands over time. Planning for future growth and accommodating additional data sources or dimensions is important.

2.1.6.3 Advantages of Multidimensional OLAP (MOLAP)

i. MOLAP provides speedy query response times, allowing users to retrieve and analyse data quickly.

ii. It offers a multidimensional picture of data, allowing for better insights and analysis from various angles.

iii. MOLAP is ideal for advanced analytical processes because it supports complex calculations and aggregations.

iv. It enables dynamic and ad hoc data exploration, allowing users to make decisions on the go.

v. MOLAP enables users to study data hierarchies and details by facilitating easy navigation and drill-down capabilities.

vi. It optimises performance by storing and retrieving pre-aggregated data efficiently.

vii. MOLAP allows for data slicing, dicing, and pivoting, allowing for more flexible analysis and reporting.

viii. It allows for simple integration with business intelligence and reporting solutions.

ix. MOLAP ensures data integrity by providing consistent and correct data across dimensions.

x. It enables businesses to make data-driven decisions, uncover patterns, and gain a market advantage.

2.1.6.4 Disadvantages of Multidimensional OLAP (MOLAP)

i. MOLAP demands a lot of storage space because it gathers and saves data in a multidimensional format, which can be expensive for businesses.

ii. MOLAP can struggle to handle enormous volumes of data efficiently, especially as data sizes rise exponentially over time.

iii. Creating and reloading MOLAP cubes takes time, especially when dealing with complicated data structures or frequent modifications.

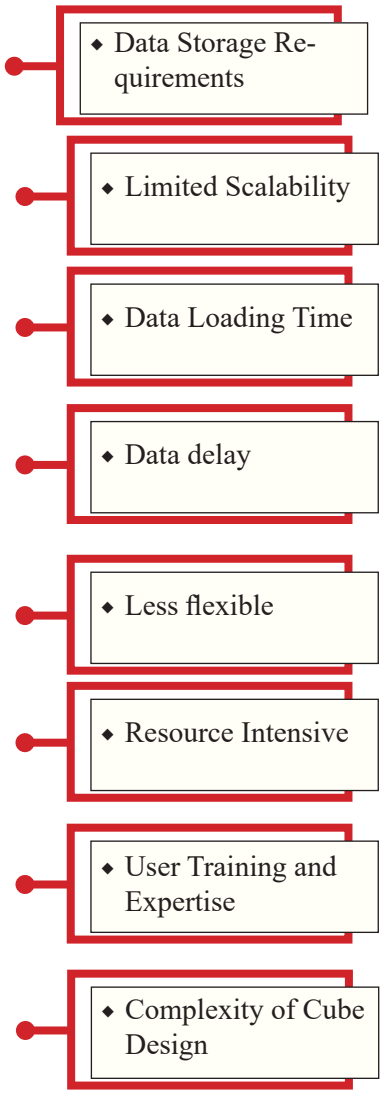
iv. Because MOLAP relies on periodic updates or refreshes, it may not always reflect real-time data, resulting in potential data delay and the possibility of analysing obsolete information.

v. Because MOLAP is built for structured and preset analysis paths, it is less flexible for ad hoc or exploratory research that involves dynamic query changes.

vi. MOLAP systems may demand significant hardware resources to provide efficient processing and analysis, which can raise infrastructure costs.

vii. To use MOLAP effectively, users must have a thorough understanding of multidimensional principles as well as experience with the specific MOLAP tools, which may necessitate further training.

viii. Creating and maintaining a well-optimised MOLAP cube necessitates careful consideration of dimensions, hierarchies, and measures, which can be complex and time-consuming.



2.1.6.5 MOLAP Tools

i. Express server: Express Server is a web-based environment that works on the Oracle database and provides multidimensional analytical functionality.

ii. SAP business intelligence: SAP provides business analytics solutions that include data analysis, reporting, and visualisation capabilities.

iii. Essbase: Essbase is an Oracle multidimensional database tool created primarily for analytical purposes.

iv. Yellowfin: Yellowfin is a business analytics application that enables data analysis and visualisation by allowing users to build reports and dashboards.

v. Clear analytics: Clear Analytics is a business solution that connects with Microsoft Excel to provide data analysis and reporting capabilities based on Excel.

2.1.7 Relational OLAP (ROLAP)

Relational OLAP (ROLAP) is a type of OLAP (Online Analytical Processing) that is based on a relational database management system (RDBMS). Unlike multidimensional OLAP (MOLAP), which stores data in multidimensional cubes, ROLAP stores data in traditional relational database tables. ROLAP allows for flexible and dynamic data analysis by leveraging the power of SQL queries and relational algebra. In ROLAP, the data is organised in a star or snowflake schema, where fact tables represent the measures or metrics being analysed, and dimension tables contain the descriptive attributes of the data. ROLAP systems can handle large volumes of data and support complex analytical computations. They provide a high degree of flexibility and allow users to perform ad hoc queries and drill down into the data at different levels of granularity. ROLAP can leverage the infrastructure and data management capabilities already in place within an organisation. ROLAP also offers real-time data analysis, as it directly queries the relational database for up-to-date information. ROLAP allows for a more detailed level of data storage compared to MOLAP, enabling the analysis of fine-grained data.

- Relational analysis

2.1.7.1 Key Points in ROLAP

i. ROLAP organises data in relational database tables.

ii. It leverages SQL queries for flexible and dynamic data analysis.

iii. ROLAP offers compatibility with existing relational databases.

iv. It provides real-time analysis capabilities, allowing for up-to-date information.

v. ROLAP enables the storage of detailed data for in-depth analysis.

vi. ROLAP utilises a star or snowflake schema to organise data.

vii. ROLAP is a popular choice for businesses that already have relational databases in place.

2.1.8 Hybrid OLAP (HOLAP)

Hybrid OLAP (HOLAP) is a data analysis approach that combines the best parts of multidimensional OLAP (MOLAP) and relational OLAP (ROLAP). It stores summarised data in a special format for quick access while keeping detailed data in a regular database. HOLAP is great for handling large amounts of data and complex queries, giving users the benefits of both MOLAP and ROLAP. It allows users to efficiently analyse data at different levels of granularity, making it a versatile solution for multidimensional data analysis. Hybrid OLAP (HOLAP) combines the benefits of both MOLAP and ROLAP techniques, offering a flexible and efficient approach to multidimensional data analysis. HOLAP utilises a hybrid storage model, where it leverages multidimensional storage for aggregations and summaries while utilising the relational storage for storing detailed data. This allows HOLAP to strike a balance between the fast query performance of MOLAP and the scalability and flexibility of ROLAP. In HOLAP, aggregations and pre-calculated summaries are stored in a multidimensional format, similar to MOLAP, enabling quick retrieval of summarised data. On the other hand, detailed data is stored in a relational database, providing the ability to handle large volumes of data and support complex queries. HOLAP tools provide seamless integration between the two storage models, allowing users to navigate and analyse data at different levels of granularity.

- Combines the benefits of MOLAP and ROLAP

2.1.8.1 Advantages of ROLAP/HOLAP

i. Compatibility with existing relational databases: ROLAP leverages relational database infrastructure, allowing enterprises to use their existing database systems for analytical applications without additional infrastructure.

- Compatibility

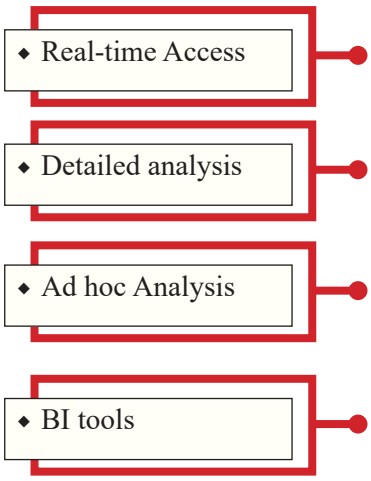
ii. Flexible and dynamic analysis: ROLAP supports flexible and dynamic analysis through SQL queries, allowing users to change and analyse data based on their individual needs readily.

- Flexibility

iii. Scalability: Because ROLAP can manage massive amounts of data and sophisticated computations, it is ideal for organisations with big data requirements.

- Manage Big data

iv. Real-time analysis: ROLAP enables real-time data access,



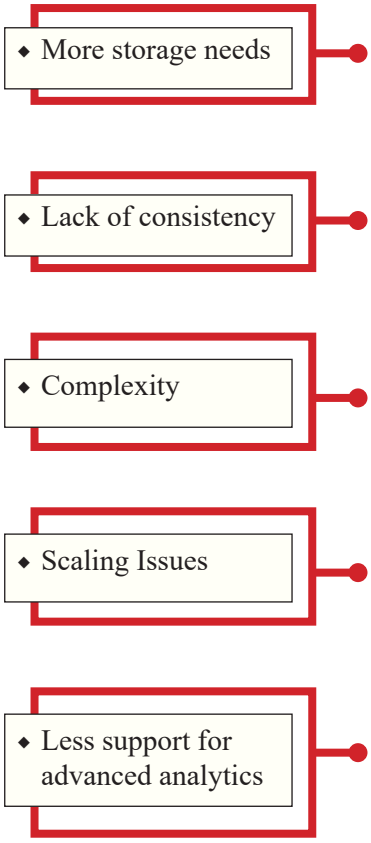
allowing users to make informed decisions based on the most recent facts.

v. Detailed data storage: ROLAP allows for the storage of detailed data, enabling in-depth analysis and granular insights into business operations.

vi. Ad hoc querying: ROLAP supports ad hoc queries, allowing users to perform on-the-fly analysis and gain insights into various dimensions of data.

vii. Integration with business intelligence tools: ROLAP seamlessly integrates with various business intelligence tools, enabling advanced reporting, visualisation, and dashboarding capabilities.

2.1.8.2 Disadvantages of ROLAP/HOLAP



i. Higher storage requirements: ROLAP/HOLAP typically requires more storage space than other OLAP techniques, as it stores data in relational databases, which may increase business storage costs.

ii. Data inconsistency: ROLAP/HOLAP relies on real-time access to relational databases, which can be prone to data inconsistencies if updates or changes are made during the analysis process.

iii. Complexity of data modelling: ROLAP/HOLAP requires a well-designed data model with appropriate relationships and hierarchies, which can be complex and time-consuming to develop and maintain.

iv. Limited scalability: ROLAP/HOLAP may face challenges in scaling to handle large volumes of data efficiently, especially when dealing with complex data structures or increasing data sizes over time.

v. Lack of support for advanced analytics: ROLAP/HOLAP is primarily focused on providing analytical capabilities based on SQL queries, and it may lack support for advanced analytics techniques such as predictive modelling or machine learning.

Table 2.1.2 ROLAP, MOLAP AND HOLAP

ROLAP	MOLAP	HOLAP
Relational Online Analytical Processing is referred to as ROLAP.	Multidimensional Online Analytical Processing is referred to as MOLAP.	HOLAP stands for Hybrid Online Analytical Processing.
The ROLAP storage mode makes the relational database that was defined as the partition's data source store the aggregated data from the division in indexed views.	The MOLAP storage mode principle mandates that a multidimensional operation be maintained in analysis services to save aggregates of the division and a copy of its source data after the division has been conducted.	Both MOLAP and ROLAP properties are connected through the HOLAP storage mode. Similar to MOLAP, HOLAP allows the division's aggregate to be stored in a multidimensional operation in an instance of SQL Server Analysis Services.
ROLAP doesn't save a copy of the source data in the data folders for Analysis services. Instead, the indexed views in the record source are used to respond to requests when the result cannot be obtained via the query cache.	This MOLAP approach has been rigorously optimised to improve query times. The space for storing data may either be on the partition-describing computer or on a separate system where Analysis services are being provided. Since a replica of the source data is kept in the multidimensional operation, queries may be answered without needing to resort to the source record for the partition.	When using HOLAP, no extra copies of the original data are kept. For queries that just need to look at the division's aggregates' one summary record
In comparison to MOLAP or HOLAP storage modes, query response is usually slower while using ROLAP storage. With ROLAP, processing times are typically longer.	A significant improvement in query response times may be achieved by employing aggregations. Only as recent as the separation's most recent processing is the record in the partition's MOLAP operation.	For example, queries that access source records (to drill down to an atomic cube cell for which there is no aggregate information) must retrieve data from the relational database, which is slower than if the source data were retained in the MOLAP architecture.

2.1.9 DSS, EIS and MIS

- DSS-decision-making

DSS (Decision Support Systems) - DSS is an information system that assists in making decisions by providing valuable insights and analysis based on collected data, helping users evaluate alternatives and understand the potential outcomes of their choices.

- EIS-strategic decision-making

EIS (Executive Information Systems) - EIS is a specialised information system designed to support top-level executives in strategic decision making by providing summarised, relevant, and real-time information from various sources, helping executives monitor the organisation's performance and identify trends and opportunities.

- MIS-manages operational data

MIS (Management Information Systems) - MIS is an information system that focuses on providing operational data and reports to support managerial tasks such as planning, organising, and controlling operations within an organisation, helping managers make informed decisions and monitor day-to-day activities.

- Decision support

In today's complex business environment, organisations rely on various information systems to meet their decision making needs. DSS, EIS, and MIS play distinct roles in providing the right information to the right individuals at different levels of the organisation. DSS offers analytical tools and models to support decision making processes at different organisational levels. It helps users analyse data, generate reports, and evaluate different scenarios, enabling them to make informed and effective decisions. DSS combines data from various sources and applies advanced analysis techniques to provide insights and recommendations. EIS caters to the strategic decision making needs of top-level executives. It provides a concise and summarised view of key performance indicators, trends, and critical information from both internal and external sources. EIS supports executives in setting strategic goals, monitoring progress, and identifying areas that require attention or intervention. MIS focuses on managing operational data and generating reports to support routine managerial tasks. It collects, stores, and processes data related to day-to-day activities, such as sales, inventory, and employee performance. MIS provides managers with timely and accurate information, enabling them to monitor operations, identify issues, and make data-driven decisions.

2.1.9.1 Evolution and Role of DSS, EIS & MIS

Decision Support Systems (DSS), Executive Information Systems (EIS), and Management Information Systems (MIS) have evolved to cater to the increasing complexity of organisational decision making and the growing need for accurate and

timely information. Management Information Systems (MIS) initially emerged as computer-based systems that collected, processed, stored, and distributed information to support managerial decision making. MIS focused on providing structured and standardised reports and data to managers at various levels within the organisation, assisting in operational and tactical decision making. As organisations grew and the need for strategic decision making became prominent, Executive Information Systems (EIS) emerged. EIS provided top-level executives with summarised, relevant, and real-time information, allowing them to monitor key performance indicators, analyse trends, and make strategic decisions. EIS emphasised data visualisation and analytical capabilities, presenting information through dashboards and reports that provided a comprehensive overview of the organisation's performance. With the advancement of technology and the need for more sophisticated decision making tools, Decision Support Systems (DSS) came into play. DSS incorporated advanced analytics, modelling, and simulation techniques to assist managers in complex decision making scenarios. DSS supported both structured and unstructured decision making, providing interactive interfaces, data analysis capabilities, and scenario evaluation tools.

- Evolutionary systems

2.1.9.2 Decision Support System (DSS)

Decision Support Systems (DSSs) are informational tools designed to aid businesses in making complex choices that demand careful consideration, deliberation, and subsequent action. By collecting and analysing information to help with problem-solving and decision making, an information system provides valuable assistance to an organisation's middle and upper management. Automatic or manual activation of DSS is possible.

- Support decision making

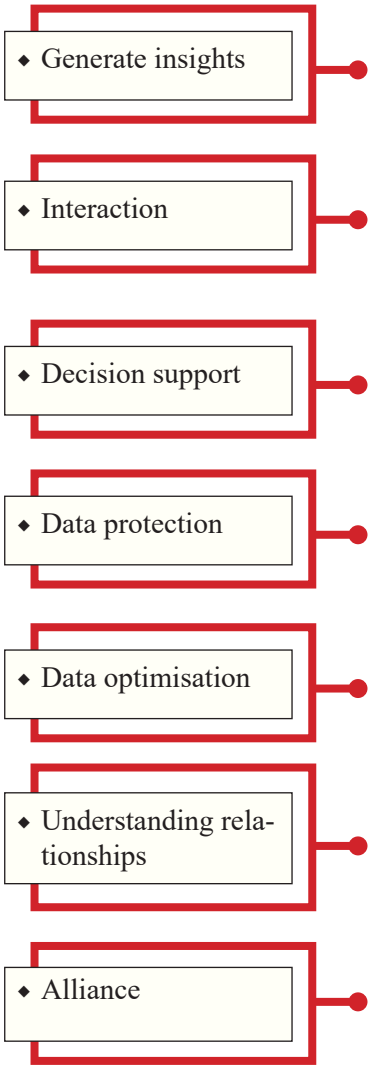
2.1.9.3 Purpose of a Decision Support System

A decision support system gathers and analyses data to provide thorough information reports. Instead of analysing data, the DSS's purpose is to gather it, which is distinct from the way other process applications work. An organisation's planning departments, like the operations department, utilise a DSS to gather data and produce reports that managers may use to make decisions. DSS is mostly used to gather information on project sales, inventories, and operations and to provide users access to information in a comprehensible way. Theoretically, DSS may be used in a wide range of scientific disciplines, including business, medicine, and forest management. Real-time reporting is one of the primary purposes of DSS in an organisation. This may be especially helpful for businesses that employ just-in-time (JIT) inventory management. A company requires real-time information

- Data gathering

on its inventory levels to place "just-in-time" orders and avoid production delays that might have a negative domino effect. A DSS is thus preferable to a conventional system for a decision maker or an organisation.

2.1.9.4 Components of a Decision Support System



i. **Model management:** DSS uses models and algorithms to analyse data and generate insights. Model management involves selecting appropriate models, configuring them, and integrating them into the system.

ii. **User interface:** The user interface allows users to interact with the DSS, input data, specify parameters, and view the results.

iii. **Knowledge base:** The knowledge base contains rules, heuristics, and expert knowledge that assist in decision making. It may include historical data, best practices, decision criteria, and guidelines for problem-solving.

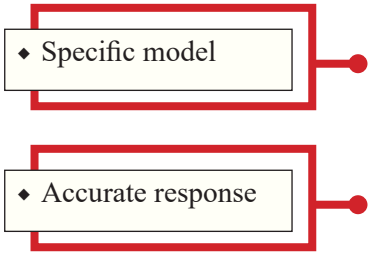
iv. **Security and privacy:** This component ensures the confidentiality, integrity, and availability of data within the DSS. It includes measures to protect sensitive information and restrict access based on user roles and permissions.

v. **Data management:** This component involves collecting, storing, and organising relevant data from various sources, such as databases, spreadsheets, and external systems.

vi. **Analysis tools:** DSS employs various analytical tools, such as statistical analysis, data mining, visualisation, and forecasting techniques. These tools help users understand patterns, trends, and relationships in the data.

vii. **Collaboration and communication:** DSS facilitates collaboration and communication among users, allowing them to share information, discuss decisions, and work together on solving complex problems.

2.1.9.5 Types of Decision Support Systems



i. **Model-based:** They are complex systems that allows the users to analyse and manipulate specific models such as organisational, financial, and statistical modelling .

ii. **Knowledge-based:** Provides accurate and unique responses to problems using pre-stored information, protocols, guidelines, or interactive decision making tools such as flowcharts.

iii. **Document-based:** It deals with information in various

electronic forms that are unstructured.

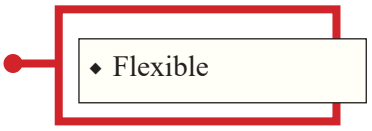
iv. **Data driven:** Helps in storing and analysing internal and external corporate data.

2.1.9.6 Advantages of Decision Support System

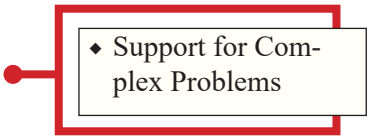
i. DSS automates data collection, analysis, and reporting processes, reducing the time and effort required for decision making. It streamlines workflows, eliminates manual tasks, and provides users with easy access to relevant information, improving overall efficiency and productivity.

ii. DSS leverages advanced analytical techniques and models to analyse data, reducing the likelihood of errors and biases in decision making. It ensures that decisions are based on accurate and reliable information, leading to more reliable outcomes.

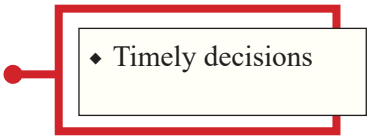
iii. DSS can be tailored to the specific needs and requirements of an organisation. It can accommodate various data sources, analysis techniques, and decision models, allowing for flexibility and adaptability in different decision making scenarios.



iv. DSS is particularly useful for solving complex problems that involve a large amount of data and multiple variables. It enables decision makers to break down complex issues, explore different scenarios, and evaluate the impact of various factors on the outcomes.

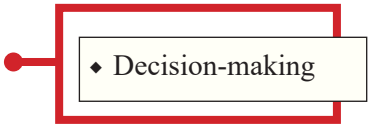


v. DSS can provide real-time or near-real-time access to data and information, enabling decision makers to make timely decisions based on the most up-to-date information available.



vi. DSS often includes features that facilitate collaboration and communication among decision makers. It allows for sharing of information, exchange of ideas, and collaboration on decision making processes, improving team dynamics and collective decision making.

vii. DSS provides decision makers with valuable insights, analysis, and information to support their decision making process. It helps them evaluate alternatives, assess risks, and understand the potential outcomes of different choices, leading to more informed and effective decisions.



2.1.9.7 Executive Information System

An Executive Information System (EIS) is a specialised information system designed to meet the strategic decision making

needs of an organisation's top-level executives. An EIS's primary objective is to assist executives in formulating strategic goals, analysing the organisation's performance, and recognising opportunities and potential obstacles. EIS takes data from a variety of sources, including internal databases, market research reports, and external databases, and presents it in a user-friendly and visually appealing format, frequently via interactive dashboards and reports. It enables executives to swiftly access and analyse information pertinent to their decision making process without delving into specific operational data. An EIS's emphasis on real-time or near-real-time data is one of its distinctive aspects. It allows executives to monitor the performance of the organisation in real time, allowing them to make timely decisions and respond to developing trends and challenges. This real-time reporting capacity is especially important in fast-paced businesses where rapid decisions can make or break establishing a competitive advantage.

- Strategic executive insights

2.1.9.8 Features of EIS

i. **Drill-down capabilities:** EIS offers drill-down capabilities that allow executives to explore data in more detail. They can drill down from summarised views into underlying data, such as transactional records or individual performance metrics, to investigate root causes, identify patterns, or validate assumptions.

- Detailed data exploration

ii. **User-friendly interface:** EIS typically has a user-friendly interface that allows executives to access and interact with information easily. It may include dashboards, charts, graphs, and other visual representations that provide a quick overview of key performance indicators (KPIs) and trends.

- Convenient

iii. **Customisation and personalisation:** EIS allows executives to customise and personalise their views based on their specific information requirements. They can choose the type of data they want to see, set up alerts for critical events or thresholds, and configure the system according to their preferences.

- Custom-built

iv. **Real-time information:** EIS aims to provide real-time or near-real-time information to executives. It integrates with various internal and external data sources, such as operational systems, market data, and competitive intelligence, to ensure that executives have access to the most up-to-date information for effective decision making.

- Up-to-date information

v. **Integration with multiple data sources:** EIS integrates data from multiple sources within the organisation, such as finance, sales, marketing, human resources, and oper-

- Integrates data

ations. It pulls data from different systems and databases, transforms it into a consistent format, and presents a unified view to executives.

vi. **Collaboration and communication:** EIS supports collaboration and communication among executives and other stakeholders. It may include features like discussion forums, annotation tools, and document sharing, enabling executives to share insights, exchange ideas, and collaborate on decision making processes.

- Collaborate on decision-making

vii. **Security and access controls:** EIS incorporates robust security measures to protect sensitive information. It ensures that only authorised users have access to specific data and functionality, employing authentication mechanisms, role-based access controls, and encryption techniques to maintain data confidentiality and integrity.

- Security

viii. **Integration with executive workflows:** EIS can integrate with other executive workflows, such as strategic planning, budgeting, and performance management systems. This integration ensures that the information provided by EIS aligns with the overall strategic objectives and facilitates a seamless flow of data and insights across different processes.

- Streamlined workflow integration

ix. **Decision support:** EIS provides decision support capabilities by offering executives relevant and timely information for making strategic decisions. It consolidates data from various sources and presents it in a meaningful and summarised format, helping executives gain insights and evaluate different alternatives.

- Strategic decision support

2.1.9.9 Advantages of Executive Information System (EIS)

i. EIS simplifies complex information, empowering executives to analyse trends, evaluate scenarios, and make accurate strategic decisions in terms of organisational goals.

- Taking strategic decisions

ii. EIS offers a consolidated view of data, helping executives monitor performance, ensure decision consistency, and align actions with the organisation's strategic objectives.

- Strategic alignment

iii. EIS automates data collection and analysis, saving executives time and effort, allowing them to focus on critical analysis and decision making.

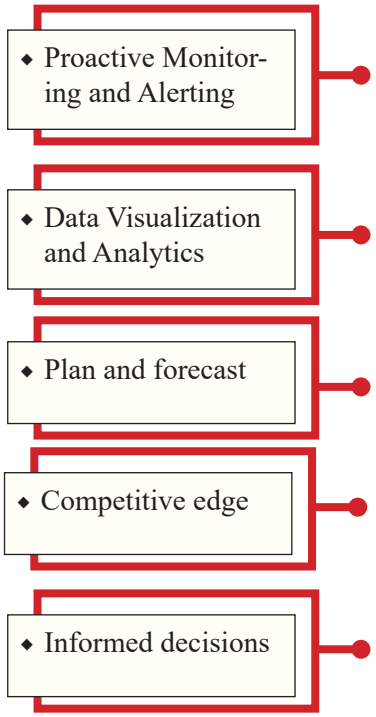
- Efficiency and productivity

iv. EIS facilitates sharing insights, discussing strategies, and collaborating on decisions, fostering a collaborative decision making culture within the organisation.

- Collaboration and communication

v. EIS integrates data from multiple sources, providing executives with a holistic view of the business, enabling bet-

- Integrates data



ter-informed decisions.

vi. EIS continuously monitors metrics and thresholds, generating alerts for executives to identify issues or opportunities in a timely manner.

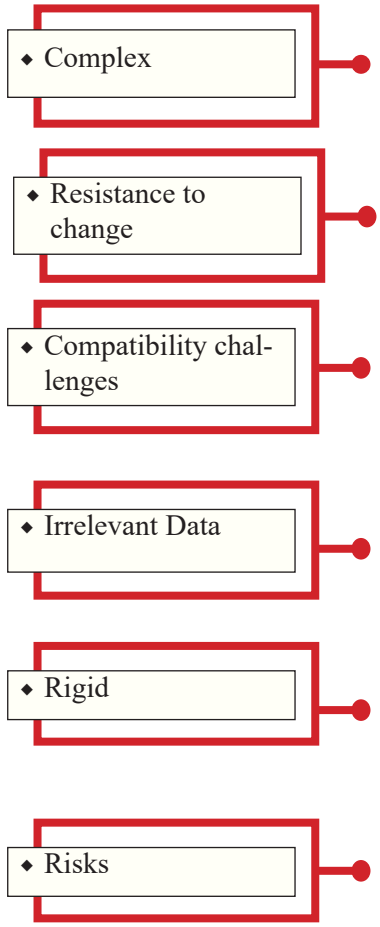
vii. EIS utilises visualisations and analytics tools, helping executives explore data, identify patterns, and communicate insights effectively.

viii. EIS supports strategic planning and forecasting activities, enabling executives to evaluate scenarios, simulate decisions, and develop accurate forecasts.

ix. IS empowers organisations to gain a competitive edge by enabling faster decision making, adapting to market changes, and identifying new opportunities for growth and success.

x. EIS provides top-level executives with up-to-date and pertinent data, enabling them to make informed decisions and respond quickly to market changes.

2.1.9.10 Disadvantages of Executive Information System (EIS)



i. **Implementation complexity:** EIS implementation can be complex and resource-intensive, requiring significant time, effort, and investment in data integration, system customisation, and user training.

ii. **User resistance and adoption challenges:** EIS adoption may face resistance from executives and employees unfamiliar with the system.

iii. **Data quality and integration issues:** EIS heavily relies on data integration from multiple sources, which can lead to challenges related to data accuracy, consistency, and compatibility.

iv. **Information overload and irrelevant data:** EIS may present executives with a large volume of information, leading to information overload and difficulty in identifying the most relevant and actionable insights.

v. **Lack of flexibility and customisation:** EIS systems may have limitations in terms of flexibility and customisation, making it challenging to accommodate specific information needs and preferences of individual executives.

vi. **Security and privacy risks:** IS systems, which consolidate sensitive data from various sources, may pose security and privacy risks if not properly secured and protected.

vii. **High maintenance and upkeep costs:** EIS systems re-

quire ongoing maintenance, upgrades, and technical support, which can result in high operational costs for the organisation.

- Costly

viii. **Technical dependencies and system integration challenges:** EIS integration with existing systems and databases may face technical challenges, such as compatibility issues, requiring careful planning and coordination with IT departments.

- Technical challenges

ix. **Learning curve and training requirements:** Executives and users may require extensive training and expertise to fully utilise the functionalities of the EIS, which can impact productivity and efficiency during the initial implementation phase.

- Need for training

2.1.9.11 MIS (Management Information Systems)

A Management Information System (MIS) is a computer-based system that helps organisations gather, process, store, and distribute information to support their managerial decision making processes. MIS collects data from various sources within the organisation, such as sales, inventory, and finance, and transforms it into meaningful information that managers can use. It provides managers with reports, charts, and dashboards that give them a clear overview of the organisation's performance, helping them monitor key indicators and trends. MIS helps managers make informed decisions by providing timely and accurate information. For example, it can generate sales reports showing which products are selling well and which are not, enabling managers to adjust their strategies accordingly. MIS also facilitates communication and collaboration by allowing different departments to share information and work together more efficiently. It improves efficiency by automating routine tasks, reducing paperwork, and streamlining processes. Overall, MIS is an essential tool for managers to access relevant information, analyse data, and make informed decisions that drive the success of their organisations.

- Transforms data into information

2.1.9.12 Objectives of MIS

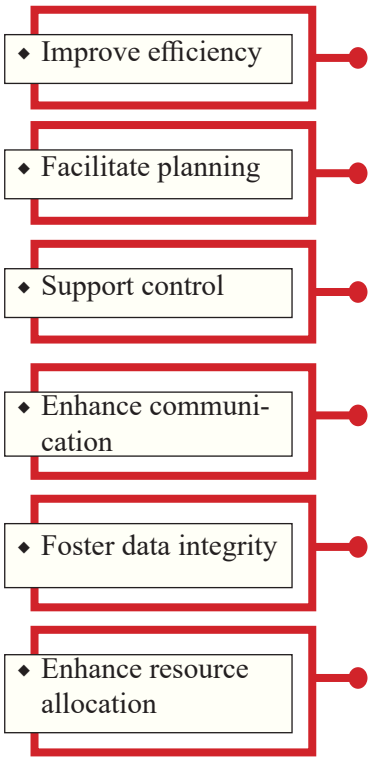
i. MIS aims to gather and provide accurate and reliable information to managers, ensuring that decision making is based on reliable data.

- Provide accurate information

ii. MIS assists in improving decision making by providing relevant and timely information in a summarised and understandable format.

- Easy decision-making

iii. MIS automates routine tasks, reduces manual effort, and



streamlines processes, enhancing operational efficiency within the organisation.

iv. MIS supports planning activities by providing data and insights that help managers develop effective strategies and set realistic goals.

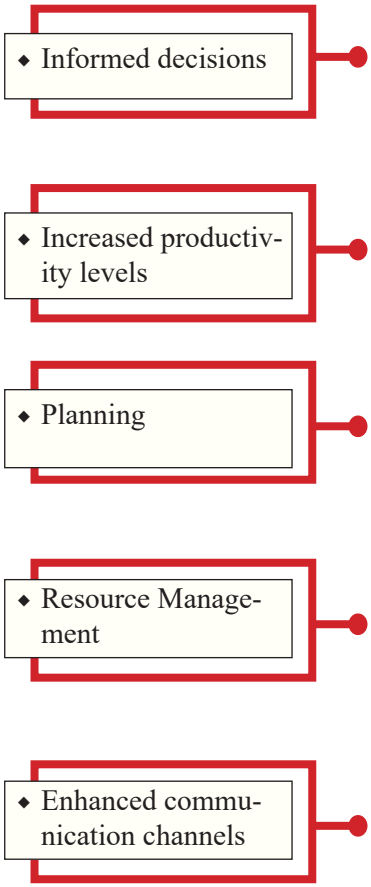
v. MIS enables managers to monitor and control various aspects of the organisation by providing real-time information on key performance indicators and deviations from targets.

vi. MIS promotes effective communication by providing a platform for sharing information across departments and facilitating collaboration among team members.

vii. MIS ensures data integrity by implementing controls and security measures to prevent unauthorised access, data manipulation, or loss.

viii. MIS assists in optimising resource allocation by providing insights into resource utilisation, identifying areas of inefficiency, and facilitating informed decisions on resource allocation.

2.1.9.13 Advantages of MIS



i. **Improved decision making:** MIS provides timely and accurate information to managers, enabling them to make informed decisions based on reliable data, leading to better outcomes and increased organisational effectiveness.

ii. **Enhanced efficiency and productivity:** MIS automates routine tasks, streamlines processes, and reduces manual effort, resulting in improved efficiency, reduced costs, and increased productivity within the organisation.

iii. **Better planning and forecasting:** MIS provides data and analytical tools that assist in strategic planning, forecasting, and goal-setting, helping organisations align their actions with long-term objectives and adapt to changing market conditions.

iv. **Effective resource management:** MIS enables organisations to optimise resource allocation by providing insights into resource utilisation, identifying areas of waste or inefficiency, and facilitating informed decisions on resource allocation.

v. **Improved communication:** MIS serves as a platform for sharing information, facilitating collaboration among departments and teams, and enhancing communication within the organisation, leading to better coordination and teamwork.

vi. **Enhanced data integrity and security:** MIS implements controls and security measures to ensure data integrity, confidentiality, and protection against unauthorised access or manipulation, safeguarding sensitive information and maintaining trust.

- Improved data protection

vii. **Timely and accurate reporting:** MIS generates reports and visualisations that present information in a summarised and understandable format, providing managers with quick access to relevant data, key performance indicators, and trends for effective monitoring and reporting.

- Prompt precise reporting

viii. **Streamlined processes and reduced paperwork:** MIS reduces reliance on manual paperwork, automates processes, and digitizes information, leading to streamlined operations, reduced administrative burden, and increased operational efficiency.

- Efficient workflows, less paperwork

ix. **Improved customer relationship management:** MIS enables organisations to gather and analyse customer data, facilitating personalised interactions, targeted marketing efforts, and improved customer satisfaction and loyalty.

- Enhanced CRM capabilities

x. **Competitive advantage:** MIS provides organisations with a competitive edge by enabling quick decision making, agile responses to market changes, and the ability to leverage data and insights for strategic positioning and innovation.

- Competitive edge

2.1.9.14 Disadvantages of MIS

i. **Implementation challenges:** Implementing MIS can be complex and challenging, requiring significant investment in infrastructure, resources, and training, which may result in delays, disruption, and resistance from employees.

- Implementation difficulties

ii. **Costly maintenance and upgrades:** MIS systems require ongoing maintenance, upgrades, and technical support, which can result in substantial long-term costs for the organisation.

- Not economical

iii. **Data quality and integration issues:** MIS heavily relies on accurate and integrated data from various sources, and any inconsistencies or errors in data entry can lead to unreliable information and skewed decision making.

- Data integrity challenges

iv. **Security risks:** MIS systems may be vulnerable to security breaches, data theft, or unauthorised access if proper security measures and protocols are not in place, posing a risk to sensitive organisational information.

- Data security concerns

v. **Dependency on technology:** Overreliance on MIS systems can lead to a loss of human judgment and intuition, as well

- Technology reliance concerns

as a reduced ability to adapt to unexpected situations or nuances that cannot be captured solely through data and technology.

2.1.9.15 Digital Dashboard

A digital dashboard is a customisable visual tool that presents real-time or near-real-time data concisely and intuitively. It allows users to monitor key performance indicators, metrics, and trends relevant to their goals and objectives. By displaying information through charts, graphs, and visual representations, digital dashboards enable users to quickly assess their business unit's status, progress, and potential issues. Users can easily identify patterns, spot anomalies, and make data-driven decisions by accessing critical information all in one centralised location. With the ability to customise the dashboard according to their needs, users can focus on the most relevant data and gain valuable insights that drive performance, improve efficiency, and support strategic decision making. Ultimately, digital dashboards provide a comprehensive and easily digestible overview of essential information, empowering users to take proactive actions and achieve their desired outcomes.

- Benefits of Digital Dashboard

2.1.9.16 Advantages of Digital Dashboard

- Graphical data display
- Adaptable and Individualised
- Consolidated data access
- Improved Interaction
- On-the-go data access

i. **Visual data representation:** Digital dashboards present data visually through charts, graphs, and visualisations, making complex information easily understandable and enabling quick identification of trends and patterns.

ii. **Customisable and personalised:** Digital dashboards are customisable, allowing users to choose the specific metrics and data they want to monitor, tailoring the dashboard to their unique needs and preferences.

iii. **Centralised information:** Digital dashboards consolidate data from multiple sources into a single location, providing a centralised view of the most important information and eliminating the need to navigate various systems or reports.

iv. **Enhanced collaboration and communication:** Digital dashboards facilitate collaboration by providing a shared platform where team members can access and discuss data, fostering communication, alignment, and coordinated actions.

v. **Mobile accessibility:** Many digital dashboards are accessible on mobile devices, enabling users to access critical information on the go, empowering remote or travelling users to stay connected and make informed decisions anytime, anywhere.

vi. **Real-time data insights:** Digital dashboards provide real-time or near-real-time data updates, allowing users to access the latest information and make timely decisions based on accurate insights.

- Instantaneous Data Insights

vii. **Improved decision making:** By providing relevant and actionable data in a concise format, digital dashboards empower users to make data-driven decisions quickly, leading to more informed and effective choices.

- Enhancing Decision-Making

Summarised Overview

Structured, unstructured, and semi-structured data types represent different levels of organisation, where structured data follows a predefined format, unstructured data lacks organisation, and semi-structured data combines elements of both. OLTP (Online Transaction Processing) systems handle real-time transactional operations, while OLAP (Online Analytical Processing) systems optimise complex analytical queries and reporting. Multidimensional models categorise data into dimensions, providing a hierarchical view for analysis, while relational models use tables and relationships to store and retrieve data efficiently. Hybrid OLAP combines multidimensional and relational models to offer flexible analysis capabilities. DSS (Decision Support System) assists in complex decision making processes by providing tools and models, EIS (Executive Information System) provides real-time information to executives for strategic decision making, and MIS (Management Information System) supports managerial decision making by collecting, processing, and distributing relevant information. Digital dashboards present key performance indicators and data visually, allowing users to monitor and analyse information effectively.

Self Assessment Questions

1. Define structured data and give an example of a structured dataset commonly used in businesses.
2. How does the organised nature of structured data ease data processing and analysis, particularly in relational databases?
3. Explain the concept of unstructured data and provide an example of how businesses can extract value from it.
4. What challenges might organisations face when attempting to analyse and interpret unstructured data compared to structured data?
5. Define semi-structured data and offer an example of a file format commonly associated with it.

6. How does semi-structured data combine attributes of both structured and unstructured data, and what advantages might this offer in analysis
7. Describe the main purpose of OLTP systems and provide an example of a business scenario where OLTP is extensively used.
8. How does OLTP handle real-time transactions, and what is its significance in ensuring operational efficiency?
9. Define OLAP and explain how it supports multidimensional data analysis.
10. How does OLAP differ from OLTP in terms of data processing objectives and the types of queries they address?

Assignments

1. Create a basic online order system. Add customers, products, and orders. Retrieve order information using SQL queries.
2. Analyse sales data. Build a simple sales report with product categories, dates, and revenue. Use pivot tables and charts.
3. Create a basic dashboard using Power BI or Google Data Studio. Display student grades or project progress. Customise with filters and interactive elements.

Suggested Reading

1. Pochiraju, B. S., & Seshadri, S. (2016). *Essentials of Business Analytics*. Springer.
2. Albright, C., & Winston, W. L. (2017) *Business Analytics – Data Analysis and Decision Making (6th Edition).* Cengage Learning.
3. Camm, J. D., Cochran, J. J., Fry, M. J., & Ohlman, J. W. (2015). *Essentials of Business Analytics.* Cengage Learning.
4. Bhima Sankaran Pochiraju and Sridhar Seshadri. (2019) *Essentials of Business Analytics*. Springer.

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1. Christian Albright S and Wayne L Winston .(2017). *Business Analytics – Data Analysis and Decision Making (6th Edition)*. Cengage Learning
2. Winston, W. L. (2014). *The art of business analytics: Building and running a successful analytics practice.* Wiley.
3. Thorlund, J., & Larsen, G. H. N. (2013) *Business Analytics for Managers*.
4. Prasad, R. N., & Acharya, S. (2016). *Fundamentals of Business Analytics (2nd Edition)*. Wiley India Pvt. Ltd.
5. Barlett, R.. A (2013). *Practitioners' Guide to Business Analytics*. McGraw Hill Professional

Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

Unit 2

BI Components

Learning Outcomes

After completing this unit, the learner will be able to:

- learn about different type BI components
- get awareness business layer, administration layer and operational layer
- comprehend the uses of BI in different areas

Background

Business Intelligence (BI) encompasses components that enable organisations to gather, analyse, and present data for informed decision making. The fundamental components of BI include data sources, data integration, data warehousing, data analytics, and reporting. Data sources serve as the foundation, providing raw data from various systems, such as transactional databases, external sources, or data feeds. Data integration involves consolidating data from multiple sources and transforming it into a unified format, ensuring data consistency and accuracy. Data warehousing involves the storage and organisation of integrated data in a central repository, optimised for reporting and analysis. Data analytics encompasses a range of techniques, including descriptive, diagnostic, predictive, and prescriptive analytics, to uncover insights, identify patterns, and make data-driven decisions. This component involves data exploration, data mining, statistical modelling, and machine learning algorithms. Reporting is the final component, where the analysed data is presented in meaningful visualisations, dashboards, and reports, enabling stakeholders to gain actionable insights. These components collectively form a comprehensive BI system that empowers businesses to extract valuable knowledge from data, monitor performance, identify trends, and respond to emerging opportunities or challenges effectively. The evolution of BI components has been shaped by technological advancements, such as cloud computing, big data, and artificial intelligence, allowing organisations to handle vast amounts of data, perform real-time analysis, and leverage sophisticated algorithms for advanced insights.

Keywords

Business intelligence, Business analytics, Business layer

Discussion

2.2.1 Business Intelligence

Business intelligence (BI) encompasses the management and technological structure that facilitates data gathering, storage, and analysis within a corporation. It includes data mining, operations analysis, benchmarking, and descriptive analytics. Business intelligence provides managers with relevant reports, key performance indicators, and trends to aid in effective decision making. It is important to differentiate between raw data and processed business intelligence data. Business intelligence (BI) software takes company data and presents it in user-friendly formats, such as reports, dashboards, charts, and graphs. Business users have access to various data types, including semi-structured and unstructured data, sourced internally and externally. This data can include historical and current information, including data from social media platforms.

- Data-driven decision-making platform

2.2.1.1 History of Business Intelligence

The history of business intelligence (BI) dates back to the 1960s and 1970s, when organisations recognised the need to harness data for decision making. Early developments included the creation of data management systems and decision support systems (DSS) to handle growing data volumes. In the 1980s, executive information systems (EIS) emerged, providing senior executives with summarised reports and key performance indicators (KPIs) for strategic decision making. The 1990s marked a significant milestone for BI as data warehouses became more prevalent and data mining techniques were introduced to uncover insights from data. The term "business intelligence" gained popularity during this period, representing the ability to leverage data for competitive advantage. The early 2000s saw the rise of self-service BI tools, empowering business users to access and analyse data independently and reducing reliance on IT departments. The evolution of BI continued with the integration of big data and advanced analytics, enabling organisations to gain

- BI Evolution

deeper insights into their operations and customer behaviour. Cloud-based solutions further democratised BI, making it more accessible and scalable for businesses of all sizes. Today, BI has evolved into a comprehensive ecosystem encompassing data integration, analytics, reporting, and visualisation, enabling organisations to make data-driven decisions and gain a competitive edge.

2.2.1.3 Business Analysis and Business Intelligence

- Past vs. future analysis

Focusing on when events occur is the main difference between business intelligence and business analytics. Business intelligence focuses on data-driven events that have happened in the past and are happening now. On the other hand, business analytics focuses on future events. The same data is used in both BI and BA processes, but in the latter, it is used for forecasting.

Let us mention other important differences between BI and BA.

Basis of distinction	Business intelligence	Business analytics
Meaning	Processes past and present data for solving operational problems	Processes past and present data for solving anticipated problems
Solution	For immediate problems	For future problems
Nature	Strategic	Tactic
Process	Automated monitoring	Data mining
Uses	KPI reports	Statistical and quantitative research
Users	CEOs, CFOs, CIOs	Data Scientists

2.2.2 Major Components of Business Intelligence (BI)

- Blending

Data integration

Data integration involves combining data from multiple sources, such as databases, applications, and external systems, to create a unified and consistent view of information. It ensures that data is accurate, complete, and up-to-date, enabling effective analysis and reporting.

Data warehousing

Data warehousing involves the process of collecting, organising, and storing large volumes of data in a central repository. It provides a structured and optimised environment for data retrieval and analysis, facilitating quick and efficient access to information for reporting and decision making purposes.

- Repository

Data modelling

Data modelling is the process of designing the structure and relationships of data to align with the organisation's business requirements. It involves creating entities, attributes, and relationships to represent the data accurately, ensuring data integrity and supporting efficient data analysis.

- Designing the structure

Data mining

Data mining refers to the extraction of patterns, insights, and relationships from large datasets. It involves applying statistical and machine learning techniques to uncover hidden patterns, identify trends, and make predictions. Data mining helps businesses gain valuable insights from their data, enabling them to make data-driven decisions and discover new opportunities.

- Data extraction

Reporting and dashboards

Reporting and dashboards involve presenting data in visual formats, such as reports, charts, and interactive dashboards. These components provide a concise and easily understandable view of key business metrics, trends, and performance indicators. They enable users to quickly analyse and interpret data, monitor progress towards goals, and make informed decisions based on the presented information.

- Visual data presentation

OLAP (Online Analytical Processing)

OLAP is a multidimensional data analysis technique that allows users to analyse data from different perspectives. It enables users to drill down, roll up, slice, and dice data to explore and analyse it from various angles. OLAP helps uncover deeper insights, discover patterns, and perform complex analysis tasks efficiently.

- Multidimensional data exploration

Data visualisation

Data visualisation involves presenting data in visual formats, such as charts, graphs, and maps, to enhance understanding and communication. It makes complex data more accessible and intuitive, allowing users to grasp patterns and trends quickly. Effective data visualisation improves decision making by provid-

- Visual formats

ing clear and concise representations of data.

Predictive analytics

- Making forecasts

Predictive analytics uses historical data and statistical models to make predictions about future outcomes and trends. By analysing patterns and relationships in data, businesses can forecast customer behaviour, market trends, and potential risks. Predictive analytics enables proactive decision making, helping organisations take appropriate actions to optimise performance and mitigate risks.

Performance management

- KPI tracking, goal evaluation

Performance management involves monitoring and measuring key performance indicators (KPIs) to assess organisational performance and track progress towards goals. It helps businesses evaluate their performance against targets, identify areas for improvement, and make informed decisions to optimise performance and achieve desired outcomes.

Data governance

- Data integrity assurance

Data governance encompasses establishing policies, procedures, and controls to ensure the quality, accuracy, security, and compliance of data. It involves defining data standards, roles and responsibilities, data privacy measures, and data access controls. Effective data governance ensures that data is trustworthy, reliable, and protected, supporting the integrity and credibility of business intelligence initiatives

2.2.2.1 Differences between Traditional BI and Modern BI

- IT-driven reporting, service analytics

Traditional business intelligence (BI) and modern BI differs in several key aspects. In traditional BI, the focus was primarily on generating standardised reports and delivering static insights to decision makers. The process was often centralised within the IT department, where data was collected, transformed, and presented to users in predefined formats. This approach required users to submit requests for specific reports or data, leading to longer turnaround times and limited flexibility in data exploration. Traditional BI systems were designed to address historical and operational questions, providing a retrospective view of the business. On the other hand, modern BI embraces self-service analytics and empowers users to directly access and explore data in real time. Modern BI tools provide intuitive interfaces that enable users to create their own reports, dashboards, and visualisations without heavy reliance on IT. This shift towards self-service capabilities allows users to ask ad-hoc questions, perform data discovery, and gain insights on the fly. Additionally, modern

BI leverages advanced technologies such as data visualisation, natural language processing, and machine learning to provide more interactive and dynamic experiences.

2.2.2.2 Benefits of Business Intelligence

i. BI streamlines business processes by automating data collection, analysis, and reporting. This eliminates manual and time-consuming tasks, allowing employees to focus on value-added activities. By improving operational efficiency, BI helps organisations save time and resources, leading to increased productivity and cost savings.

- Improved operational efficiency

ii. Business intelligence allows organisations to track and monitor key performance indicators (KPIs) in real time. With BI tools, managers can easily access dashboards and reports that comprehensively view business performance across various departments and functions. This enables timely identification of strengths, weaknesses, and areas that require improvement, facilitating proactive decision making to drive performance improvements.

- Enhanced performance monitoring

iii. BI equips organisations with a competitive edge by providing insights into market trends, customer behaviour, and competitor analysis. By leveraging BI capabilities, businesses can identify new market opportunities, tailor their products or services to meet customer needs and develop effective strategies to outperform competitors. BI enables organisations to stay ahead of the curve, adapt to changing market conditions, and make data-driven decisions that give them a competitive advantage.

- Competitive edge

iv. Business intelligence enables organisations to better understand their customers. By analysing customer data and behaviour, BI helps identify customer preferences, purchasing patterns, and satisfaction levels. This information enables organisations to personalise their offerings, improve customer service, and enhance customer experiences, ultimately leading to higher customer satisfaction and loyalty.

- Customer satisfaction

v. BI plays a crucial role in identifying and managing risks within an organisation. By analysing data from various sources, including financial data, operational data, and market data, BI helps identify potential risks and vulnerabilities. This allows organisations to take proactive measures to mitigate risks, ensure compliance with regulations, and protect their reputation.

- Risk management

vi. Implementing business intelligence fosters a data-driven culture within an organisation. It encourages employees at all levels to base their decisions on data and evidence rather

- Data-driven culture

than intuition or personal bias. This promotes a more objective and informed decision making process, leading to better outcomes and alignment with organisational goals.

- Agility and adaptability

vii. BI enables organisations to quickly adapt to changing business environments. By providing real-time insights and flexible reporting capabilities, BI allows organisations to monitor performance, detect market shifts, and respond promptly to emerging trends or challenges. This agility helps organisations seize new opportunities, mitigate risks, and stay ahead of industry disruptions.

- Enhanced collaboration and communication

viii. Business intelligence facilitates data sharing and collaboration across departments and teams. BI tools provide a centralised platform for accessing and analysing data, enabling employees to collaborate, share insights, and align their efforts. This improves communication and fosters a data-driven decision making culture across the organisation.

- Continuous improvement

ix. Business intelligence supports a culture of continuous improvement by providing organisations with feedback on their performance. Through data analysis and monitoring, BI identifies areas of inefficiency or underperformance, allowing organisations to implement targeted improvement initiatives. This iterative approach helps organisations refine their processes, optimise resource allocation, and drive continuous growth and innovation.

- Informed decision-making

x. Business intelligence provides organisations with valuable insights and actionable information, enabling them to make informed decisions based on data. By analysing and interpreting data, BI helps organisations identify trends, patterns, and relationships, empowering decision makers to take strategic actions that drive business success.

2.2.3 Business Layer

- Data processing intermediary

The business layer is a crucial component of a software architecture which serves as the intermediary between the presentation layer (user interface) and the data layer (database). The primary function of the business layer is to process the data before it is stored in the data base. It acts as a bridge between user interactions and data storage, ensuring that data is processed, validated, and manipulated according to defined rules and requirements. The business layer is responsible for handling complex calculations, data transformations, and business-specific operations, such as data validation, authorisation, and workflow management. It provides a structured and standardised approach to implementing business rules, making the application more

maintainable, scalable, and adaptable to changes. Additionally, the business layer abstracts the underlying data storage details, allowing the presentation layer to interact with the data through well-defined interfaces and APIs. By separating business logic from presentation and data layers, the business layer promotes modularity, reusability, and flexibility in software development.

2.2.4 Administration Layer

The administration layer, also known as the management layer, plays a critical role in the architecture of software systems. It serves as the control centre for overseeing and managing the various aspects of an application or system. The primary function of the administration layer is to provide tools, interfaces, and functionalities for system administrators or authorised personnel to configure, monitor, and control the system's behaviour and settings. Administrators can perform tasks such as user management, security configuration, system configuration, and performance monitoring in this layer. They have the authority to set access permissions, define user roles, and manage user accounts. Additionally, administrators can configure system parameters, define business rules, and manage workflows to align the system with the organisation's requirements. The administration layer typically offers a user-friendly interface or a set of administrative tools that allow administrators to perform these tasks efficiently. It provides a centralised location for managing the system, ensuring that it operates smoothly and securely. Some key features of the administration layer include user administration, role-based access control, system configuration management, logging and auditing capabilities, and performance monitoring tools. These features enable administrators to maintain the system's integrity, security, and performance.

- Control centre in software systems

2.2.5 Operation Layer

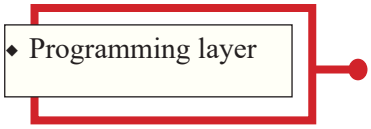
The operation layer, or the operational or execution layer, is a fundamental component in software systems. It is responsible for executing and carrying out the core operations and functionalities of the application. The primary function of the operation layer is to interact with the underlying data layer, retrieve and store data, and perform various processing tasks to fulfil user requests. Business logic is implemented and executed in the operation layer to process user inputs, validate data, perform calculations, and carry out specific operations based on predefined rules and algorithms. This layer acts as the engine that drives the application, orchestrating the flow of data and performing the necessary actions to deliver the expected outcomes. The opera-

- Core functionality execution

tion layer also interfaces with external systems, such as databases, APIs, or other software components, to exchange data and information. It ensures proper data handling, data integrity, and synchronisation with external systems as required by the application. The operation layer may include modules or components that handle exception handling, error logging, and reporting. It captures and manages errors and exceptions that occur during the execution process, providing appropriate feedback to users or administrators.

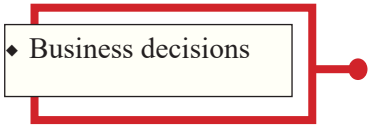
2.2.6 Implementation Layer

The, also known as the development layer or programming layer, is a key component in the software development process. It involves the actual coding and implementation of the software based on the design and specifications provided by the architecture and design layers. The primary function of the implementation layer is to write the code that translates the desired functionality into a working software application. This layer utilises programming languages, frameworks, and development tools to convert the design concepts into executable code. It involves tasks such as writing algorithms, defining data structures, implementing user interfaces, and integrating various modules and components. The implementation layer ensures that the software application is developed according to the defined requirements, adheres to coding standards and best practices, and follows the established architectural patterns. It involves rigorous testing, debugging, and refactoring to ensure the quality, reliability, and performance of the software. The implementation layer plays a critical role in transforming abstract concepts and designs into a tangible and functional software solution.

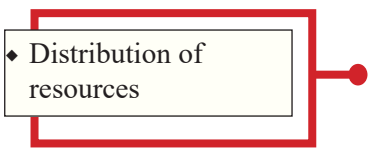


2.2.7 Uses of BI

2.2.7.1 Use of BI in Management



i. **Strategic planning:** BI supports strategic planning by providing historical data analysis and predictive modelling. Managers can analyse trends, patterns, and forecasts to develop effective strategies, identify market opportunities, and make proactive business decisions.



ii. **Resource allocation:** BI helps in optimising resource allocation by analysing data on sales, inventory, production, and other operational aspects. Managers can identify areas of over or underutilisation, streamline processes, and allocate resources more efficiently to improve productivity and

reduce costs.

iii. **Customer analysis:** BI enables managers to gain insights into customer behaviour, preferences, and satisfaction levels. By analysing customer data, managers can identify profitable customer segments, personalise marketing strategies, improve customer service, and enhance overall customer experience.

- Consumer targeted strategies

iv. **Risk management:** BI provides managers with risk analysis and mitigation capabilities. By analysing historical data and identifying potential risks and vulnerabilities, managers can take proactive measures to minimise risks, enhance security, and ensure regulatory compliance.

- Proactive measures

v. **Collaboration and communication:** BI platforms facilitate data sharing and collaboration among managers and departments. It enables managers to share reports, dashboards, and insights with relevant stakeholders, fostering a culture of data-driven decision making and effective communication.

- Alliance

vi. **Data-driven decision making:** BI provides managers with accurate and up-to-date information, enabling them to make informed decisions based on data insights rather than relying solely on intuition or guesswork.

- Data-informed decision making

vii. **Performance monitoring:** BI tools allow managers to track key performance indicators (KPIs) and metrics in real time, providing a clear view of the organisation's performance against set goals and benchmarks. This helps in identifying areas of improvement and taking timely actions to address any issues.

- Performance assessment

2.2.7.2 Operational Efficiency and Effectiveness

i. BI helps in optimising operational processes by providing real-time visibility into key metrics and performance indicators. Managers can identify process bottlenecks, streamline workflows, and implement continuous improvement initiatives to enhance productivity and reduce costs.

- Process optimization

ii. BI enables operational managers to monitor inventory levels, track stock movements, and analyse demand patterns. By having accurate and timely information, managers can optimise inventory levels, reduce stock outs, minimise holding costs, and improve supply chain efficiency.

- Inventory management

iii. BI provides insights into resource utilisation, such as equipment, personnel, and facilities. Managers can analyse resource allocation, identify underutilised or over utilised assets, and optimise resource allocation to improve opera-

- Resource utilization

tional efficiency and reduce costs.

- Demand forecasting

iv. BI enables operational managers to analyse historical sales data, market trends, and customer behaviour to forecast future demand. This helps in accurate demand planning, inventory management, production scheduling, and ensuring sufficient resources are available to meet customer demands.

- Real-time monitoring and alerts

v. BI tools provide real-time monitoring capabilities, allowing operational managers to receive alerts and notifications on critical operational metrics. This enables them to quickly identify and address issues, minimise downtime, and maintain smooth operations.

- Data analysis and reporting

vi. BI tools allow operational managers to analyse large volumes of data from various sources and generate insightful reports. These reports provide a comprehensive view of operational performance, helping managers identify bottlenecks, inefficiencies, and areas for improvement.

- Quality control and defect tracking

vii. BI tools can be utilised to monitor product quality, track defects, and identify root causes of quality issues. This allows operational managers to take corrective actions, improve product quality, and enhance customer satisfaction.

2.2.7.3 Process Improvement

- Analysis of cause

i. **Root cause analysis:** BI enables managers to analyse data from different sources and identify root causes of process inefficiencies or quality issues. Managers can implement targeted improvement strategies by understanding the underlying factors contributing to process problems.

- Automating

ii. **Process automation:** BI can identify manual and repetitive tasks that can be automated to streamline processes. By automating routine tasks, organisations can reduce errors, improve efficiency, and free up resources for more value-added activities.

- Continuous process enhancements

iii. **Continuous improvement initiatives:** BI supports the implementation of continuous improvement methodologies such as Six Sigma or Lean. It provides data and insights needed to define improvement goals, measure progress, and drive continuous process enhancements.

- Alliance

iv. **Collaboration and communication:** BI platforms facilitate collaboration and communication among process improvement teams. Stakeholders can share data, insights, and recommendations, fostering a culture of collaboration and driving collective process improvement efforts.

- Evaluation

v. **Performance measurement and monitoring:** BI tools comprehensively view key performance indicators (KPIs) and metrics related to various processes. Managers can track

real-time performance, identify bottlenecks, and monitor progress towards process improvement goals.

vi. **Process benchmarking:** BI allows organisations to compare their processes against industry benchmarks or best practices. This helps identify areas where processes are falling behind and provides insights into areas for improvement.

- Industry best practices

vii. **Predictive analytics:** BI tools equipped with predictive analytics capabilities can forecast process performance and identify potential issues before they occur. This helps organisations proactively address process challenges and optimise operations.

- Forecast

2.2.7.4 Performance Improvement

i. **Performance dashboards:** BI dashboards provide visual representations of performance data, making it easy for managers to monitor and analyse performance metrics. These dashboards can be customised to display relevant KPIs and highlight areas that require attention.

- Visual representations

ii. **Identifying trends and patterns:** BI enables organisations to uncover trends and patterns in performance data. By analysing historical data, managers can identify factors that contribute to high or low performance and develop strategies to replicate successes or address challenges.

- Trend analysis

iii. **Performance benchmarking:** BI allows organisations to compare their performance against industry benchmarks or competitors. This helps identify areas where performance is lagging and provides insights into best practices and strategies for improvement.

- Benchmarks

iv. **Employee performance management:** BI can be used to track and analyse individual and team performance. By providing visibility into performance metrics, organisations can identify top performers, provide targeted coaching and training, and align employee goals with overall performance objectives.

- Evaluation of performance

v. **Continuous improvement initiatives:** BI supports continuous improvement methodologies by providing data and insights needed to drive performance enhancements. Organisations can leverage BI to identify improvement opportunities, measure the impact of process changes, and continuously optimise performance.

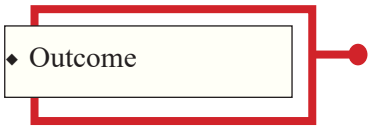
- Data-driven performance optimisation

vi. **Data-driven decision making:** BI provides organisations with real-time access to data and analytics that enable data-driven decision making. By analysing performance metrics and trends, managers can identify areas of under-

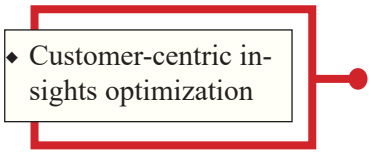
- Evidence-based decision-making

performance and make informed decisions to improve performance.

vii. **Goal setting and tracking:** BI tools allow organisations to set performance goals and track progress against those goals. Managers can monitor key performance indicators (KPIs) and metrics to ensure they are on track and take corrective actions if needed.

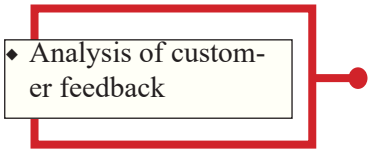


2.2.7.5 Customer Experience

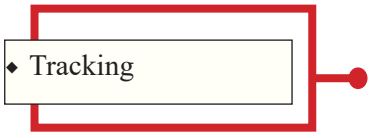


i. **Customer behaviour analysis:** BI enables organisations to analyse customer data and understand customer behaviour patterns. By examining purchase history, browsing habits, and interactions with the company, organisations can gain insights into customer preferences and tailor their offerings to meet customer needs effectively.

ii. **Personalisation and targeted marketing:** BI helps organisations create personalised customer experiences by segmenting customers based on their preferences and behaviours. By leveraging customer data, BI allows organisations to deliver targeted marketing campaigns, product recommendations, and personalised offers, enhancing customer engagement and satisfaction.

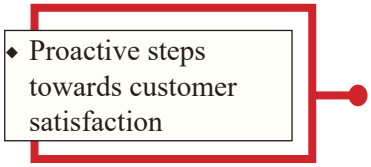


iii. **Customer sentiment analysis:** BI tools can analyse customer feedback and sentiment from various sources, including surveys, social media, and online reviews. This analysis helps organisations understand customer sentiments, identify improvement areas, and promptly address customer concerns, leading to an enhanced customer experience.



4. **Customer journey mapping:** BI supports mapping the customer journey, which involves tracking and analysing customer interactions across different touchpoints. Organisations can optimise the customer experience and streamline processes to deliver a seamless experience by visualising the customer journey and identifying pain points or bottlenecks.

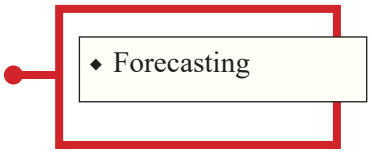
5. **Real-time customer insights:** BI provides real-time access to customer data, allowing organisations to monitor customer behaviour and preferences as they happen. This enables organisations to respond quickly to changing customer needs, resolve issues promptly, and provide personalised experiences in real time.



6. **Customer satisfaction measurement:** BI helps measure customer satisfaction through metrics such as Net Promoter Score (NPS) and customer satisfaction surveys. By analys-

ing this data, organisations can identify areas where satisfaction levels are low and take proactive steps to improve the customer experience.

7. **Predictive analytics for customer retention:** BI supports predictive analytics models that can forecast customer churn or identify potential upsell/cross-sell opportunities. By leveraging customer data and historical patterns, organisations can proactively engage with at-risk customers and take targeted actions to retain them.



Summarised Overview

The business component is essential to an organisation's operations, encompassing various functions and processes that drive its success. The business layer acts as a bridge between the presentation and data layers, encapsulating the business logic and rules to ensure efficient operations and workflows. The administration layer oversees the management and governance of the business component, providing oversight, decision making, and strategic direction. The operation layer focuses on the day-to-day execution of operational activities, streamlining processes, and optimising efficiency. The implementation layer involves translating business requirements into functional systems and solutions, ensuring successful deployment and integration. Business intelligence (BI) plays a vital role in management by providing data-driven insights, performance metrics, and analytics to support informed decision making. Operational BI enables real-time monitoring, analysis, and optimisation of operational processes for improved efficiency and productivity. Process improvement leverages BI to identify bottlenecks, streamline workflows, and optimise business processes for enhanced performance. Performance improvement utilises BI to track key performance indicators, identify areas of improvement, and drive organisational growth. Customer experience is enhanced through BI by analysing customer data, preferences, and feedback to personalise interactions, improve service quality, and drive customer satisfaction and loyalty.

Self Assessment Questions

1. Define business intelligence and explain its role in aiding decision making within organisations.
2. How does business intelligence enable companies to transform raw data into actionable insights for strategic planning?
3. Describe the concept of data integration and provide an example of why it's essential in modern businesses.
4. What challenges might arise during the process of integrating data from various sources, and how can these challenges be mitigated?
5. Explain the purpose of a data warehouse and how it differs from a traditional database.
6. What advantages does a data warehouse offer in terms of data storage, accessibility, and analytical capabilities compared to traditional databases?
7. Define data modelling and discuss its importance in structuring and organising data for analysis.
8. How does data modelling improve data quality and ensure consistency in information interpretation?
9. Describe the concept of data mining and provide an example of how it's used to discover hidden patterns in large datasets.
10. How can data mining techniques be applied in identifying customer preferences for targeted marketing strategies?

Assignments

1. Develop a comprehensive business layer framework for customer service operations that integrates data from multiple sources and enables effective decision making and resource allocation.
2. Implement an operation layer system for customer service that streamlines and automates key processes, such as ticket management, routing, and escalation, to enhance efficiency and response times.
3. Utilise business intelligence tools and techniques to analyse customer data and feedback, identify trends and patterns, and generate actionable insights for improving customer service strategies and delivering personalised experiences.

Suggested Reading

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Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

03 BLOCK

DATA INTEGRATION AND DATA MODELLING

Content

Unit 1

Data Warehouse

Learning Outcomes

After learning this unit, the learners will familiarize with:

- the concept of Data Warehouse, Data sources and Data mapping
- what differentiates Data Warehouse from a Data Mart
- the steps involved in Data staging
- the approached and techniques of Data integration

Background

Cloud computing has transformed the business world by enabling businesses to easily retrieve and store valuable data about their customers, products, and employees. This information is used to make critical business decisions. Many multinational corporations have turned to data warehousing to organise data flowing in from corporate branches and operations centres all over the world. For example, one department may store data in Customer Relationship Management (CRM) software, another in accounting software such as Quickbooks, and yet another in logistics software such as NetSuite. But, now that data isn't all in one place, how can businesses consolidate and manage it all to gain valuable business insights? This is where data warehousing comes in. A data warehouse "provides a location for you to store all of your business data in order to obtain a 360-degree view of the business by combining various data sources." With data warehousing, a company can view their CRM data, accounting data, and logistical data from a single point of view, as well as any interactions.

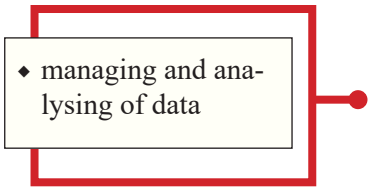
Keywords

Data Warehouse, Data Mart, Data sources, Data mapping, Data staging, Data quality, Data profiling

Discussion

3.1.1 Data Warehouse

Large business organisations must work with a significant amount of data and information for decision making. For instance, businesses with multiple branches, businesses dealing with multiple product lines, businesses with complex organisation structures, etc., handle bulk information. Collection and analysis of such information from different sources is a cumbersome process for such organisations. This necessitates the need for data warehousing. The term 'Data Warehouse' comprises two words- Data and Warehouse. The term 'data' means raw facts processed to generate information; the term 'warehouse' simply means a store room or storehouse. Data Warehouse, thus means a storehouse which holds bulk quantities of data. Data Warehouse is a system which collects data from multiple sources and stores the data collected from multiple sources in a single place. Current data and historical data are stored in the data warehouse, which acts as a central repository. Data Warehouse can be used for storing images, videos and sensor data. Data Warehouse consists of three tier functioning: database server, analytics engine, and front engine client. The database server is the bottom tier which stores the data. The analysis of the data is performed by the analytical engine, which encompasses the middle tier. The front-end tier is the top tier which presents the results.



3.1.1.1 Benefits of Data Warehouse

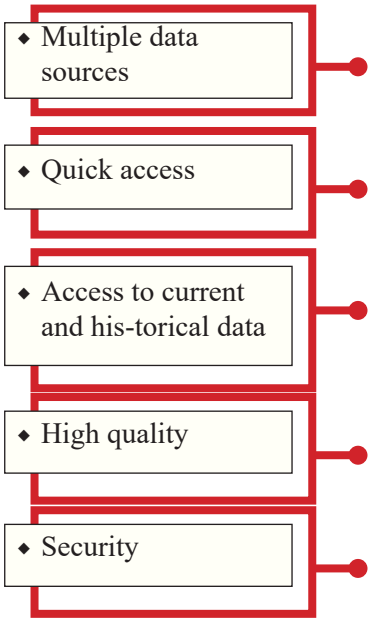
i. Data Warehouse provides access to large amounts of consolidated data from multiple sources.

ii. Data warehouses offer speedier retrieval of data which the business can use for decision making.

iii. Data Warehouse is a central repository that stores present and historical data.

iv. The data in a data warehouse passes through various stages of filtering and cleansing. Thus Data Warehouse offers high quality data to the users.

v. Data Warehouse involves secured sharing of data.



3.1.2 Data Mart

A Data Mart can be called a subset of a Data Warehouse. It is part of the Data Warehouse, which deals with a single line of a business, such as a single department. A Data Mart's scope is narrow compared to that of a Data Warehouse. For instance, a Data Warehouse holds information about the business organisation as a whole, whereas a Data Mart deals with only one department like sales, production, marketing etc. Hence Data Marts are sometimes known as Departmental Data Mart.

- Departmental Data Mart

3.1.2.1 Benefits of Data Mart

i. Data Mart provides all the relevant information to the stakeholders giving them an opportunity to make reliable forecasts based on the available information.

- Reliable forecasts

ii. Data Mart allows specific business teams and users to quickly access data and combine it with data from a variety of other sources. They won't need to travel to IT to receive routine extracts once the connections to their chosen data sources are established because whenever they have a requirement, they are able to retrieve live data from a data mart. As a result, both the business and the information technology teams experience higher levels of productivity.

- Easy access

iii. A data mart allows data analytics at the department level. Analysts are able to move faster from data to gain insights, which enables them to take decisions that are both better and more quickly. They are able to concentrate on particular opportunities and challenges in fields such as finance and human resources.

- Departmental analytics

iv. Setting up an enterprise data warehouse which can serve the needs of the entire organisation could be time-consuming and labour-intensive. A data mart, on the other hand, focuses on meeting the needs of specific business teams and requires access to fewer data types. As a result, implementation is simplified and accelerated.

- Time-consuming and labour-intensive

v. Data marts offer a flexible data management solution that accompanies business requirements and allows for the usage of data from previous projects to assist with current duties. Teams can modify their data mart in accordance with new and developing analytics projects.

- Adaptivity

Table 3.1.1 Differences between Data Warehouse and Data Mart

Data Warehouse	Data Mart
System that serves as central data storage location which collect data from multiple sources.	Subset of Data Warehouse which deals with a single line of a business
Broader	Narrow
Data-oriented	Project-oriented
Large amounts of data are stored as it deals with the entire organisation	Small amount of data as it focuses only on a single department
Flexible	Not flexible
Longer life span	Shorter life span
Data are contained in detail form	Data are presented in a summarised format.
It is a centralised system	It is a decentralised system

3.1.3 Data Sources

- Data origin

The term "data source" refers to the location from which the information being used originates. A data source could be the location where data is created for the first time, or it could be the location where physical information is first converted to its digital equivalent. Even the most specialised data could serve as a source if it is accessible to and utilised by another process. A database is the primary source of a database management system. For a computer programme, a file, spreadsheet, datasheet etc, can be the data sources.

3.1.4 Data Mapping

- Data linkage

Data mapping involves relating a data field from one source with those of another. This is the initial step in making data transfer, integration, and other data management chores easier. Data transfer, data intake, data processing, and data management all require the use of data mapping in some capacity. The consolidation of multiple data sets into a single repository should be the goal of any data mapping effort.

There are three techniques of data mapping. They are:

- Data matching

i. Automated data mapping – This needs specialist software that can match fresh data to your current structure or schema. Machine learning is frequently used by these tools to constantly improve the data model.

ii. Semi-automated data mapping- The process of semi-automated data mapping, more commonly known as "schema mapping," is a technique that combines the most beneficial aspects of both fully automated data mapping and manual data mapping.. Software that is specifically designed to connect various sources and their targets is used by developers. The team member will manually review the system and make any necessary changes after the process has been laid out. In the case of performing basic integrations, migrations, or transformations on tiny datasets, taking this approach is a wise choice to make, especially for teams that are working with tighter budgets.

- Schema mapping

iii. Manual data mapping- A developer who can implement rules to transfer or inject data from one source field to another is required for manual data mapping. Without the assistance of automated tools, developing a reliable data management strategy for modern businesses is becoming increasingly difficult due to the vast amounts of data to which these businesses have access. Instead, when the database isn't too large, manual data mapping is a good option for a one-time activity because it only requires the mapping of the data once.

- One-time activity

3.1.5 Data Staging

A Staging is a location where unprocessed or raw data is stored temporarily before being modified for future use. These data warehousing processes are commonly referred to as "data scrubbing" or "data staging." The "data scrubbing" processes are among the most time-consuming and labour-intensive tasks in a data warehouse project. However, without proper scrubbing, even clean data can lose its analytical value. Physical transformation entails the use of simple standard business terms and standard data values. A comprehensive dictionary linked to the data warehouse will be a useful tool. During this "staging" step, data from multiple applications may be combined, or the data's integrity may be checked. Scrubbing data refers to the process of modifying or removing data that is either incorrect, incomplete, improperly formatted, or repeated from a database. Scrubbing can also involve removing data that is repeated. The procedure helps ensure that the data are more accurate, consistent, and reliable. Data staging frequently requires complex programming, but warehousing tools that aid in this process are increasingly being developed. Data quality analysis programmes and filters that identify patterns and structures within existing operational data may also be used in staging.

- Data is cleaned, standardised, and prepared for analysis

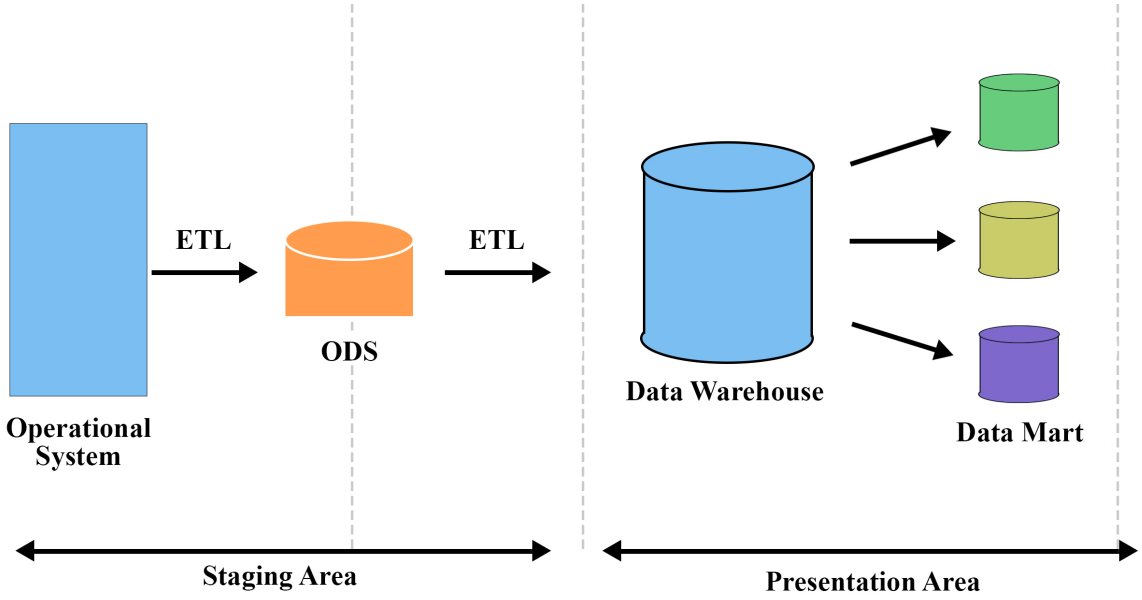


Figure 3.1.1 Data staging

Data that is stored in sources needs to be extracted, cleansed to get rid of inconsistencies and gaps, and integrated to combine data from multiple sources into a single schema. ETL stands for "Extraction, Transformation, and Loading," and it refers to a set of tools that can combine different schemata, extract, transform, cleanse, validate, and filter source data before loading it into a data warehouse. During this stage, problems that are typical of distributed information systems, such as inconsistent data management and incompatible data structures, are addressed. The ETL processes that extract, integrate, and clean data from operational sources to feed the data warehouse layer are housed in the data staging layer. ETL processes actually feed the reconciled data layer—a single, detailed, comprehensive, high-quality data source—in a three-layer architecture, which in turn feeds the data warehouse. As a result, the ETL process operations as a whole are frequently called as reconciliation. These are also the most complex and technically difficult phases of the data warehouse process. ETL occurs once when a data warehouse is first populated, and then it occurs every time the data warehouse is regularly updated. Here's a breakdown of the most common causes of database errors:

- Reconciliation

- A mistake made by a human during data entry
- Merging databases
- A lack of data standards across the industry as a whole as well as within individual companies
- Older systems that hold on to obsolete data

3.1.6 Data Integration

- Combines data

It is a technique of data pre-processing that combines data from various sources into a unified data store and presents the data in a consistent manner. Multiple data cubes, databases, or flat files may be used as sources.

The approaches to data integration are formally classified as triple <G, S, M> where,

G - Global schema,

S - Heterogeneous source of schema,

M - Mapping between the queries of source and global schema.

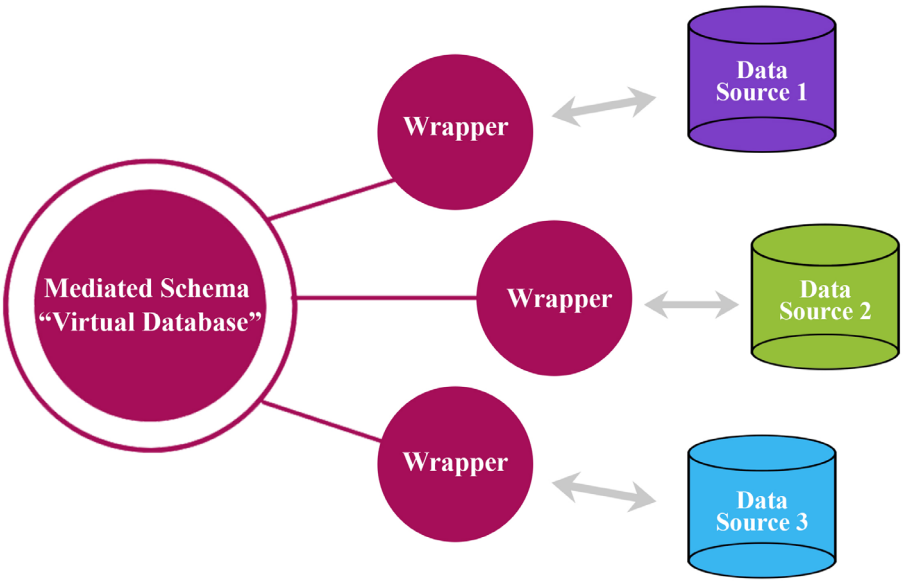


Figure 3.1.2 Data integration

Data integration is the process of combining data from multiple sources to present users with a cohesive view. The primary idea behind data integration is to make data more readily available and easier to consume and process for both systems and humans. When done correctly, data integration can save IT costs, free up resources, improve data quality, and stimulate creativity without requiring major changes to existing applications or data structures. And, while IT organisations have always needed to integrate, the payout has never been theoretically higher than it is now. The data integration layer is in charge of scheduling the various tasks that must be completed in order to integrate data from various source systems. This layer is where a lot of formatting and cleansing activities take place to ensure that data is consistent across the enterprise. This layer is heavily reliant on off-the-shelf tools and consists of high-level job control for the numerous processes (procedures) required to keep the data warehouse up to date.

- Combining data from different sources to create a unified view

3.1.6.1 Advantages of Data Integration

A digital enterprise is founded on data and the algorithms that process it, and it derives the greatest value possible from its information assets—from anywhere in the business ecosystem, at any time. Data and related services flow unhindered, yet securely, across the IT landscape in a digital business. Data integration provides a comprehensive view of all information flowing through an organisation and prepares the data for analysis. Companies with mature data integration capabilities have a significant competitive advantage, which includes:

- More valuable insights are developed as a result of a more holistic view of data that can be easily analysed.
- Reduced the necessity to manually transform and combine data sets, which increased operational efficiency.
- Business rules-based automated data transformations improve data quality.
- Reduction in IT costs.
- Improves collaboration and unification of systems.
- Free up resources.
- Improvement in data quality.
- Encourage innovation without altering apps or data structures.

3.1.6.2 Functioning of Data Integration

- Integrate data into data warehouse

A company has data about its customers, products, and orders stored in three different systems: a CRM system, a product management system, and an order management system. The company wants to integrate this data into a single data warehouse so that it can generate comprehensive reports and analytics.

- Automate the data

The first step is to extract the data from the three source systems. The company can use data integration tools to automate this process. The tools will connect to the source systems and extract the data into a common format. Once the data has been extracted, it needs to be transformed. The company may need to cleanse the data, convert data types, and aggregate data. For example, the company may need to convert all of the customer addresses to a common format and aggregate the order data by customer and product.

The transformed data is then loaded into the data warehouse. The company can use data integration tools to automate this process as well. The tools will create the necessary tables and

columns in the data warehouse and load the transformed data. Once the data has been loaded, the company can start generating reports and analytics. The company can use a variety of business intelligence (BI) tools to query the data warehouse and generate reports and dashboards.

- Generating reports and analytics

Data integration is a powerful tool that can help organisations to make better decisions, improve their operations, and create new products and services.

3.1.6.3 Approaches of Data Integration

There are two major approaches to data integration: the "tight coupling approach" and the "loose coupling approach."

A. Tight coupling:

Tight coupling in data integration refers to a design approach in which two or more software components are tightly connected or integrated, enabling them to function smoothly. While this method may allow for fast integration, it may also make the solution stiff and difficult to change. Any changes to the interfaces, protocols, or data models of the systems may necessitate extensive redesign in the integration solution.

- Source and target systems are closely integrated

B. Loose coupling:

In data integration, loose coupling refers to a design approach in which the integration solution is meant to minimise dependencies and interactions between the linked systems. It encourages scalability, flexibility, and ease of maintenance. Loose coupling, as opposed to direct point-to-point connections or specific schemas, relies on standardised interfaces, such as APIs or data formats, to enable communication between systems. Moving data from its original source to its final destination is the ultimate objective of data integration while ensuring it is unified, error-free, and OLAP compatible. This goal can be accomplished in a variety of ways, but it is critical to understand which approach will provide the most value and take the least amount of time.

- Systems are more isolated

Which approach is better?

The best approach to data integration depends on the specific requirements of the organisation. If performance and scalability are the top priorities, then tight coupling may be the best approach. However, if flexibility and ease of maintenance are more important, then loose coupling may be the better option.

Difference between tight coupling and loose coupling

The difference between tight coupling and loose coupling are as follows:

Characteristic	Tight coupling	Loose coupling
Integration complexity	High	Low
Maintenance complexity	High	Low
Flexibility	Low	High
Performance	Good	Fair
Scalability	Good	Fair

The following are various data integration approaches that fall under the Tight Coupling and Loose Coupling categories:

- ETL Automation

i. Extract, Transform, and Load (ETL)

ETL is the most practical option for large-scale data integration. ETL has been around for decades and is one of the most popular methods for extracting, cleansing, and consolidating data in a data warehouse. ETL software will extract data from a source system and then transfer it to the target system after converting it to the correct format. To be completed, the process is mostly automated and guided by data maps. Users can automate dataflows using these data maps. Modern ETL software has simplified codeless ETL processing. ETL teams no longer need to spend days establishing connectors across apps; instead, they can create data maps and automate their tasks in minutes.

- ELT Approach

ii. Extract, Load, and Transform (ELT)

ELT, or pushdown optimisation, is another approach to data integration similar to ETL. Instead of transforming the data at a staging area, this approach directly loads it onto a destination data warehouse. The final step in the ELT process is transformation. Instead of batch processing, the ELT approach is commonly used for streaming data. It is quicker and uses fewer resources. Furthermore, it is used for transforming chunks of data rather than bulk data at once, making it an excellent choice for the financial, medical, and engineering sectors.

iii. Import/Export data

Importing and exporting data is a straightforward method

of data integration. Data is exported from the main data source, typically in the form of a CSV or an excel file, and then loaded onto the destination in this approach.

For example, suppose you have data in your CRM that you want to move to a centralised repository. Manually extract data from each CRM list and load it into your central repository.

- Data Transfer

iv. Point to point

Another defunct data integration approach is point-to-point. Because an organisation only used two or three applications, the point-to-point approach was a viable option in the early days of computing. This meant that all applications could communicate with one another via point-to-point connectivity.

- Direct Connect

v. Data virtualisation

Data virtualisation (DV) is gaining widespread recognition due to its ability to eliminate the necessity for physically moving data. DV establishes a virtual data layer at the destination, enabling users to perform queries, consolidate and unify data, create transformations, and extract valuable business insights. Importantly, this process leaves the source data untouched. DV offers notable advantages, including increased speed, error reduction, and support for near-real-time data integration. Furthermore, it serves as a data layer that facilitates transformation, making it a viable option for OLAP and data visualisation, allowing for direct utilisation without the need for a traditional data warehouse.

- Virtual data layer

vi. Application specific integration

An application-specific integration approach is used to locate, retrieve, clean, and integrate data from a single source. This kind of integration makes it easier to move data between sources. The method is also known as 'application integration.' Organisations can choose which applications to connect and how to connect them. Application integration is much faster and allows complete information exchange between two applications, but it is limited to a small number of integrated applications.

- Application integration

vii. Middleware integration

Data movement between applications and from apps to databases is made possible by middleware. It is useful for integrating legacy and modern systems. Middleware serves as an interpreter between various systems, ensuring that data is compatible as it is transferred from the legacy

- Interpreter

to the modern system. The middleware data integration method facilitates access to legacy systems. It establishes a connection with them automatically for streaming data and batch processing. However, the middleware layer must be deployed by a developer and must be maintained on a regular basis.

3.1.6.4 Issues in Data Integration

During data integration, three issues must be addressed:

i. Schema integration
ii. Redundancy detection
iii. Data value conflict resolution

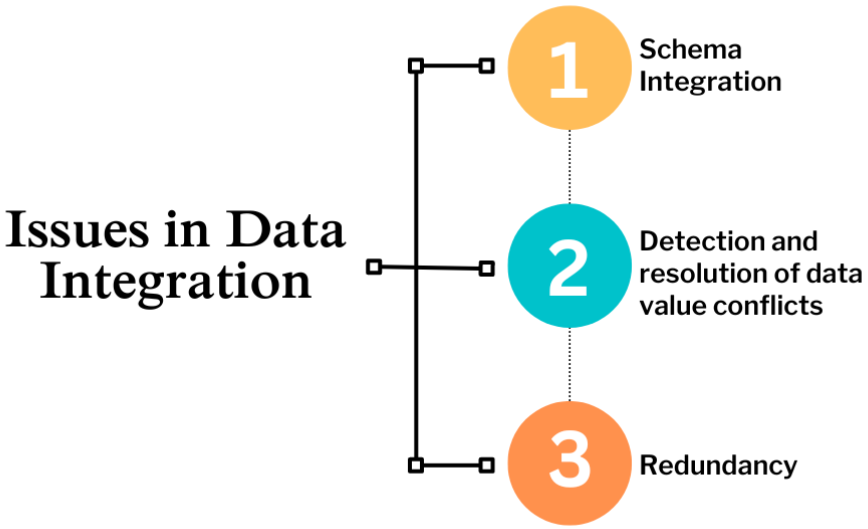
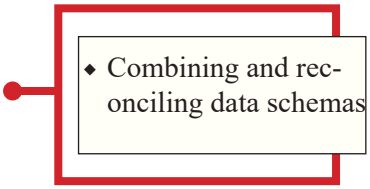


Figure 3.1.3 Issues in data integration

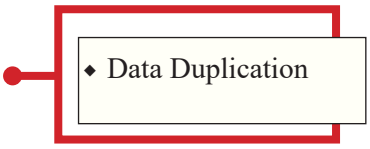
i. Schema integration

The process of combining and reconciling data schemas from numerous sources into a unified schema is known as schema integration. It entails discovering common characteristics, resolving differences, and establishing a consistent data representation. The purpose is to enable easy data interchange and interoperability between systems with various formats. Schema integration ensures that data from diverse sources may be merged, queried, and analysed properly. Understanding the semantics and structure of the data, mapping attributes to the unified schema, and dealing with conflicts or inconsistencies are all required. Successful schema integration improves data consistency and correctness while also allowing for more efficient data integration and analysis.



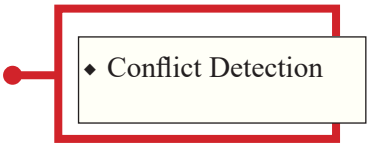
ii. Redundancy

Redundancy in data integration means having the same or similar data stored in multiple places. It can happen when data is copied or replicated across different systems or databases. Redundancy can create problems like data inconsistencies or inaccuracies because changes made in one place may not be reflected in others. It can also increase storage needs and make it harder to manage and maintain data.



iii. Detection and resolution of data value conflicts

Data conflict detection involves identifying discrepancies or inconsistencies in data values across different sources. It aims to uncover instances where data from multiple sources contradicts or contradicts each other, enabling organisations to address and resolve the conflicts to ensure data accuracy and integrity. Resolution of data conflicts involves reconciling conflicting data values from different sources by determining the correct or most accurate value or by merging and harmonizing conflicting values to achieve data consistency.

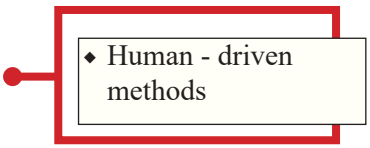


3.1.6.5 Data Integration Tools and Techniques

Data integration techniques are available at all organisational levels, from fully automated to manual. Typical data integration tools and techniques include:

i. Manual data integration

It is simply the process by which a single user manually collects necessary data from different sources by directly accessing interfaces, then cleans it up as required and consolidates it into a single warehouse. This is ineffective and inconsistent, and it makes no sense for all but the smallest organisations with limited data resources.



- Mediator

ii. Middleware data integration

It is an integration approach in which a middleware application acts as a mediator, assisting in the normalisation of data and its incorporation into the master data pool. (Consider adapters for old electronic equipment with out-of-date connection points.) Legacy applications are frequently incompatible with others. Middleware is utilised in situations in which a data integration system is unable to access data originating from one of these applications.

- Automated Integration

iii. Application based integration

It is a way of integrating data where software applications locate, retrieve, and integrate data. The software needs to make data from various systems compatible with one another during integration so that it can be transmitted from one to another.

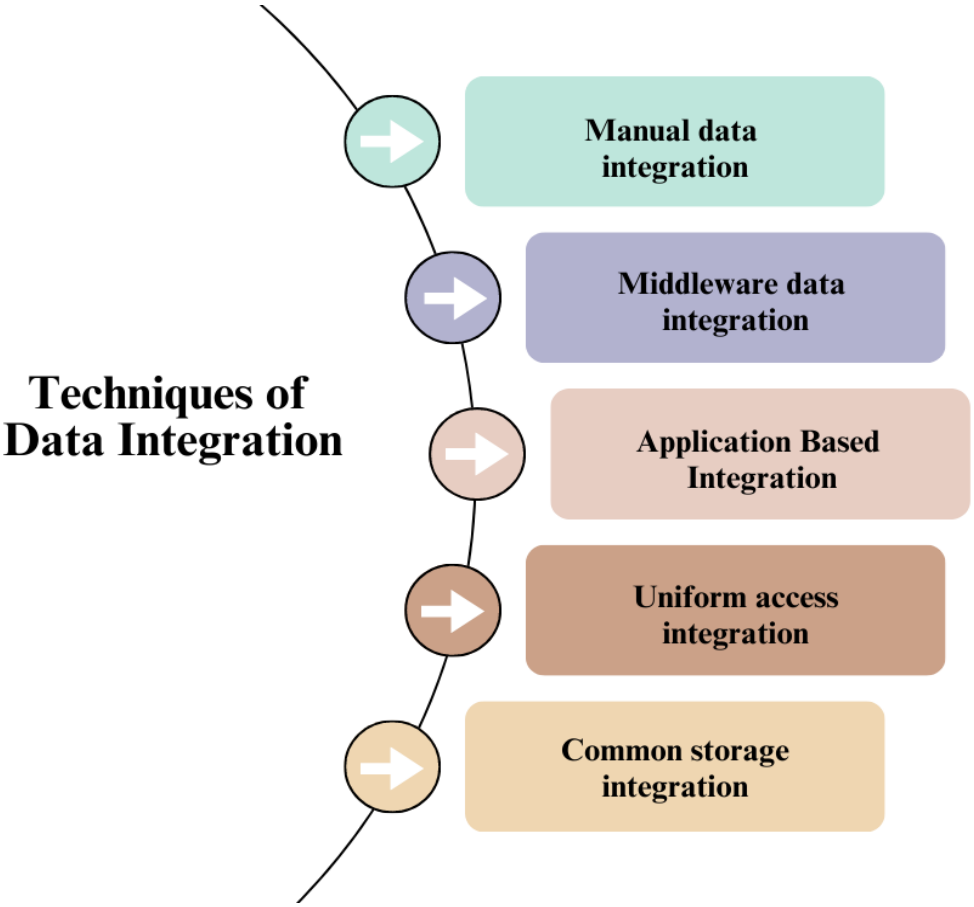


Figure 3.1.4 Data integration

iv. Uniform access integration

This type of data integration focuses on developing a front end that ensures data consistency when accessed from various sources. However, the data remains in its original location. Object-oriented database management systems have the potential to be utilised in order to create the appearance of uniformity between disparate databases using this method.

- Front-End Integration

v. Common storage integration

It is the most commonly used storage method in data integration. In the integrated system, A copy of the data taken from the primary source is saved and then processed so that it may be seen in a unified manner. In contrast, uniform access leaves data in the source. The underlying principle of the traditional data warehousing solution is the common storage approach.

- Centralised storage environment

3.1.7 Data Profiling

The process of reviewing and analysing data to get a full understanding of its properties, structure, quality, and patterns is known as data profiling. It entails analysing the data's content, structure, and relationships to determine its integrity and suitability for specific uses. Various methodologies and technologies are used during data profiling to extract metadata, statistical summaries, and data quality indicators. Examining data types, formats, distributions, uniqueness, completeness, and spotting abnormalities or outliers are all part of this process. Profiling can also include determining data dependencies and relationships and finding any data errors or discrepancies. Data profiling provides insights into overall data quality and assists in identifying data gaps, data purification requirements, and prospective data integration difficulties. It facilitates the comprehension of data semantics, the identification of data patterns, and the making of informed decisions concerning data transformation, integration, or migration initiatives.

- Data examination

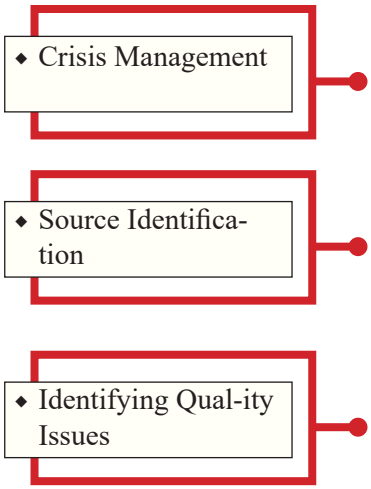
3.1.7.1 Benefits of Data Profiling

i. The tool can assist in removing duplicates after data analysis. It can be used to find pertinent data that could influence business decisions, pinpoint quality issues that exist inside a system, and reach specific inferences about the company's long-term viability.

- Deduplication

ii. Profiled data can be used to avoid minor errors from becoming large problems. It may help illuminate potential consequences for novel situations. Data profiling aids in

- Error Prevention



the creation of a precise snapshot of a company's health to assist in decision making.

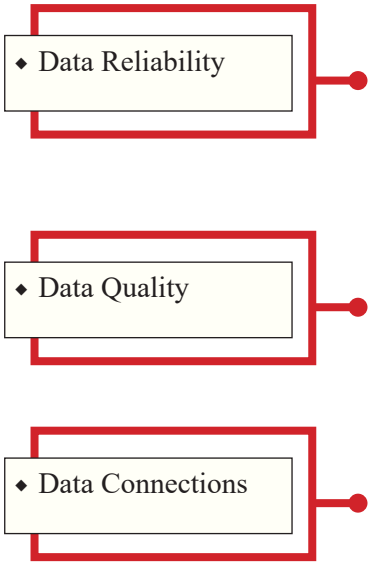
iii. Data profiling helps in proactive crisis management by quickly addressing problems before they arise.

iv. A variety of data sources, such as blogs, social media, and other big data markets, are interacted with by the majority of databases. Profiling can identify the original data source and guarantee secure encryption. After that, a data profiler can examine those many databases, source programmes, or tables to make sure the data complies with predetermined business rules and statistical benchmarks.

v. Data profiling identifies regions in a system where data quality problems, such as data corruption or user input errors, are most prevalent.

3.1.7.2 Different Types of Data Profiling

The following are the three different types of data profiling.



i. **Structure discovery**- Structure analysis verifies that the data you have is accurate and correctly formatted. Structure discovery also looks at the data's simple, fundamental statistics. The reliability of the data can be analysed using statistics such as the minimum and maximum values, medians, modes, means and standard deviations. It is also known as structure discovery.

ii. **Content discovery**-The act of digging deeper into each database component to examine the data's accuracy is known as content discovery. It helps in identifying sections that have null values, inaccurate values, or values that are unclear and thereby focus on quality.

iii. **Relationship discovery**- It entails learning what data is being used and attempting to comprehend the relationships between the data sets. Relationship discovery identifies connections between different data sets.

3.1.8 Data Quality

Data quality is a measure of the condition of data based on factors such as accuracy, completeness, consistency, reliability and whether it's up to date. Measuring data quality levels can help organisations identify data errors that need to be resolved and assess whether the data in their IT systems are fit to serve their intended purpose. Data quality may be defined as the development and implementation of activities that use quality management techniques to ensure data is fit to serve the specific needs

of an organisation in a specific context. Data is considered to be of high quality when it is regarded as suitable for the purpose for which it was collected. Duplicated data, incomplete data, inconsistent data, incorrect data, poorly defined data, poorly organised data, and poor data security are some of the data quality issues. Data quality analysts conduct data quality assessments, assessing and interpreting each individual data quality metric, calculating an aggregated score for the data's overall quality and giving organisations a percentage that represents the accuracy of their data. A low data quality scorecard indicates poor data quality, which is of little value, is misleading and can result in decisions that are detrimental to the organisation.

- Ensure suitability of data

Data quality rules are an essential component of data governance, which is the process of developing and implementing a defined, agreed-upon collection of rules and standards for the governance of all data within an organisation. Effective data governance should harmonise data from multiple sources, create and monitor data usage policies, and eliminate inconsistencies and inaccuracies that would otherwise jeopardise data analytics accuracy and regulatory compliance.

- Data Governance

3.1.8.1 Data Quality Dimensions

Six main dimensions of data quality are as follows:

i. **Accuracy:** The data need to reflect actual, real-world scenarios, and the level of accuracy should be verifiable

ii. **Completeness**: Completeness is a measure of the data's ability to deliver all available required values effectively.

iii. **Consistency:** The uniformity of data, as it moves across networks and applications, is data consistency. The same data values stored in different places must not be in conflict.

iv. **Validity:** Data should be collected in accordance with the established business rules and parameters, and it should also correspond to the appropriate format and fall within the appropriate range.

v. **Uniqueness:** Uniqueness makes sure that none of the values in all of the data sets are the same or overlap. A low uniqueness score can be improved by cleaning up and getting rid of duplicate data.

vi. **Timeliness:** Timely data is data that is available when it is needed. So that data is always readily available and accessible, it may be changed in real time.

Summarised Overview

A data warehouse is a centralised repository that stores integrated and historical data from multiple sources, whereas data marts are data warehouse subsets that focus on specific business processes or departments. Data sources are the origins of data and include databases, files, APIs, and other systems that generate or store data. To ensure compatibility and effective integration, data mapping defines linkages and transformations between data items from various sources. Data staging serves as a temporary storage location for data that is being prepared, converted, and cleansed before it is fed into a data warehouse or data mart. Data integration is the process of combining data from several sources into a single and consistent format, allowing for a full perspective of information. Data profiling is the process of analysing data to determine its quality, structure, consistency, and completeness in order to find anomalies and ensure data accuracy. Data quality, on the other hand, assesses the suitability of data for use, including accuracy, completeness, consistency, reliability, and relevance, all of which are critical for informed decision making and the success of data-driven projects.

Self Assessment Questions

1. What is the primary purpose of a data warehouse in a business context, and how does it differ from a traditional database?
2. How can a data warehouse facilitate the integration of data from various sources, leading to more effective business decision making?
3. Define a data mart and explain how it relates to a data warehouse in terms of data organisation and accessibility.
4. Give an example of a specific scenario where creating a data mart would be beneficial for a company's analytical needs.
5. Describe what data sources are and provide examples of internal and external data sources that organisations can utilise.
6. How can organisations ensure the quality and reliability of data from diverse sources to maintain accurate analytics and reporting?
7. Explain the concept of data mapping and its importance in data integration processes.
8. How does data mapping help ensure that data from different sources can be effectively transformed and merged into a unified format?
9. Define data staging and its role in preparing data for analysis within a data warehouse.
10. How does the process of data staging contribute to data quality and consistency before it is loaded into the analytical environment?

Assignments

1. Identify and describe different types of data sources (e.g., databases, APIs, web scraping) and their relevance in modern data ecosystems.
2. Discuss the challenges and benefits of using external data sources in decision-making processes.
3. Explain the concept of data mapping and its importance in data integration. Provide an example of data mapping in a real-world scenario.
4. Describe the steps involved in creating a data mapping document for a complex data integration project.
5. Compare and contrast ETL (Extract, Transform, Load) and ELT (Extract, Load, Transform) data integration approaches. When is each approach more suitable?
6. Define data profiling and explain its significance in data management. Provide an example of how data profiling can help improve data quality.

Suggested Reading

1. Christian Albright S and Wayne L Winston (2017). *Business Analytics – Data Analysis and Decision Making (6th Edition).* Cengage Learning
2. Albright, C., & Winston, W. L. (2017) *Business Analytics – Data Analysis and Decision Making (6th Edition).* Cengage Learning.
3. Harts, D. (2008). *Microsoft Office 2007 Business Intelligence - Reporting, Analysis, and Measurement from the Desktop*. TATA McGraw-Hill Edition.
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Reference

1. Camm, J. D., Cochran, J. J., Fry, M. J., & Ohlman, J. W.(2015). *Essentials of Business Analytics.* Cengage Learning.
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Space for Learner Engagement for Objective Questions

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Unit 2

Data Modelling

Learning Outcomes

After learning this unit, the learner will be able to:

- know about the database and data management system.
- familiarise with the data model types
- aware of the data modelling techniques.

Background

Data was kept in a hierarchical or network structure in the early days of computer systems, making it difficult to retrieve and manipulate information efficiently. The drawbacks of these architectures became clear as firms grew to rely more heavily on data processing and storage. The relational approach, pioneered by Edgar F. Codd in the 1970s, revolutionised data organisation and management. The relational model introduced the idea of tables, which represented entities and their relationships. This model allowed for more flexible and efficient data storage and retrieval, which led to the creation of database management systems (DBMS). A number of causes contributed to the necessity for data modelling. Firstly, businesses needed a standardised manner to display their data to ensure consistency and understanding across multiple departments and systems. Data modelling enabled the building of conceptual and logical models that captured the entities, attributes, and interactions inside a certain domain. In a retail organisation, for example, data modelling allows for the depiction of entities such as customers, products, and orders, as well as their relationships. This makes inventory management, sales analysis, and customer relationship management easier. Data modelling is critical in the healthcare business for depicting patient records, medical diagnosis, and treatment procedures. This enables efficient data storage, retrieval, and analysis, which leads to better patient care and medical research. The requirement for efficient data organisation, integration, and utilisation across diverse industries drove the birth of data modelling. It offers a structured approach to data representation and management, resulting in better decision making, data consistency, and system compatibility.

Keywords

Database, Data Entity, Data Models, Data Modelling techniques

Discussion

3.2.1 Database

The expanding use of computers significantly impacts databases and database technology. A collection of interconnected data is known as a database. Data are known, documentable facts with concealed significance. A database is a collection of interconnected, semantically significant data. To put it another way, a database contains a source from which data is obtained, some interaction with events occurring in the real world, and a user base that is keenly interested in its contents. A database must accurately reflect the mini world it represents in order for it to always be dependable and accurate; as a result, updates to the database must be made as quickly as possible. A database can be created and updated manually or automatically. A database that can be manually constructed and maintained is a library card catalogue. A database management system or a suite of application programmes made especially for the purpose of creating and maintaining computerised databases can do either.

- Interconnected data

3.2.2 Data Base Management System

A database management system (DBMS) is a collection of software tools that facilitate end users' creation and management of databases. The DBMS is a general-purpose software system which makes it easier for different users and applications to define, build, manipulate, and share databases. Identifying the data types, structures, and restraints of the information that will be stored within a database is the steps involved in establishing a database. The DBMS also keeps a copy of the database definition or summary information. The process of putting the data on a storage medium under the management of the DBMS is known as building the database. A database can be modified by performing operations like querying it to retrieve specific data, updating it to account for changes in the miniature world, and creating reports from the data. Multiple people and programmes can access the same database at once when it is shared. By submitting queries or data requests to the DBMS, an application programme can access the database. Typically, a query results in the retrieval of some data; nevertheless, a transaction may result in some data being read from the database and some data being written there.

- Collection of software tools

3.2.3 Data Entity

- Data entity benefits: Abstraction, Integration, Simplification

A data entity is an abstraction from how database tables are physically implemented. For instance, in normalised tables, the majority of the information for each customer may be kept on a customer table, while the remaining information may be dispersed among a few closely related tables. In this instance, the customer concept's data entity appears as a single denormalised view, where each row includes information from the customer table as well as tables that are related to it. A business notion is captured in a data entity in a way that facilitates development and integration. A data entity's abstract nature can make developing and customising applications easier. When the physical tables inevitably change between versions, the abstraction also shields the application code from it.

3.2.4 Data Entity Capability

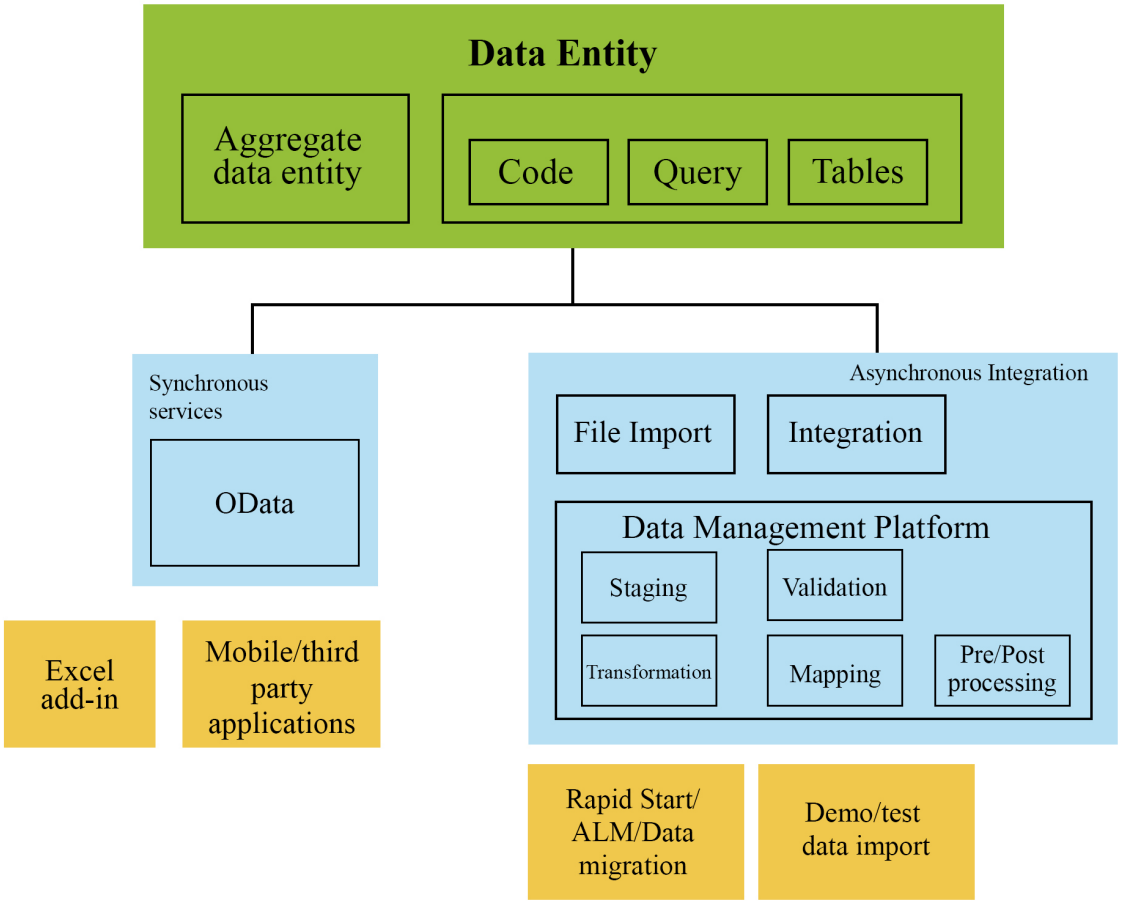

Figure 3.2.1 Data Entity Model

The following abilities are available to a data entity:

i. AXD, Data Import/Export Framework (DIXF) entities, and aggregate queries are all replaced with a single notion, which unifies their disparate and divergent concepts.

ii. It offers a single stack for encoding business logic and enabling import/export, integration, and programmability situations.

iii. It becomes the main method for exporting and importing data packages for demo data scenarios and Application Lifecycle Management (ALM).

iv. It can be made available as OData services, which can then be incorporated into Microsoft Office integrations and scenarios involving synchronous tabular integration.

3.2.5 Cardinality of Relationship

Cardinality of relationship modelling refers to the number of occurrences or instances of one item that can be related to another. It determines the type and diversity of the relationship between entities. The uniqueness of the data values included in a column is referred to as cardinality in the context of databases. High cardinality simply means that a significant portion of the values in the column are completely unique. A column with a low cardinality simply has many "repeats" inside its data range. There are different types of cardinality that can exist between the tables.

- Occurrences or instances

3.2.6 Mapping Cardinality

The number of instances or entities in one entity set that can be connected to the number of instances or entities in another entity set is referred to as mapping cardinality, also known as relationship cardinality. In a data model, it describes the connection between two entity sets. The most frequent way to describe mapping cardinality is through symbols or verbal descriptions.

- Relationship cardinality

3.2.6.1 One-to-One Relationship

Each instance in one entity set is linked to precisely to one instance in another entity set in a one-to-one relationship, and vice versa. It denotes a particular and distinctive connection between the parties involved.

- One to one

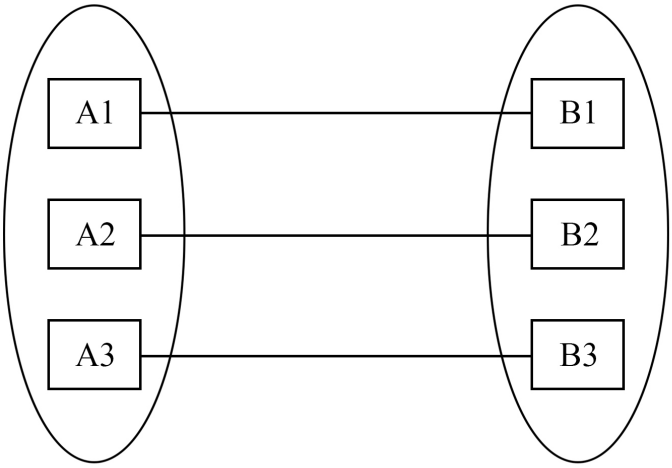

Figure 3.2.2 One-to-one relationship

3.2.6.2 One-to-many Relationship

- One to several instances

When there is a one-to-many relationship between two entity sets, each instance in one set can be linked to several instances in the other set, while each instance in the second set can only be linked to one instance in the first set. It denotes a situation in which various entities that are related to one another exist.

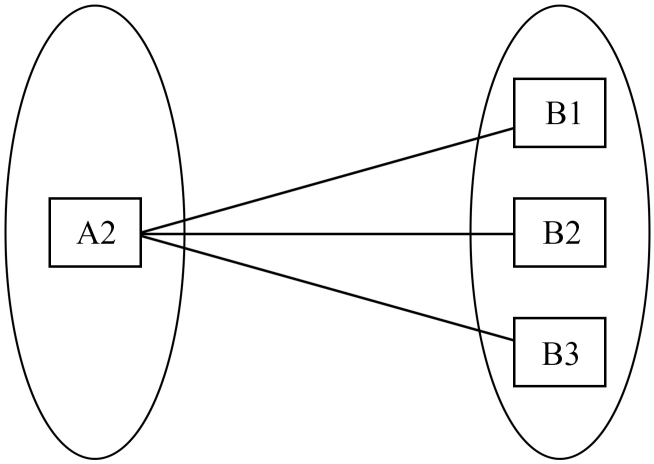

Figure 3.2.3 One-to-many relationship

3.2.6.3 Many-to-one Relationship

- Numerous instances to one

One sort of relationship between two entity sets is a many-to-one relationship, in which numerous instances in one set may be linked to a single instance in the other set. Each instance in the second group, however, can only be connected to a single instance in the first. It symbolises a connection between various entities and a single entity.

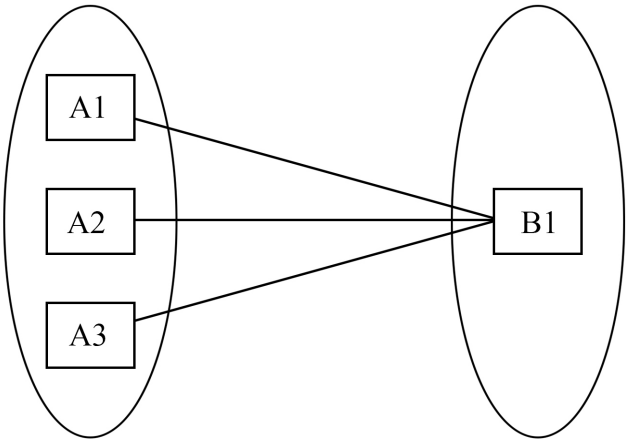

Figure 3.2.4 Many-to-one relationship

3.2.6.4 Many-to-many Relationship

- Association of many instances

An entity set relationship known as a "many-to-many relationship" allows for the association of many instances of one set with numerous instances of the other set. It denotes a complicated relationship in which several elements from both sets may be connected to one another, potentially creating a complex web of links between the constituent elements.

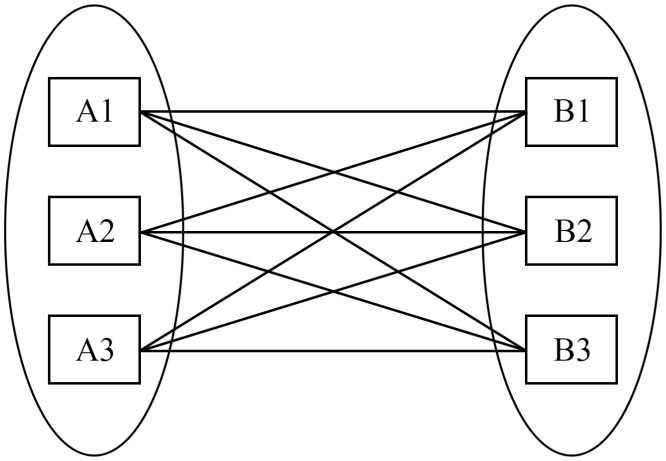

Figure 3.2.5 Many-to-many relationship

3.2.7 Data Models

- Defines database structure

A data model is a group of concepts that can be utilised to define the structure of a database and offers the means to accomplish this abstraction. Database structure refers to the data types, connections, and constraints placed on the data. A collection of basic operations for defining database updates and retrievals is also included in most data models.

3.2.8 Types of Data Models

- Database Model categories

We can categorise the many data models that have been based on the principles they employ to describe the database structure. A good database model highlights the logical structure of databases in terms of their relationship and bottlenecks. There are many kinds of models which are usually diagrammatically represented.

3.2.8.1 Conceptual Data Models

- Domain models

The foundational ideas and semantics of a specific domain are established through conceptual data models, also known as domain models, and they aid in conveying these to numerous stakeholders. Entity-Relationship or Unified Modelling Language (UML) Class models can be used to generate conceptual models in Enterprise Architect, which act as a common language while conducting project analysis.

3.2.8.2 Logical Data Models

- Refinement of concepts

Entity-Relationship or UML Class models can be used to construct logical data models, which provide further depth to conceptual model parts and improve the domain's structure. The advantage of using a logical data model is that it can act as a foundation for the physical data model and subsequent implementation of a database. In order to create a schema or semantic data model of, for instance, a relational database and its needs, entity-relationship modelling is an abstract and conceptual database modelling technique. Entity-Relationship Diagrams are used to illustrate the results (ERDs). With the help of ERDs, you can create conceptual data models and generate Data Definition Language (DDL) for the target DBMS. Using a DDL transformation, a logical model can be converted into a physical data model. Logical data models are a useful tool for defining the detailed structure of the data elements contained within a system as well as the connections that exist between those data elements. They improve the data elements that were initially presented by a conceptual data model and form the foundation for the physical data model. The UML Class notation is often employed if one wishes to represent a logical data model within Enterprise Architect.

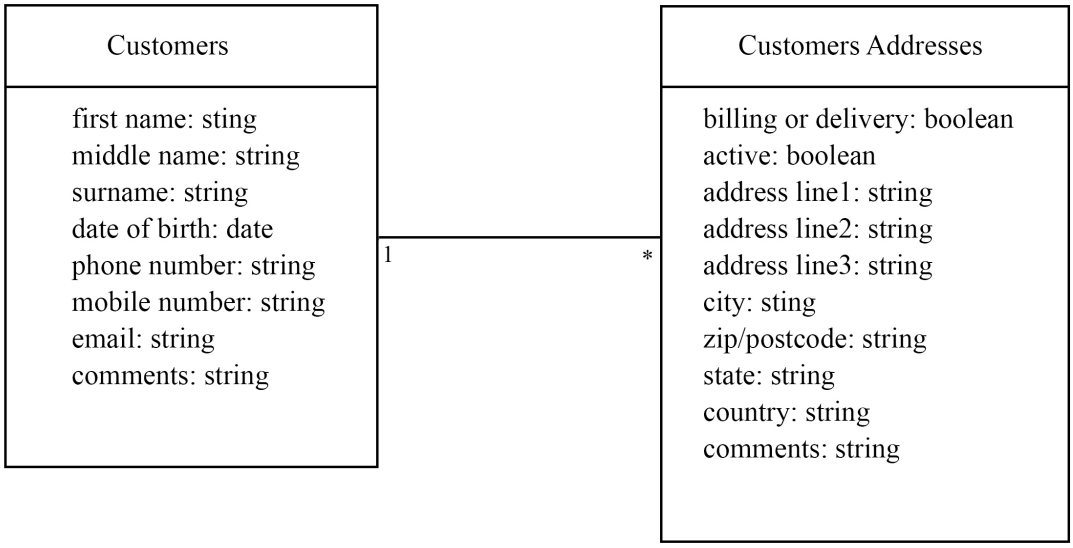

Figure 3.2.8 Logical Data Model

This is a simple example of a Logical data model:

Customers and Customers Addresses data elements include UML attributes; names and generic data types are platform-in-dependent.

3.2.8.3 Physical Data Models

The Physical data model defines platform-specific data types and other meta-data related to a given DBMS implementation. Enterprise Architect's UML Profile for Data Modelling is used expressly for this purpose to help you visualise your database structure and automatically derive the relevant database schema. With the help of the profile, you may model database columns, keys, constraints, indexes, triggers, referential integrity, and other properties of relational databases as well as map database concepts such as tables and relationships onto UML concepts such as classes and associations. To maximise traceability and confirm the accuracy of system implementation, you can simply manage dependencies between each level of abstraction since Enterprise Architect enables you to visualise each type of data model in the same repository. A physical data model is a visual depiction of the data structure offered by a relational database architecture. This is made feasible by the depth of physical data model captures and how closely those elements map to elements of the database design, such as tables, columns, primary keys, and foreign keys.

- Visually represents the structure

3.2.9 Data Modelling Techniques

3.2.9.1 The Hierarchical Data Model

- Hierarchical Data Storage

The hierarchical data model is designed to work with hierarchical data. A tree-structured organisational chart for a firm is one example. Hierarchical data is a type of data format in which objects are linked to one another via parent-child connections in a tree structure. Consider data to be a family tree, with grandparents, parents, children, and grandkids constituting a hierarchical network of linked data. This is typically used to display an organisational chart, a task-based project, or a taxonomy of linguistic concepts. Today, hierarchical data is still commonly employed. A hierarchical data structure is commonly used to store personnel information.

3.2.9.2 The Network Data Model

- Flexible Relationship Representation

The network data model is another technique utilised in a more specific circumstance. It offers a flexible means of representing items and their relationships. When the schema is regarded as a graph, a major feature of this data model is that its object types are nodes, and the interactions form arcs in the graph. The network model is similar to the hierarchical model, but its arcs are not constrained to create a hierarchy. Though it is not widely used in business, the network data model lies at the heart of many mainframe computers established in the early days of computer networking in the 1970s. Most network data model databases are now superseded by relational databases.

3.2.9.3 The Relational Data Model

- Tabular Data Representation

Since its introduction in the late 1970s, the relational data model has been the most extensively used data model. Its distinguishing feature is that data is kept in tables and columns. Each table includes information related to a particular logical object, such as a shop, and the relationship between these tables represents the link between these tables.

3.2.9.4 The Entity-Relationship Data Model

- Relationships between entities

A conceptual modelling method used to express relationships between entities in a database is called the Entity-Relationship (ER) data model. Entities are represented as tables, attributes as columns, and connections between tables are relationships. ER diagrams aid in the visualisation and design of database schemas by illuminating the logical organisation of a database, including entities, attributes, and relationships.

3.2.9.5 The Dimensional Data Model

A version of the relational model is the dimensional data

model. It has attributes and relationships, just like the entity-relationship model. On the other hand, the dimensional data model includes only two major categories of attributes for an entity or table: facts and dimensions. The fact characteristics are dimensions that represent measures of a specific action. A fact, for example, could represent a transaction between a client and a store. Facts are typically numerical data, and fact tables are thoroughly normalised with minimal redundancy. The dimension attributes are stored in tables that also contain the definition of the business item being measured by the fact. Dimensions are typically descriptive and textual rather than numerical. They depict the idea rather than its measurement. In the business intelligence and analytics fields, the dimensional data model is commonly utilised. With a fact table linked to numerous dimensions, it's known as the star schema.

- Fact-Dimension Representation

3.2.10 Normalisation

Normalisation is a method in relational database design that tries to decrease redundancy, improve data integrity, and reduce anomalies. It entails examining relation schemas in terms of functional dependencies and primary keys. Decomposing poor relation schemas into smaller, well-structured relation schemas that meet particular normal form criteria results in normalisation. This procedure helps to reduce insertion, deletion, and update anomalies while also ensuring effective data storage and retrieval. Designers construct a formal framework for analysing relation schemas by normalising the database, defining a set of normal form tests, and determining the highest normal form requirement that each relation meets, representing the degree of normalisation achieved.

- Redundancy Reduction Technique

3.2.11 Practical Use of Normal Forms

The majority of practical design projects obtain existing database designs from earlier designs, designs in legacy models, or existing files. In practise, normalisation is carried out to ensure that the generated designs are of good quality and fulfil the previously indicated desirable qualities. Although various higher normal forms, such as the 4NF and 5NF, have been created, their practical utility becomes doubtful when the constraints on which they are based are rare and difficult to grasp or detect by the database designers and users who must uncover these constraints. As a result, database architecture in industry nowadays focuses on normalisation only up to 3NF, BCNF, or at most 4NF.

- Practical Normalization limits

3.2.11.1 First Normal Form

- Atomic values

It states that the domain of an attribute must include only atomic (simple, indivisible) values and that the value of any attribute in a tuple must be a single value from the domain of that attribute. Hence, 1NF disallows having a set of values, a tuple of values, or a combination of both as an attribute value for a single tuple. In other words, 1NF disallows relations within relations or relations as attribute values within tuples. The only attribute values permitted by 1NF are single atomic (or indivisible) values.

3.2.11.2 Second Normal Form

- Composite primary keys

The principle of full functional dependency underpins the second normal form (2NF). According to the concept of the second normal form, only tables with composite primary keys can be in 1NF but not in 2NF. If a relational table is in 1NF and every non-key column is completely dependent on the primary key, it is in second normal form 2NF. That is, every non-key column must be dependent on the primary key as a whole.

3.2.11.3 Third Normal Form

- Transitive reliance

The principle of transitive reliance underpins the third normal form (3NF). According to the third normal form, all columns in a relational table must be dependent solely on the primary key. A relational table is in third normal form (3NF) if it is already in 2NF and every non-key column is not transitively reliant on its main key. In other words, all non-key attributes rely solely on the primary key for functionality. According to Codd's original definition, a relation schema R is in 3NF if it satisfies 2NF and no nonprime attribute of R is transitively dependent on the primary key.

3.2.11.4 Fourth Normal Form

- Multivalued interdependence

If a relational table is in BCNF, it is in the fourth normal form (4NF), and all multivalued relationships are also functional dependencies. The concept of multivalued interdependence underpins the fourth normal form (4NF) (MVD). When a relational table has at least three columns and one column has multiple rows whose values match a single row in one of the other columns, this is called a "multivalued dependency."

3.2.11.5 Fifth Normal Form

- Join dependence

A table is in the fifth normal form (5NF) if it can't be broken up into any number of smaller tables without losing information. The first four normal forms are based on the idea of functional dependence, but the fifth normal form is based on the idea of join dependence. Join dependency means that after a table has been split into three or smaller tables, they must be able to be put back

together again using their common keys. In other words, 5NF shows when an entity can't be broken down any further. 5NF is hard to understand and not simple.

3.2.12 Star Schema

A star schema is a multi-dimensional data model that is used to arrange data in a database so that it may be easily understood and analysed. Data marts, databases, data warehouses, and other technologies can all use star schemas. Data warehouses, databases, data marts, and other technologies can all benefit from star schemas. The star schema style is ideal for querying massive amounts of data. By eliminating the duplication of repetitious business definitions, star schemas are efficient at storing data, maintaining history, and updating data, making it quick to aggregate and filter data in the data warehouse.

- Arrange data in a database

Fact tables and dimension tables

Business data is demoralised into facts and dimensions (such time and product) using a star schema. A star schema has a single fact table in the centre, containing business "facts". A number of other dimension tables are connected to the fact table along "dimensions" like time or product. By linking two or more fact tables and dimension tables together, star schemas allow users to slice and dice the data anyway they see appropriate.

- Fact-Centric Data Analysis

3.2.12.1 Benefits of Star Schemas

i. Simplicity and ease of understanding

Star schemas have a clear and intuitive structure that makes them easy to learn and traverse. The central fact table is surrounded by dimension tables, forming a visual representation that resembles a star. This ease of use simplifies data analysis and query formulation.

- Easy to learn and traverse

ii. Improved query performance

In comparison to more sophisticated schemas such as snowflake schemas, star schemas often involve fewer tables and easier join requirements. Because the database engine has fewer associations to explore, query performance improves.

- Enhanced Retrieval Speed

iii. Enhanced analytical capabilities

Star schemas help to make analytical procedures like slicing and dicing, drill-down, roll-up, and complex aggregations more efficient and effective. These features allow users to effortlessly

- Effortlessly explore data

explore data from many dimensions, do in-depth research, and acquire useful insights.

iv. Flexibility and scalability

- Adaptable and scalable

Star schemas are extremely adaptable and scalable. New dimensions can be simply added to the schema without disrupting the existing structure, allowing for the inclusion of new data sources and properties. Because of this adaptability, star schemas are well suited to changing business requirements.

3.2.13 Snowflake Schema

- Logical sub dimensions

A snowflake schema is a multi-dimensional data model that is an extension of a star schema in which dimension tables are divided into sub dimensions. Snowflake schemas are commonly used for business intelligence and reporting in OLAP data warehouses, data marts, and relational databases. In a snowflake schema, engineers break down individual dimension tables into logical sub dimensions. This complicates the data model, but it may be easier for analysts to deal with, especially for specific data kinds. It is termed a snowflake schema because its entity-relationship diagram (ERD) resembles a snowflake.

3.2.13.1 Benefits of Snowflake Schemas

i. Normalised data structure

- Normalisation

Snowflake schemas use normalisation, which eliminates data redundancy by spreading dimensions over numerous tables. This normalisation improves data consistency and eliminates update anomalies, leading to greater data integrity.

ii. Space efficiency

- Compact Structure Layout

Snowflake schemas are more space-efficient than star schemas. Normalising dimension tables eliminates repetitive data, resulting in reduced table sizes and better storage utilisation.

iii. Flexibility in dimension hierarchies

- Adaptive Dimension Hierarchies

Snowflake schemas provide dimension hierarchy flexibility. In contrast to star schemas, which often confine hierarchies to a single dimension database, snowflake schemas can handle complex and varied hierarchies across numerous normalised dimension tables.

iv. Simplified data maintenance

Updating dimension attributes in snowflake schemas needs only changes to the dimension table, as opposed to updating many entries in a denormalised structure. This decreases the likelihood of discrepancies and streamlines data maintenance responsibilities.

- Streamlined Maintenance

3.2.14 Fact Constellation Schema

The Fact Constellation Schema represents a multidimensional model of tables. This schema is a collection of distinct fact tables with a few-dimensional tables in common. It is also known as a Galaxy schema since it can be depicted as a set of several star schemas. The fact schema is the most commonly used schema for designing a data warehouse, and it is also slightly more difficult than the star and snowflake schema models. Fact constellation schema is an online analytical processing tool with a large number of fact tables that share dimension tables and are aggregated as a group of stars. It is often referred to as an extension of the star constellation model.

- Streamlined Maintenance Process

Summarised Overview

A database is a structured collection of data that is organised and saved with the help of a Database Management System (DBMS). The database management system (DBMS) provides tools and functionalities for effective data management, storage, retrieval, and transformation. Data entities represent distinct items or concepts in the actual world within a database, and the cardinality of relationships specifies the number of occurrences between entities. Various data models, such as hierarchical, network, relational, object-oriented, and document-based models, are used to organise and arrange data within a database. To establish a conceptual representation of the database system, data modelling approaches such as entity-relationship modelling, UML, and dimensional modelling are used. By decreasing redundancy and eliminating abnormalities, the normalisation process maintains data integrity and efficiency. Star schema is a prominent data warehousing modelling strategy that organises data around a primary fact table and many dimension tables. The snowflake schema is an expansion of the star schema that includes further normalisation of dimension tables. By sharing dimension tables across several fact tables, the fact constellation schema enables more flexible interactions between data components. Databases can be properly created and managed by comprehending these ideas and utilising relevant strategies, allowing for efficient data storage, retrieval, and analysis.

Self Assessment Questions

1. What is a database, and how does it differ from a spreadsheet or a flat file?
2. How can a well-structured database enhance data storage, organisation, and retrieval for businesses?
3. Define a DBMS and explain its role in managing data within an organisation.
4. How does a DBMS contribute to ensuring data integrity, security, and efficient data manipulation?
5. Describe the concept of a data entity and provide an example of a data entity in a business context.
6. How does identifying data entities help in designing a structured and organised database schema?
7. What does the cardinality of relationship refer to in a database context, and how does it influence data relationships?
8. Provide an example of a business scenario where different levels of cardinality (one-to-one, one-to-many, many-to-many) are relevant for designing database relationships.

Assignments

1. Create the star schema diagram and explain how it can facilitate efficient data analysis and reporting for sales-related queries.
2. Choose a specific modelling technique, such as UML (Unified Modelling Language) or ER (Entity-Relationship) modelling. Apply the selected technique to design a data model for a library management system.
3. Compare two different types of data models, such as hierarchical and object-oriented models

Suggested Reading

1. Christian Albright S and Wayne L Winston (2017). *Business Analytics – Data Analysis and Decision Making (6th Edition).* Cengage Learning
2. Albright, C., & Winston, W. L. (2017) *Business Analytics – Data Analysis and Decision Making (6th Edition).* Cengage Learning.
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04 BLOCK

ENTERPRISE REPORTING

Content

Unit 1

Reporting Perspective

Learning Outcomes

After learning this unit, the learner will be able to:

- familiarise enterprise reporting and its historical evolution
- recognise the benefit of enterprise reporting
- identify the reporting characteristics

Background

In the past, businesses relied on fragmented and department-specific reporting systems, which often resulted in data silos and limited visibility across the entire enterprise. This fragmented approach made it difficult for decision makers to access and analyse data effectively, hindering their ability to make informed decisions. The advent of technology and the exponential growth of data in the business environment necessitated a shift towards a more integrated and holistic reporting approach. Organisations realised the need to consolidate data from various sources, break down data silos, and provide decision makers with a comprehensive view of their operations. The emergence of enterprise reporting can be attributed to several key factors. First, advancements in information technology enabled organisations to capture, store, and process vast amounts of data. This technology provided the infrastructure needed to integrate data from multiple systems and sources, creating a unified view of the enterprise. Second, the increasing competition and global nature of business required organisations to make data-driven decisions quickly and accurately. Enterprise reporting became essential for monitoring key performance indicators, identifying operational inefficiencies, and uncovering growth opportunities. Moreover, regulatory requirements and compliance standards compelled organisations to establish robust reporting mechanisms. Enterprise reporting became crucial for maintaining transparency, accountability, and regulatory compliance. Prior knowledge in areas such as data management, data analysis, and reporting practices laid the foundation for the development of enterprise reporting. This knowledge encompassed techniques for data extraction, transformation, and loading (ETL), data modelling, and visualisation. The concept of enterprise reporting arose from the need to overcome the limitations of fragmented reporting systems and leverage the power of integrated data. It emerged as a response to technological advancements, increasing competition, and regulatory demands. By providing a comprehensive and unified view of an organisation's data, enterprise reporting empowers decision makers to make informed choices and drive business success.

Keywords

Enterprise/Business Reporting, Data Visualisation

Discussion

4.1.1 Introduction

Decision makers are in need of information to make accurate and timely decisions. Information is essentially the contextualisation of data. Information is often provided in the form of a written report (digital or on paper), although it can also be provided orally. Simply put, a report is any communication artefact prepared with the specific intention of conveying information in a presentable form to whoever needs it, whenever and wherever they may need it. It is usually a document that contains information (usually driven from data and personal experiences) organised in a narrative, graphic, and/or tabular form, prepared periodically (recurring) or on an as-required (ad-hoc) basis, referring to specific time periods, events, occurrences, or subjects. In business settings, types of reports include memos, minutes, sales reports, progress reports, justification reports, compliance reports, annual reports, and policies and procedures. Reports can fulfil many different (but often related) functions.

- Information Delivery

Here are a few of the most prevailing ones:

- To ensure that all departments are functioning properly
- To provide information
- To provide the results of an analysis
- To persuade others to act
- To create an organisational memory (as part of a knowledge management system)

4.1.2 Business Report

A business report is a written document that contains information regarding business matters. Business reporting (also called enterprise reporting) is an essential part of the larger drive toward improved managerial decision making and organisational knowledge management. The foundation of these reports is

- Enterprise reporting

various sources of data coming from both inside and outside the organisation. Due to the expansion of information technology coupled with the need for improved competitiveness in businesses, there has been an increase in the use of computing power to produce unified reports that join different views of the enterprise in one place. Usually, this reporting process involves querying structured data sources, most of which are created by using different logical data models and data dictionaries to produce a human-readable easily digestible report. These types of business reports allow managers and co-workers to stay informed and involved, review options and alternatives, and make informed decisions.

The role of business reporting in managerial decision making

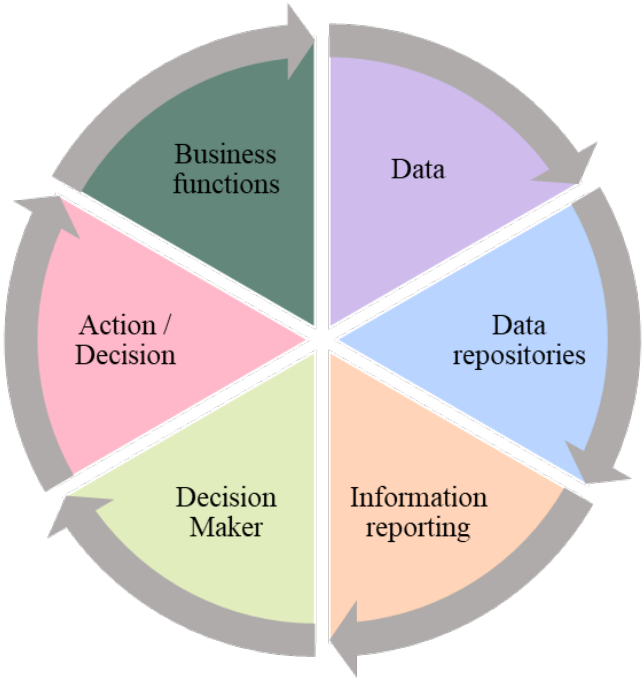


Figure 4.1.1 Decision making

Figure 4.1.1 shows the continuous cycle of managerial decision making. Perhaps the most critical task in this cycle process is the reporting (i.e. information generation)—converting data from different sources into actionable information.

The key to any successful report is clarity, brevity, completeness, and correctness. In terms of content and format, there are only a few categories of business reports: informal, formal, and short. Informal reports are usually up to 10 pages long; are routine and internal; follow a letter or memo format; and use personal pronouns or contractions. Formal reports are 10 to 100 pages long; do not use personal pronouns or contractions; in-

clude a title page, table of contents, and an executive summary; are based on deep research or an analytic study; and are distributed to external or internal people with a need-to-know designation. Short reports are to inform people about events or system status changes and are often periodic, investigative, compliance and situational focused. The nature of the report also changes significantly based on whom the report is created for. Most of the research in effective reporting is dedicated to internal reports that inform stakeholders and decision makers within the organisation. There are also external reports between businesses and the government (e.g. For tax purposes or for regular filings to the SEBI). These formal reports are mostly standardised and periodically field either nationally or internationally.

- Formal, Informal, internal and External reports

Standard Business Reporting, which is a collection of international programs by a number of governments aims to reduce the regulatory burden for businesses by simplifying and standardising reporting requirements. The idea is to make business the epicentre when it comes to managing business-to-government reporting obligations. Businesses conduct their financial administration; the facts they record and the decisions they make should drive their reporting. The government should be able to receive and process the information without imposing undue constraints on how businesses administer their finances.

- Simplify and standardise reporting requirements

4.1.3 Enterprise Reporting

Enterprise reporting is the creation and distribution of reports concerning business performance to key decision makers in an organisation. This may include reports on metrics on key performance indicators or information curated for day-to-day activities. Enterprise reporting provides users with a comprehensive view of the business and its performance at a high level with metrics, dashboards, graphs, and other user-friendly business intelligence tools. Large enterprises and corporations often utilise internal data in order to gain insight into how the company is performing as a whole. Data analysis can include anything from the company's annual revenue to the business expenses of one single department. Business intelligence tools can then turn this information into self-explanatory reports that help owners and other invested stakeholders make better business decisions. Enterprise reporting can also be utilised to analyse various trends within an organisation. Enterprise reporting is the regular provision of information to decision makers within an organisation to support them in their work. These reports can take the form of graphs, text and tables and, typically, are disseminated through an intranet as a set of regularly updated web pages.

- insights into business performance

4.1.3.1 Types of Enterprise Reporting

Enterprise reporting refers to a variety of reports that provide insights and information to help organisations make decisions. Here are some examples of common forms of enterprise reporting.

- Financial health

i. **Financial reports:** Financial reports, which include income statements, balance sheets, cash flow statements, and financial ratios, which focus on the organisation's financial health. They give important stakeholders with a summary of the company's financial performance.

- Operational efficiency

ii. **Operational reports:** Operational reports look into the operational components of the business, such as production reports, inventory reports, quality control reports, and performance reports for individual departments or processes. They aid in monitoring and improving operational efficiency.

- Sales pattern, market insight

iii. **Sales and marketing reports:** These reports analyse sales patterns, consumer behaviour, market insights, and the success of marketing campaigns. They aid in the optimisation of sales and marketing tactics, the identification of growth prospects, and the tracking of client satisfaction.

- Talent management

iv. **HR reports**: These reports provide information about human resources, such as employee demographics, workforce planning, recruitment and retention metrics, training and development reports, and performance assessments. They aid in human resource decision making and talent management.

- Succinct review

v. **Executive summary reports**: Executive summary reports provide a succinct review of the organisation's performance, including significant indicators, accomplishments, issues, and strategic recommendations. They are intended for high-level decision makers who are in need of high-level information.

- Actionable insights

vi. **Business intelligence reports**: These reports use data analytics and visualisation techniques to give actionable insights from a variety of data sources. They include interactive dashboards, data visualisations, and ad hoc analysis reports, all of which aid in data-driven decision making.

- Regulatory compliance

vii. **Compliance and regulatory reports**: These reports assure adherence to industry-specific legal and regulatory standards. Reports on regulatory filings, audit trails, risk assessments, compliance status, and internal controls are among them.

viii. **Project management reports**: These reports keep track

of ongoing projects' progress, money, and resources. They contain project status reports, milestone tracking, resource allocation reports, and project financials, all of which help with project management and decision making.

- Project Progress Monitoring

ix. **Customer reports**: These reports concentrate on data connected to customers, such as customer satisfaction surveys, feedback analysis, and customer segmentation. They aid in the identification of client preferences, the enhancement of the customer experience, and the development of marketing strategies.

- Customer Data Analysis

x. **Reports on trend analysis:** These reports examine historical data to detect trends and patterns within the organisation. They enhance long-term planning and decision making by providing insights into areas like sales trends, production trends, customer behaviour, and market trends.

- Historical Trend Analysis

4.1.4 Benefits of Enterprise Reporting

Design and deliver large volumes of reports to a business and customers in any format: from printed documents and PDFs to fully interactive reports on the web. End-users can interact with the reports or build reports of their own. With enterprise reporting software, one can easily and affordably scale reporting to thousands of users.

- Report Delivery

i. Enterprise reporting provides key decision-makers with a holistic view of the business, enabling them to make more informed and timely decisions. By tracking key performance indicators (KPIs) and other metrics across all departments and functions, enterprise reporting can help organizations identify trends, patterns, and opportunities that may not be visible from a siloed perspective.

- Improved decision-making

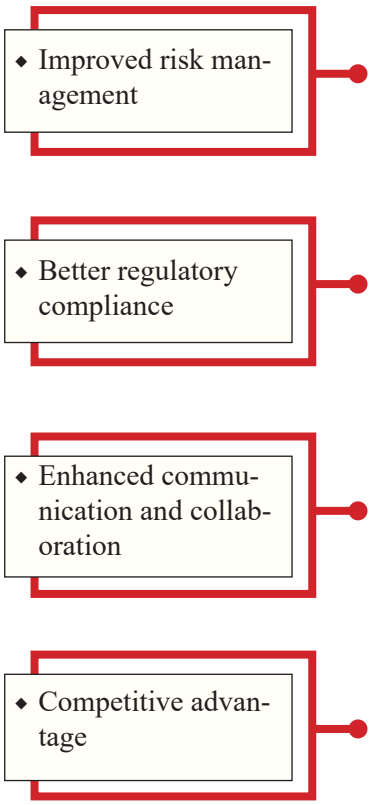
ii. Enterprise reporting can help organizations to streamline their operations and improve efficiency by automating manual reporting processes and providing self-service capabilities to users. This can free up employees to focus on more strategic tasks, and can also help to reduce the risk of errors.

- Increased efficiency and productivity

iii. Enterprise reporting can help organizations to improve transparency and accountability by providing clear and concise insights into performance at all levels of the organization. This can help to foster a culture of trust and collaboration, and can also help to identify and address any areas of underperformance.

- Enhanced transparency and accountability

iv. Enterprise reporting can help organizations to identify and mitigate risks by providing insights into areas of exposure.



For example, enterprise reporting can be used to track sales trends, identify customer churn, and monitor inventory levels. This information can then be used to develop strategies to reduce the impact of potential risks.

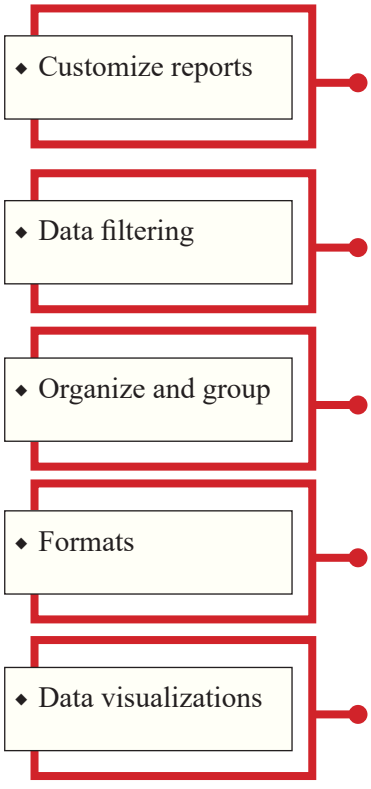
v. Enterprise reporting can help organizations to comply with a variety of regulations by providing auditable records of performance. For example, enterprise reporting can be used to track financial data, environmental impact, and customer data. This information can then be used to generate reports that meet the requirements of regulatory bodies.

vi. Enterprise reporting can help to improve communication and collaboration across the organization by providing a common platform for sharing information and insights. This can help to break down silos and promote a more cohesive and effective workforce.

vii. Enterprise reporting can help organizations to gain a competitive advantage by providing them with insights into their own performance and the performance of their competitors. This information can be used to develop strategies to improve products and services, increase market share, and reduce costs.

4.1.5 Characteristics of Enterprise Reporting

There are many characteristics that quality enterprise reporting tools possess. Some of these include



- **Perfect formatting:** Reporting solutions can customise reports so they can be printed or viewed from a presentation platform, whether that be online or through PowerPoint.
- **Data filtering & sorting**: Users can filter through data and then choose what they want to utilise for a report. Users can sort data by date, time frame, location, franchise, etc.
- **Data grouping**: Once the data has been filtered and sorted, enterprise reporting tools organise and group it so the user can see specific trends
- **Different report images:** Reports can be displayed in different formats. Some of these include jpeg and png. The user can discern which format to save the data in and choose accordingly.
- **Charts:** Enterprise reporting provides data visualisations in the form of charts, graphs, columns, meter charts, bubble charts, and more. The user can decide which type of chart is

most appropriate for the extrapolated data.

- **Report delivery:** Reports can be delivered to emails, dashboards, and websites in different languages and formats
- **Field explorer:** Data can be divided into fields or general categories that describe each set of data. For example, a field might be the names of employees or each year of business operation. The field explorer feature gives a list of all relevant fields and allows users to arrange them on the dashboard.
- **Customisable templates:** Users can make customised report templates if they find themselves frequently utilising a specific report type. They can save this template so it doesn't have to be re-created in the future.
- **Report exporting:** Reports can be exported in the form of PDF, Microsoft Workbook, HTML, Microsoft Excel, and more
- **Sub reports:** Sub reports display a smaller report inside of a larger one. Enterprise reporting solutions allow users to create sub reports of data that receives parameters from parent reports.

- Multilingual Delivery Options
- Data Organization
- Personalized Report Templates
- Multiple Export Formats
- Nested Reporting Functionality

4.1.6 Standardisation and Presentation Practices

Enterprise reporting requires standardisation and presenting practices to promote uniformity, clarity, and successful information transmission. These practices allow stakeholders to easily evaluate data and make educated decisions based on it. Here are some major factors for enterprise reporting standardisation and presentation.

- Standardization benefits

Standardised reporting framework: Establishing a standardised reporting system is critical. It aids in the consistent definition of report structure, format, and content throughout the organisation. This framework should define the reporting elements, metrics, and data sources that will be used consistently.

- Reporting system

Clear report structure: A well-structured report is easy to navigate and understand. It should include components such as an executive summary, important results, analysis, and recommendations. This allows readers to rapidly find the information they require.

- well-structured report

Consistent terminology: Standardising vocabulary and concepts throughout reports ensure that the information presented

- Terminology Standardization

is understood by all. This is especially true when employing key performance indicators (KPIs) or industry-specific measures. Terminology consistency lowers confusion and improves effective decision making.

- Visual Enhancement

Visual elements: Visual elements such as charts, graphs, and tables improve data presentation. Make use of graphics that effectively express the intended message. To enhance interpretation, consider utilising colour coding, annotations, or trend indicators. Presentations that are clear and visually appealing increase engagement and knowledge.

- Interactive Dashboards

User-friendly dashboards: Interactive dashboards provide a full picture of key metrics and allow users to dynamically explore data. Create dashboards with an easy-to-use interface, simple navigation, and customisable functionality. To acquire deeper insights, users should be able to drill down into individual data or alter parameters.

- Data Validation

Accuracy and quality assurance: Implement rigorous data validation methods to verify the accuracy and reliability of reported data. Perform data quality checks, reconcile discrepancies, and document data sources and transformations utilised in reporting. Quality assurance practices are critical for ensuring the accuracy of the reported data.

4.1.7 Ad Hoc Analyses

- Visual reports on demand

Ad hoc analysis is a business intelligence (BI) process designed to answer a specific business question by using company data from various sources. A report helps stakeholders assess an event and formulate actionable next steps. With ad hoc analysis, users can extract the insight they need to make better business decisions without having to involve the IT department. Typically, an ad hoc report is more visual than a standard data report, making it easy for a non-technical audience to understand and utilise. Ad hoc analysis is performed by business users on an as-needed basis to address data analysis needs not met by the business's static, regular reporting. The benefits of self-service BI conducted by ad hoc analysis tools include the following.

- Comprehensive Analytical Support

i. Customisability

Ad hoc analysis tools provide enterprise data analytics across the organisation, supporting a variety of niche business needs and feature customisable reports to meet the specific needs of users. Many BI solutions also provide templates for easier adoption, limiting data intake to only what is needed. For more advanced users, SQL queries enable a

more granular experience, selecting specific business data for reports.

ii. Ease of use

Most data exploration BI tools are user-friendly and are built with the non-technical user in mind. The interfaces and dashboards are intuitive and simplify data analysis through a single-use report.

- User-friendly

iii. Reduces the IT workload

Ad hoc reporting tools for self-service business intelligence allow users to create timely and tailored reports. This speeds up decision making and response times to business queries.

- Timely and tailored reports

iv. Saves time and financial resources

The intuitive functionality of ad hoc analysis tools eliminates the need for developers to help with queries and create reports. This saves the business money and allows IT teams to focus on other tasks.

- Time saving

4.1.8 Data Mining

Data mining is a process used by companies to turn raw data into useful information. By using software to look for patterns in large batches of data, businesses can learn more about their customers to develop more effective marketing strategies, increase sales and decrease costs. Data mining depends on effective data collection, warehousing, and computer processing. Data mining involves exploring and analysing large blocks of information to glean meaningful patterns and trends. It can be used in a variety of ways, such as database marketing, credit risk management, fraud detection, spam Email filtering, or even to discern the sentiment or opinion of users. The data mining process breaks down into five steps. First, organisations collect data and load it into their data warehouses. Next, they store and manage the data, either on in-house servers or the cloud. Business analysts, management teams, and information technology professionals access the data and determine how they want to organise it. Then, application software sorts the data based on the user's results, and finally, the end-user presents the data in an easy-to-share format, such as a graph or table.

- Raw data into valuable insights

4.1.9 Data and Information Visualisation

Data visualisation (or more appropriately, information visualisation) has been defined as "the use of visual representations to explore, make sense of, and communicate data". Although the name that is commonly used is data visualisation, usually

- Visual Representation

what is meant by this is information visualisation. Since information is the aggregation, summarisations and contextualization of data (raw facts), what is portrayed in visualisations is the information and not the data. Data visualisation is closely related to the fields of information graphics, information visualisation, scientific visualisation, and statistical graphics. Until recently, the major forms of data visualisation available in both business intelligence applications has included charts and graphs, as well as other types of visual elements used to create scorecards and dashboards.

Summarised Overview

A business report is a detailed document that delivers facts and information about a company's performance while emphasising key metrics and insights. It is a decision making tool that gives stakeholders a clear picture of the organisation's activities. The systematic process of acquiring, analysing, and presenting data from diverse sources within an organisation is referred to as enterprise reporting. It enables businesses to develop comprehensive reports that include several areas such as finance, operations, and management, offering a full picture of the enterprise's performance. Financial reporting, operational reporting, executive reporting, and regulatory reporting are all examples of enterprise reporting. Each category focuses on a different part of the organisation, such as financial statements, operational indicators, strategic goals, and industry compliance. The advantages of enterprise reporting are numerous, including greater insight into organisational performance, enhanced strategic planning, informed decision making, and the ability to spot trends and patterns through data analysis. It enables organisations to make data-driven decisions, optimise operations, and achieve their objectives more effectively. Enterprise reporting characteristics include data accuracy, dependability, timeliness, and relevance. It guarantees that information is reliable, up to date, and consistent with the organisation's goals, allowing stakeholders to make educated decisions based on credible insights. Enterprise reporting requires standardisation and presenting practises to ensure consistency and promote greater understanding. Organisations may guarantee that information is presented consistently across multiple reports by adopting standardised formats, data definitions, and reporting protocols. This allows for easy comparison and analysis. Data mining is critical in enterprise reporting because it extracts relevant patterns, trends, and insights from huge amounts of data. It entails the application of advanced analytical tools to uncover hidden links and provide valuable information for decision making, allowing organisations to acquire actionable insights and achieve a competitive advantage in the market.

Self Assessment Questions

1. Define a business report and explain its significance in conveying information within an organisation.
2. How does the structure of a business report typically differ from other forms of communication, such as emails or presentations?
3. Describe what enterprise reporting entails and provide examples of the types of information commonly covered in such reports.
4. How can enterprise reporting contribute to strategic decision making and performance assessment at various levels of an organisation?
5. Explain the importance of standardisation in data presentation and reporting within a company.
6. How can adopting standardised presentation practices enhance clarity and comprehension of data-driven information?
7. Define ad hoc analyses and describe their role in responding to specific business questions or challenges.
8. Provide an example of when an ad hoc analysis might be more appropriate than a predefined report in addressing a unique business situation

Assignments

1. Discuss how enterprise reporting is helpful to an organisation internally and externally?
2. Select a complex social issue or a global challenge (e.g., climate change, income inequality, public health) and collect relevant data from credible sources. Use data visualisation techniques to create a series of visualisations that tell a compelling story about the issue.
3. Choose a dataset of your choice (e.g., weather data, population statistics, sports statistics) and create a compelling data visualisation that effectively communicates key insights from the data.

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Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

Unit 2

Business Performance Measurement Tools

Learning Outcomes

After learning this unit, the learners will be able to gain awareness on the:

- concept of Balanced scorecard
- elements of Balanced scorecard
- meaning and benefits of Dashboard

Background

The success of any organisation depends on the constant evaluation of the actions that are taken by the organisation to reach its objectives. In the present era, as there is much uncertainty in the business environment, it is essential for any organisation to constantly evaluate its actions to counter the dynamic forces. Measuring companies' performance is important. Traditionally, financial indicators are used to measure a company's performance. Mostly it is visible in the balance sheet of the company, i.e. Land, building, Machines, Cash etc. But a company's success doesn't primarily rely on the success of financial or physical assets. There are some other aspects like the quality of its customers, the efficiency of the work processes, the skills of its employee etc., are contributing to the success of the company. These important aspects are not ever shown in the balance sheet of the company. All companies have yet to continue the same performance evaluation based only on financial indicators. Furthermore, there arises the need to identify and evaluate based on other indicators rather than financial indicators. A business performance measurement tool is a performance evaluation and management-control instrument that can be crucial in helping businesses achieve their sustainability objectives. Some organisations restrict business performance measurement only to the measurement of the financial aspects of the business organisation. Measurement of the financial aspects, as well as the non-financial aspects, is required to reflect the true picture with regard to the performance of a business organisation. The present unit deals with the various business performance measurement tools such as Balanced scorecard, Dashboards and so forth.

Keywords

Balanced scorecard, Key Performance Indicators (KPIs), Performance Objectives, Dashboard

Discussion

4.2.1 Key Performance Indicators (KPIs)

The success of any organisation depends on the constant evaluation of the actions that the organisation takes to reach its objectives. In the present era, as there is much uncertainty in the business environment, it is essential for any organisation to constantly evaluate its actions to counter the dynamic forces. Business performance tools are essential for organisations to successfully assess, evaluate, and improve their performance. These tools include a wide range of strategies and methodologies that allow firms to monitor key metrics, identify areas for improvement, and make educated decisions.

- Business performance tools

As various organisations are competing for same set of customers which results in immense competitive environment, the organisation needs to constantly evaluate its performance so as to counter the competitive forces. There is no room for complacency as organisations cannot afford it. Rather, to survive in the present time, organisations need to be proactive. Every organisation needs to constantly change its strategy/actions so as to handle the intense competition. To overcome this situation, organisations are applying KPIs, i.e., key performance indicators, based on metrics, which help to measure the performance of the organisation. But, it is very important to note that all KPIs are metrics, but all metrics are not KPIs. As metric means quantifiable indicator, KPIs are those quantifiable indicators which help to measure the performance of the organisation. That is why all KPIs are metrics, but only those metrics are KPIs which measure the specific business objectives, and hence, it is very important that appropriate metrics should be selected for KPIs so that the overall objectives of an organisation can be quantified.

- Quantifiable metrics to measure performance

4.2.1.1 Characteristics of KPI

The KPIs have specific characteristics, which are listed below:

i. **Metric based**: As KPIs should measure the progress of the organisation towards its goals; hence, KPIs are based on metrics. But, it should be noted that all KPIs are based on metrics, but all metrics are not KPI because only those metrics are KPIs which help in measuring the business objectives of an organisation.

- KPIs and Metrics

ii. **Reflection of top management thinking**: As the KPIs are based on overall objectives, it is evident that the top management plays a very important role in defining the KPIs.

- Management's Role

The overall objectives are defined by the top management and to measure the performance of the organisation based on the overall objectives, KPIs are also framed by active involvement of the top management because any mistake in defining the KPIs will result in the erroneous measurement of the performance. Moreover, the involvement of the top management also sends a positive signal to all the managers that KPIs are very important for measuring progress of organisation towards its overall objective.

- Performance Measurement

iii. **Information**: KPIs are meant to measure the actual performance of the organisation. Hence, it is imperative that KPIs should give exact information about the performance of an organisation based on the actions taken by the organisation to reach its goals. Once the organisation sets the objective, the next important task is the implementation of specific actions based on analytics so as to reach the overall objectives, but it is also critical to constantly evaluate its actions. Moreover, the constant competition and dynamic environment often force organisation to change its actions. The KPIs should give exact information regarding the performance of each and every action taken by the organisation so that future strategies/actions can be formulated.

- Objective Accountability

iv. **Simple**: KPIs are based on the overall objectives of an organisation for constant evaluation of the performance of an organisation. It is also possible to fix the accountability of various managers applying KPIs. KPIs act as a track on which the organisation has to trend and that too without any deviation. But, it is essential that the concerned managers should be able to understand KPIs without any ambiguity. Because in case of any ambiguity, it can lead to wrong measurement of the key indicators. The KPIs should be defined considering the business objectives but in simpler language.

- Measurable

v. **Quantifiable**: KPIs are based on overall objectives which can be measured. Hence, one of the main characteristics of KPI is that it should be quantifiable. The overall objectives may be qualitative in nature, but as KPIs are based on metrics; hence, the organisation should be very careful in defining the KPIs. If KPIs are not quantifiable, then it will not be possible to define metrics, and ultimately it will not be possible to measure the actual performance.

- Limit the number of KPIs

vi. **Limited number approach**: As KPIs guide the organisation in meaning its performance, sometimes organisations go overboard and try to define the number of KPIs thinking that the more number of KPIs, the greater will be accountability. But, it is always advisable to limit the number of

KPIs. The large number of KPIs leads to distraction of any manager's attention, hence limiting the number of KPIs results in a better evaluation of the performance of an organisation.

4.2.2 Balanced Scorecard

Balanced scorecard is a performance metric used to identify, improve, and control a business's various functions and resulting outcomes. Balanced scorecard was developed by Robert S Kaplan and David P Norton in the year 1992. It includes strategies to achieve an organisation's vision. It provides organisations with a comprehensive and balanced view of their performance by considering both financial and non-financial aspects. The balanced scorecard integrates an organisation's vision and strategy into a set of measurable goals and metrics from four perspectives: financial, customer, internal processes, and learning and growth. Traditional financial parameters such as revenue, profitability, and return on investment are included in the financial perspective. The consumer viewpoint focuses on metrics like customer satisfaction, loyalty, and market share. Internal processes look at the efficiency and efficacy of major operational processes. The learning and development viewpoint assesses an organisation's ability to innovate, develop talent, and adapt to change.

- Comprehensive and balanced view of the performance

Organisations can use the balanced scorecard framework to connect their actions and objectives with their strategic goals. It enables them to assess performance in a balanced manner, discover areas for development, and make educated decisions based on a broader range of metrics. The balanced scorecard emphasises the necessity of not depending primarily on financial indicators but also taking into account aspects that contribute to long-term performance and sustainability, such as customer satisfaction, operational efficiency, and employee development.

- Assesses performance

4.2.2.1 Perspectives of Balanced Scorecard

A Balanced scorecard has four perspectives. The four perspectives of a balanced scorecard are called legs. The following are the legs of a balanced scorecard:

i. Learning and growth
ii. Business process
iii. Customer perspectives
iv. Financial data

Learning and growth

For successful execution of business strategy, the functional managers require constant learning and growth opportunities. The only mode of survival for today's organisations is to never stop learning and hence growing. In the balanced scorecard, the learning and growth perspective takes into account all the learning facilities needed to execute the business strategy. For example, what kind of training needs to be imparted to employees for the successful implementation of a strategy? Besides, it also aids the strategist in understanding what is required to sustain a firm in the future, such as how to manage turnover in the firm. The organisation should consider all those capabilities into consideration before formulating performance objectives. An organisation's capacity is represented by its earning and growth, which in turn are analysed through investigation of the organisation's resources. The presence of human resources, technological support, and infrastructure is vital to ensure continuous survival. Business organisations should ensure that they provide their employees with adequate resources and infrastructure so as to ensure the organisation's consistent earnings and improved growth. The availability of proper infrastructure helps the employees to generate a competitive advantage over the rivals in the industry.

- Capability Enhancement Alignment

Business process

Evaluation of the internal business process is essential to identify the areas in which the organisation has potential. It helps such organisations to exploit the opportunities in such areas. Evaluation of internal business processes ensures that the products are produced properly and identifies if there are any bottlenecks or wastages. It also helps in framing and developing new organisational strategies, which pave the way to accomplish the organisation's end objectives. In the balanced scorecard, this perspective identifies key internal processes important to serve the customers in the best possible manner. To deliver any product or service, it is vital that all the internal processes should work in tandem in an organisation. The organisation should question itself about what kinds of internal processes are needed to satisfy the needs of the customer. For example, if delivery time is important for a firm, it should identify which internal processes can be utilised to reduce the delivery time. After doing self-introspection, the organisation should formulate appropriate performance objectives.

- Internal Evaluation

Customer perspectives

This perspective takes into account all those customers who matter in deciding the overall strategy of an organisation. This perspective defines what the value proposition in serving the target customer is. The organisation should formulate performance objectives considering the following customer perspectives. According to Treacy and Wiersema (Discipline of Market Leaders), the organisation can attain the following excellences to win the customers.

- Customer Focus

According to Treacy and Wiersema (Discipline of Market Leaders), the organization can attain the following excellences to win the customers.

a. Operational excellence: an organisation can decide to attain operational excellence by constant improvement in the basic operational parameters. For example, the organisation can attain operational excellence by reducing undue operational expenses.

- Efficiency in Operations

b. Product leadership: an organisation can become a product leader through constant innovation. The customers can be satisfied by providing new and innovative products which satisfy the unfulfilled psychological needs of the customers, eg., Apple.

- Product Innovation

c. Customer intimacy: it is not only important to focus on the after-sales service. The organisations can win the confidence of the customers by providing them with unmatched after-sales service.

- Customer Confidence

Depending on the above discussed scenarios, the organisations should formulate specific performance objectives.

One of the important criteria organisations should consider in order for long term growth and survival is the satisfaction of its customers. Customers who are satisfied and delighted with the products and services offered by an organisation are the ones who get transformed into loyal customers. Therefore, organisations should strive to make their customers satisfied and delighted by following practices such as offering a wider choice of products and services, offering quality products at affordable price, ensuring continuous availability and so forth. The business organisation should produce products and offer services according to the customer's preferences by taking decisions from the point of view of customers.

- Customers should be pleased and satisfied.

Financial data

- Financial Goals

Financial perspective in the balanced scorecard identifies all the financial aspects which are needed to execute the business strategy. This perspective helps to consider all the financial policies and strategies needed to accomplish the set business strategy. The organisation should take into account the financial perspective for formulating the performance objective. All the stakeholders especially the shareholders of an organisation will have a keen watch on whether the organisation generates revenue or not. Organisations should ensure that they provide their shareholders with a fair rate of return for the investments the shareholders have made in the organisation which contributes to the objective of maximisation of wealth of shareholders. The financial performance of an organisation can be measured by using financial data like incomes, expenses, purchases made by the organisation during the year, turnover of the organisation during the year and so forth.

Four quadrants of balanced scorecard

Customer perspective	Internal process
Learning and Growth	Financial perspective

- Strategic Translation

From a high-level viewpoint, a balanced scorecard are based on a specific company's interpretation of their business and operating environment, specifically, the measure of customer satisfaction, internal business performance and innovation and improvement. An excellent set of balanced scorecards does not guarantee a winning strategy. They can only translate a company's strategy into specific measurable objectives as discussed earlier. For example, a failure to convert operational performance (as measured in the scorecard) into financial performance should send executives back to their drawing boards to rethink the company's strategy or its implementation.

Balanced scorecard in airline company

Balanced scorecard in Airline Company	
Customer perspective Increase customer retention rate	**Internal process** To have better co-ordination between all the departments

Learning and growth To motivate the ground crew to reduce the turnaround time	**Financial perspective** To increase per seat revenue

4.2.2.2 Importance of Balanced Scorecard

The following points highlights why a balanced scorecard acts as a good performance measurement tool. The importance of balanced scorecards is:

a. Balanced scorecard focuses on the key performance indicators for measuring the performance of an organisation thereby reducing information overload.

b. It involves identification and addition of new critical performance measures and elimination of the least important parameters.

c. Balanced scorecards helps management to take right decisions on time regarding the key aspects of business such as setting up of a new branch, development of new products, modification of the prices for the products and so on.

d. Balanced scorecards help managers to choose the best means to achieve the desired output.

e. The information from various sources is pooled in balanced scorecards which provide users with reliable source of quality information in a single report.

f. The collection of all crucial operational measures forces managers to evaluate if one improvement has come at the expense of another.

4.2.3 Dashboards

A dashboard for business intelligence is an analysis tool that displays information from numerous sources on one screen. BI dashboards give businesses the tools they need to track important performance indicators and streamline operations to meet their objectives. Dashboards are frequently used to provide analytics data to business executives and employees.

- Track Performance indicators

Key performance indicators (KPIs) and other significant business metrics and data points for a company, department, team, or process are displayed on one screen by a business intelligence dashboard, also known as a Business Intelligence (BI) dashboard. BI dashboard can also be termed as data dashboard, and business dashboard. Dashboards make use of charts and graphs which makes the report more interactive. A dashboard is often made up of visual components such as charts, graphs, tables, and gauges that convey data in a visually appealing and intu-

- Visual components

itive manner. These components can be configured to display real-time or historical data, providing users with quick insights into trends, patterns, and anomalies.

Dashboards are created to meet the specialised needs of various stakeholders, such as executives, managers, and operational personnel. They can be customised to display performance data for sales, marketing, finance, customer service, operations, and other areas. Dashboards provide a holistic perspective of an organisation's performance by integrating pertinent data into a single interface, allowing users to identify areas of strength and progress. Dashboards provide advantages that go beyond data visualisation. They help users detect issues, measure progress towards goals, and make educated decisions by providing fast and accurate information. Dashboards also improve internal communication and collaboration by simplifying the sharing of insights and encouraging a data-driven culture.

- Present data, aid decision making, and enhance collaboration

A genuine business intelligence dashboard transforms unprocessed data from various sources into insights that can be put to use. This means that a data integration platform and a contemporary data analytics platform must be included in an end-to-end solution in order for the dashboard to be constructed.

- Data Insights

Some of the characteristics of dashboards are:

a. Dashboards process interactive reports by making use of charts and graphs.

b. Dashboards offer with a user-friendly interface that is customisable.

c. the capacity to offer both history and current data.

4.2.3.1 Components of Dashboards

- Real-Time Data Integration

a. Connections to data sources: BI dashboards can be connected to operational systems, industrial equipment, and external data streams for more recent data, or to data warehouses, data marts, and data lakes.

b. Data visualisation: Dashboards can be set to display different performance indicators, statistics, and other information using different forms of data visualisations such as Basic line and bar charts as well as more complex visuals like bubble charts, heat maps, and scatter plots are all supported visualisations.

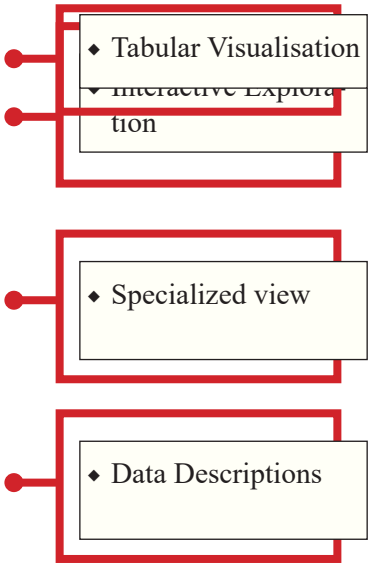
- Diverse Data Visualization Options

c. Data tables: Tables of data that offer a quick view at pertinent data values can be included in BI dashboards. To highlight certain information, such as a drop in sales or financial losses, the tabular data frequently includes colour coding or other graphical treatments.

d. **Drill-down capabilities**: By clicking on data visualisation, visitors are given the option to view and analyse specific data, view additional information, or both. By doing so, they are directed to further visualisations or data tables that are frequently organised in a hierarchical way so users can dig down to different levels if they so choose.

e. **Data filters**: In order to acquire a more specialised view of the information being shown, users can change date and time ranges, geographic settings, and other factors in data visualisations using filters, another interactive feature.

f. **Text boxes and tool tips**: Dashboards frequently have standalone text boxes and tooltips that pop up with supplementary information that describe the data being displayed or give context and more information about the analytics results.



4.2.3.2 Benefits of Dashboards

BI dashboards are becoming more and more important tools for businesses to use in order to extract useful business insights from their expanding data stores, particularly big data sets that frequently blend structured data from BI apps with unstructured and semi-structured data.

The following are the benefits of dashboards:

a. The fundamental advantage of BI dashboards is that they assist organisations in finding the answers to queries and gaining knowledge that enables them to make better, data-driven decisions.

b. Making complex data and business analytics metrics understandable for users who aren't skilled analysts

c. Assisting business executives in making better-informed decisions and strategic plans

d. Assisting organisations in identifying business trends so they can take action to grab opportunities and solve problems

e. Business analysts, managers, and employees may deploy and use self-service BI systems more easily

f. More information sharing will facilitate more collaborative data analysis and decision making processes

g. More options for data visualisation will make data easier to grasp and more useful

4.2.3.3 Importance of Dashboard

Dashboards are important in organisations because they provide a visual representation of critical data and insights. They

- Dash board: Visualize, assess, decide, collaborate

distil complex data into simple charts, graphs, and tables, allowing stakeholders to swiftly assess performance and spot patterns. Dashboards facilitate informed decision making by showing real-time or historical data in an easy-to-understand format, emphasising areas of strength and improvement. They encourage data-driven decision making, allowing organisations to measure progress towards goals, monitor key performance indicators, and spot potential issues. Dashboards also enable communication and collaboration since they can be tailored to meet the needs of various stakeholders, ensuring that everyone has access to relevant and up-to-date information.

- Enhance efficiency, data-driven decisions, transparency.

Dashboards are important because they can improve organisational efficiency and production. Dashboards remove the need for manual data collection and analysis by combining relevant data from numerous sources into a single interface. This saves time and resources while improving reporting accuracy and consistency. Dashboards enable employees at all levels to gain access to the information they require, encouraging transparency and accountability. They allow for proactive monitoring of critical parameters as well as prompt actions and interventions. Furthermore, dashboards promote data-driven interactions and foster an organisational culture of continual improvement and innovation.

4.2.4 Benchmarking

- Comparing performance

Benchmarking is the process of comparing performance to industry standards or best practises. It assists organisations in identifying performance gaps and opportunities for improvement

4.2.5 Financial Ratios

Financial ratios examine an organisation's financial performance and health. Profitability ratios, liquidity ratios, and efficiency ratios are examples of financial ratios that provide insight into financial strengths and shortcomings.

4.2.6 Customer Happiness Surveys

- Financial Analysis

Surveys are used to gauge customer happiness and gain input on products, services, and experiences. They assist organisations in better understanding client preferences and improving customer interactions.

4.2.7 Employee Performance Evaluations

- Financial Analysis

Performance evaluations compare individual employee performance to set targets. They aid in the identification of top performers, growth requirements, and the alignment of individual efforts with organisational goals.

Summarised Overview

The business performance measurement tool provides organisations with a systematic approach to assess and evaluate their overall performance by incorporating various metrics, indicators, and evaluation methods. The balance scorecard is a strategic management framework that translates an organisation's vision and strategy into measurable goals and metrics, encompassing financial, customer, internal process, and learning and growth perspectives. On the other hand, dashboards are visual representations of data that offer quick insights and facilitate informed decision making, fostering transparency and collaboration within organisations. Dashboards improve efficiency and enable data-driven decisions, while the balance scorecard ensures a comprehensive and balanced approach to performance evaluation. Benchmarking involves comparing financial ratios with industry standards to gauge an organisation's financial health. Customer happiness surveys measure customer satisfaction levels, while employee performance evaluations assess individual employee contributions and effectiveness within the organisation. The business performance measurement tool, encompassing the balanced scorecard, dashboards, benchmarking, customer happiness surveys, and employee performance evaluations, provides organisations with a comprehensive and systematic approach to assess and improve their overall performance by incorporating various metrics and evaluation methods. It enables organisations to align their strategies, measure key areas of performance, make informed decisions, foster collaboration, and ensure financial health, customer satisfaction, and employee effectiveness.

Self Assessment Questions

1. What are Key Performance Indicators (KPIs), and why are they crucial for measuring organisational success?
2. How can organisations ensure that the selected KPIs align with their strategic goals and accurately reflect performance?
3. Define the Balanced Scorecard approach and explain how it helps organisations achieve a comprehensive view of performance.
4. How does the Balanced Scorecard framework promote a balance between financial and non-financial metrics in evaluating business success?
5. Describe the concept of dashboards in data visualisation and their role in providing quick insights to stakeholders.
6. How do interactive dashboards enhance decision making by allowing users to drill down into specific data points for deeper analysis?
7. What is benchmarking, and how does it aid organisations in evaluating their performance relative to industry standards or best practices?
8. Provide an example of how benchmarking can help identify areas for improvement and drive competitive advantage within a specific industry.

Assignments

1. Discuss the advantages and disadvantages of using a balanced scorecard as a performance measurement and management tool in organizations. Provide examples to support your arguments.
2. How can a balanced scorecard be used to align the actions of various departments within an organization with its strategic goals? Provide practical examples.
3. Select a specific industry (e.g., healthcare, retail, finance) and design a dashboard tailored to that industry's needs. Discuss the unique challenges and opportunities for creating a dashboard in your chosen industry.
4. Suppose you are the administrator in a leading hospital in your city. Design a Balanced Scorecard for measuring the performance of hospital.
5. Briefly explain the tools used in business performance measurement.

Suggested Reading

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2. Scheps, S. (2017). *Business intelligence for dummies.* John Wiley & Sons.
3. Davenport, T. H., & Harris, J. G. (2017). *The analytics edge: Management strategies to boost performance.* Harvard Business Review Press.
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3. Harts, D. (2008). *Microsoft Office 2007 Business Intelligence - Reporting, Analysis, and Measurement from the Desktop*. TATA McGraw-Hill Edition.
4. Bhima Sankaran Pochiraju and Sridhar Seshadri,(2019) *Essentials of Business Analytics*. Springer.
5. Christian Albright S and Wayne L Winston (2017). *Business Analytics – Data Analysis and Decision Making (6th Edition).* Cengage Learning.

Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

Unit 3

Performance Analysis

Learning Outcomes

After completing this unit, the learner will be able to:

- familiarise the concept of performance analysis
- identify the steps in performance analysis
- explore the concept of funnel reporting

Background

It is extremely difficult to manage an operation if you do not control the information flow; however, improving its performance is nearly impossible unless measurements are clearly defined and directly available. As a result, it is critical to identify those aspects of a product or service that require the most improvement or are candidates for potential cost-cutting conditions without sacrificing overall quality. The Performance Analysis Report provides a comprehensive overview of a company's performance metrics, highlighting exactly what is going on within the organisation. Thus, it helps in analysing and reporting on all key issues and drivers that management must understand in order to effectively manage revenue, profitability, and growth.

Keywords

Performance analysis, Funnel reporting

Discussion

4.3.1 Performance Analysis

A performance analysis assesses how a company or individual performed over a specific time period. A performance analysis can track progress in three ways: revenue, other important performance metrics, and business goal progress. To interpret

this data, it is critical to identify any deviations from projected metrics, understand why they occurred, contextualise the company's development in the context of market and consumer behaviour, and then use that knowledge to decide what to promote, discourage, and plan for in the future. Performance analysis can be used by a sales manager, executive, or small business owner to understand how a company performed in comparison to projections over the course of a month or a year.

- Evaluates company or individual performance

Managers can also use performance analysis techniques to assess individual performance for periodic reviews or employee evaluations. For each situation, different metrics and goals are appropriate. In an individual performance analysis, a manager may only need information on individual and department performance, whereas company and department data is more useful in a whole business analysis than information on each employee. A business performance analysis includes metrics and goals for the company's performance. These may be more or less comprehensive depending on the scope and focus of the analysis.

- Performance Metrics

Here are some specific metrics or goals that a company may consider during a performance evaluation:

- Itemized income from different product lines, regions or product types
- Company net worth compared to market statistics
- Company goals over next three, five and 10 years
- Reviewing and adjusting costs or spending regularly
- Facility and equipment upgrade and spending
- Staff skills, size and performance
- Financial liabilities
- Return on sales and return on investment
- Profit per employee and sales per employee
- Financial ratios between assets, liabilities and net worth
- Market share and status within the market
- Meeting specific customer needs
- Digital or print brand presence and awareness

Furthermore, the following metrics and goals may be useful for analysing individual performance:

- Individual sales metrics
- Projects completed by a deadline
- Employee errors
- Metrics for departments that person leads

- Contribution to specific projects
- Personal soft skill goals and technical skill goals

4.3.1.1 Steps to Conduct a Performance Analysis

Performance analysis check whether the activities are done according to the plan. Suppose you are an entrepreneur. The following steps are followed to do the performance analysis.

- Financial Discrepancy Evaluation

i. Variance analysis

A variance analysis compares financial projections to data in various revenue categories. The variation is the difference between the projected and actual amounts, and it can be expressed as an amount or as a percentage of the total projected. Analysing revenue over time can reveal whether your company was successful in specific seasons, product lines, or markets.

- Variance Investigation

ii. Research variances

Next, take note of any significant variances that are large in proportion to the total category or in dollar terms. Then look into why the differences occurred. You could investigate external factors such as changes in supply market values, changes in material availability, seasonal variation, and larger patterns such as weather or economic trends that could have influenced that area. Consider internal factors such as staffing availability, hours worked, process efficiency, and technological capabilities in addition to external factors.

- Non-financial Metrics analysis

iii. Analyse metrics

Understanding your key non-financial business metrics can be a useful tool in determining the causes of variances. You can understand stages of your manufacturing or sales process that do not directly affect your company's revenue and provide a greater level of detail about company performance by looking into process numbers and contact numbers. To determine whether you met your objectives, use the same metrics you used to project your results. These metrics may include the number of visitors to a digital or physical store, potential sales leads, or contact with potential customers, depending on your business. Other sales, production, and distribution metrics can help you identify areas for improvement in your internal processes.

- Goal Assessment

iv. Review goals

Examine your original revenue and metric goals for the year. This could include objectives such as developing a brand tone, interacting with customers, or providing a higher level

of service. Examine how you achieved these objectives and what factors contributed to your success or failure.

v. Review competitor performance

To put your company's performance in context, consider how your competitors performed during the same time period. List your main competitors' specific advantages and disadvantages, as well as any opportunities or threats they may have presented to your markets or products.

vi. Review customer and market context

Examining the entire market and customer behaviour over time can show you whether your product is meeting needs and where you might find additional opportunities. Take note of any changes that may have occurred or influenced your customer base, as well as economic events, market demand or supply changes, and any strategy changes to your marketing approach.

vii. Decide on changes

The final step in a performance analysis is determining how to use the analysis's findings to improve your processes. Consider the reasons why you achieved that success and how you can encourage that success in the future as you look at instances where you had plenty of revenue, excellent metrics, or met your goals. Consider whether the factors that contributed to your failure were within your control. If you have control over those factors, you could devise a strategy to influence them differently by altering your strategy, staff, or process. Consider whether you can make your business more resilient or agile in the face of factors such as extreme weather, changes in demand, or economic events in the future.

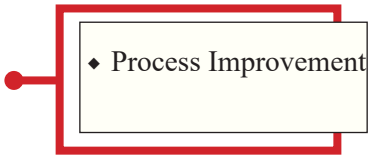


Figure 4.3.1 Steps in Performance analysis

4.3.2 Funnel Reporting

- Funnel Analysis

You must first understand the funnel before you can understand funnel reporting. The funnel is critical for mapping out the customer's journey to purchase, from brand awareness to a sale. A thriving business relies on a funnel full of ongoing leads. As a result, a funnel report can provide insight into how a customer discovers your brand and what causes them to either flow all the way through the funnel to purchase or drop off somewhere along the way. The effectiveness of your marketing initiatives,

the number of people entering the funnel, and conversion rates can all be assessed using the funnel report. You can see how many leads you are generating and how many are in the process of signing contracts or making purchases by using this report to gain insight into ongoing lead generation and sales.

A funnel report is a useful tool for determining the efficiency of a company's marketing and sales operations. It depicts the customer journey from first contact to ultimate conversion, allowing organisations to discover strengths and flaws in their sales funnel. Metrics like lead generation, funnel stage conversion rates, and total cost of client acquisition are frequently included in the report. Businesses may optimise their marketing tactics, increase conversion rates, and ultimately spur revenue growth by analysing the funnel report and making data-driven decisions.

- Insights into marketing and sales effectiveness

The funnel report gives an in-depth analysis of lead generation and sales success over time. It enables businesses to track the amount of leads that enter the funnel, track their progress through each stage, and analyse conversion rates at various touchpoints. This data assists firms in determining where prospects leave the funnel and identifying areas for optimisation. Businesses that routinely analyse the funnel report can make educated changes to their marketing and sales tactics, boosting lead generation, nurturing, and overall client acquisition.

- In-depth analysis

4.3.2.1 Stages of a Funnel

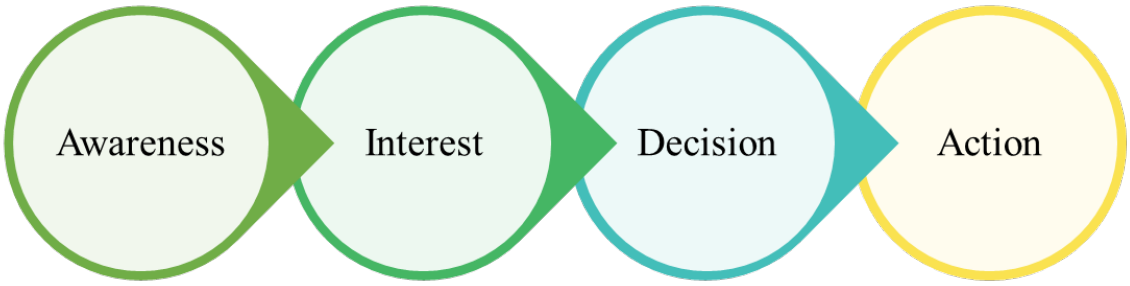


Figure : 4.3.2 Stages of a funnel

i. Awareness

The customer will initially enter the funnel through awareness. A potential customer may learn about a brand for the first time in a variety of ways, including through word-of-mouth, an Instagram advertisement, or passing a billboard on the way to work.

- Initial understanding

- Consideration Stage Evaluation

ii. Interest

If a customer finds a particular brand and likes what they see, they'll probably start looking into it further. This is the stage where reading reviews, looking at the FAQs, and evaluating the competition are all likely to occur.

- Purchase decision

iii. Decision

The prospective buyer will now begin seriously considering making a purchase. They might seek advice from a sales representative or price estimates.

- Make-or-break effect

iv. Action

The information gathered in the previous steps will be used by the customer as they progress through the funnel to determine whether or not to make a purchase. Investing in excellent branding, marketing, and customer service is critical because they will all have an impact on potential customers throughout the funnel process and ultimately have a make-or-break effect.

4.3.2.2 Types of Reporting Marketing and Sales Funnel

Reporting of marketing and sales funnels are classified into two. Namely:

- Marketing-related programme

i. Reporting for the inbound marketing funnel

An inbound report covers any marketing-related programme, such as search engine optimisation (SEO), social media, content marketing, paid advertising, webinars, and sponsorships.

- Sales process activities

ii. Reporting for the outbound sales funnel

Outbound reports cover sales process activities such as sales team outreach to target audience or all types of sales prospecting. Building one is not the same as creating an inbound marketing report.

4.3.3 Technical Architecture of Enterprise Reporting

- Device and Platform Considerations

i. Platform

It is critical to understand which platforms will be used to access the reporting application. What network bandwidth, response time, screen size, colours, operating systems and other software, processing grunt, memory, and so on are required? People will be furious when they discover they can't access the slick new Flash-based reports on their Blackberry.

ii. Delivery method

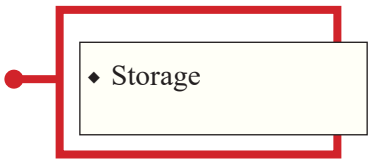
One must still deliver the file to the user's machine. In general, one can use "push" methods or, more commonly, "pull" approaches. HTTP, FTP, RSS, and SQL are among the methods used. Reports can be accessed by sharing hard discs, depending on IT environment. Not to mention SneakerNet, which involves physically copying the reports onto a CD, floppy disc, or flash disc and transporting them.

iii. File format

Similarly, specify the acceptable report file formats. This will determine which applications can read the reports and which features can be added. Plain text (everything), csv (spreadsheets), HTML (web browsers), XML (specialised software), PDF (Adobe Acrobat), and XLS (Excel) are the most common types.

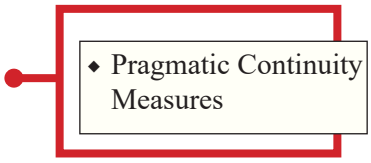
iv. Dimensioning

The reports are almost certainly saved on a computer somewhere. This implies that you must consider network connectivity and storage space. Before you go out and buy something, consider the following: (a) How many reports are we talking about? (b) How many users can we expect? and (c) How much expansion do we anticipate? You'll need to get out an envelope and figure out how much disc space you'll need (allow for storing various logs, datasets, reports, plus archives). Next, for network connectivity (bandwidth), calculate the peak throughput by estimating the maximum number of simultaneous users and multiplying by the maximum individual download speed.



v. Business continuity

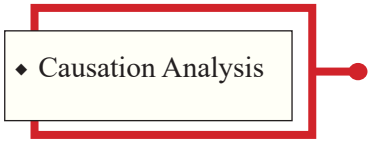
While there are numerous backup and fail-over hosting solutions available, the difficult part of business continuity planning is determining how serious outages are. For management reporting, an hour or two of downtime is unlikely to bankrupt the company. Rather than spending money to host your reports in converted ICBM missile silos on three continents, you're better off following good backup practises (store them off-site and test them regularly!) and having a "Plan B" for critical report production (by hand, if necessary) and delivery (email or - if desperate - hard copy mail outs).



4.3.4 Types of Enterprise Reporting Analytics

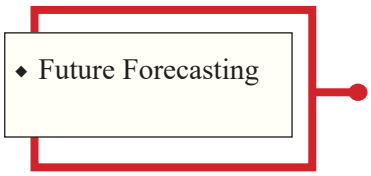
i. Descriptive

Descriptive analytics looks past data to find insights. It is the most fundamental type of analysis, simply converting data points into visuals for users to analyse and interpret. It can be used for year-end reports, performance management, and understanding overall business performance over time.



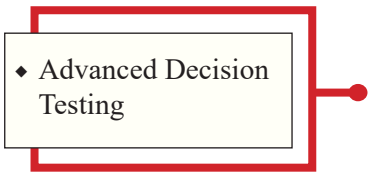
ii. Diagnostic

Diagnostic analytics provide answers to the "why," whereas descriptive analytics provide answers to the "what." It enables you to focus on specific data points (for example, a significant drop in productivity) and compare various factors to try to understand the causes by utilising features such as drill-down, data mining, correlation, and data discovery.



iii. Predictive

Predictive analytics forecasts the future based on past performance. Predictive analytics detects correlations in data by combining algorithms, machine learning, and statistical models. Then it fills in the blanks with projections based on past trends.

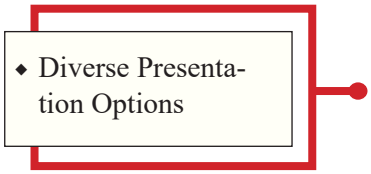


iv. Prescriptive

Prescriptive analytics is a revolutionary method for putting a business plan to the test. This type of analysis, which makes use of advanced forecasting capabilities, allows you to see the impact of potential decisions on individual metrics as well as overall business performance. This strategy combines the previous three types of analysis to provide a risk-free method of predicting the outcomes of various decisions.

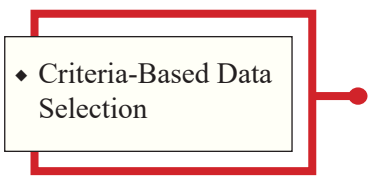
4.3.4.1 Features of Enterprise Reporting Tools

Enterprise reporting software should include a core set of features that enable users to create the aforementioned types of analysis and reports. Here's a quick rundown of what they are:



i. Pixel perfect formatting

Reports can be formatted for printing, filling out online, or presentation via PowerPoint, dashboard, or website using enterprise reporting solutions.



ii. Data filtering

Data filtering examines data for inclusion or exclusion based on user-specified criteria in order to include only relevant information.

iii. Data sorting

After the data has been filtered, the solution allows users to sort the data in a report. Sorting determines the order in which data appears, such as by time period, region, sales rep, and other factors.

- Organized Data Arrangement

iv. Data grouping

After you've filtered and sorted the data, organise it into groups based on current trends. The dataset is organised using grouping based on user-specified parameters.

- Organise into groups

v. Static and dynamic images

Reports can be displayed in a variety of formats, including static and dynamic visualisations. JPEG, GIF, PNG, WMF, and SVG are a few examples.

- Visualisations

vi. Barcodes

Create and export report barcode sets. These are machine-readable data representations that enable digital transmission, import, and exchange.

- Barcode Integration Support

vii. Charts

Bar graphs, pie charts, column, area, stacked, metre, bubble, and tree charts, heat maps, funnels, and other visualisation types are available in enterprise reporting systems.

- Diverse Charting Options

viii. Report delivery

Deliver reports in a specific language and format to specific destinations (for example, a website, employee emails, or a dashboard).

- Targeted Report Delivery

ix. Drag and drop creation

To create visually appealing reports, use an easy-to-use drag-and-drop interface.

- User-Friendly Interface Options

x. Report creation tools

Enterprise reporting solutions include a variety of tools for creating various types of reports, exporting them, developing templates, linking databases, and creating data groups.

- Comprehensive Reporting Toolset

xi. Field explorer

This feature manages and customises report fields.

- Field Customization Management

xii. Custom templates

Although most reporting tools include pre-built reports, custom report templates are also available. This feature speeds up and simplifies the process later on.

- Custom template creation

Summarised Overview

The process of evaluating and assessing the success of an organisation's activities is known as performance analysis. It entails analysing a variety of data and indicators in order to acquire insights into the company's performance and suggest opportunities for development. Setting defined objectives, acquiring relevant data, analysing the data to measure performance against specified goals, identifying strengths and weaknesses, and adopting methods to improve performance are typical processes in conducting a performance analysis. By following these steps, organisations can get important insights and make educated decisions to optimise their operations and achieve their intended outcomes. Funnel reporting is a technique for tracking and analysing the customer journey from first being aware of a product or service to making a purchase or conversion. It is divided into multiple stages, beginning at the top, where potential customers become aware of a brand or product, passing through the middle, where they engage and assess their alternatives, and eventually reaching the bottom, where they convert into actual customers. Funnel reporting gives firms important insight into consumer behaviour, allowing them to detect bottlenecks, optimise conversion rates, and increase overall marketing and sales performance. Businesses can strategically focus their marketing efforts and improve their chances of successfully converting leads into loyal customers by understanding the stages of funnel reporting and the customer's development through the funnel. Enterprise Reporting Tools are software solutions that allow businesses to effectively collect, organise, and report data. These technologies include data integration, customised reporting templates, interactive dashboards, and data visualisation, allowing firms to generate comprehensive reports, analyse critical performance indicators, and make data-driven choices. They provide a centralised platform for accessing and sharing information throughout the organisation, boosting cooperation, transparency, and operational efficiency.

Self Assessment Questions

1. Define performance analysis and explain its significance in evaluating the effectiveness of organisational activities.
2. How does performance analysis assist businesses in identifying areas of improvement and making informed decisions for growth?
3. Describe the key steps involved in conducting a performance analysis within an organisation.
4. How does setting clear objectives and gathering relevant data contribute to the accuracy and reliability of performance analysis outcomes?
5. What is variance analysis, and how does it help organisations compare actual performance against planned or expected outcomes?

6. Provide an example of how variance analysis can be used to pinpoint areas where budgeted projections diverge from actual results.
7. Explain the concept of funnel reporting and how it aids in tracking and analysing the progression of customers through different stages of a sales process.
8. How can funnel reporting help organisations optimise their sales strategies and identify potential bottlenecks in the customer journey?

Assignments

1. Conduct an individual performance analysis of a specific employee within an organisation
2. Conduct a comparative analysis of multiple marketing channels or campaigns using funnel reporting.
3. Choose a specific product or service offered by one organisation and track its customer journey through the funnel using funnel reporting.
4. Investigate the application of funnel reporting in marketing campaigns. Select a marketing campaign (e.g., email marketing, social media advertising) and develop a funnel report to assess its effectiveness. What insights can marketers gain from funnel reporting, and how can they optimise their strategies based on the findings?

Suggested Reading

1. Pochiraju, B. S., & Seshadri, S. (Year). Essentials of Business Analytics. Springer.
2. Albright, C., & Winston, W. L. (Year). Business Analytics – Data Analysis and Decision Making (6th Edition). Cengage Learning.
3. Licbonitz, J. (Year). Business Analytics: An Introduction. CRC Press.
4. Camm, J. D., Cochran, J. J., Fry, M. J., & Ohlman, J. W. (Year). Essentials of Business Analytics. Cengage Learning.
5. Thorlund, J., & Larsen, G. H. N. (Year). Business Analytics for Managers.
6. Prasad, R. N., & Acharya, S. (Year). Fundamentals of Business Analytics (2nd Edition). Wiley India Pvt. Ltd.
7. Barlett, R. (Year). A Practitioners' Guide to Business Analytics. McGraw Hill Professional

Reference

1. Gerardus blokdyk. (2021). *Enterprise Reporting The Ultimate Step-By-Step Guide*., 5STARCooks
2. Clyde P stikney(1998). *Financial Reporting and Statement Analysis: A Strategic Perspective*. Dryden Press Series in Accounting.
3. Harts, D. (2008). *Microsoft Office 2007 Business Intelligence - Reporting, Analysis, and Measurement from the Desktop*. TATA McGraw-Hill Edition.
4. Bhima Sankaran Pochiraju and Sridhar Seshadri,(2019) *Essentials of Business Analytics*. Springer.
5. Christian Albright S and Wayne L Winston (2017). *Business Analytics – Data Analysis and Decision Making (6th Edition)*. Cengage Learning

Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

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QP CODE: ……

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FIRST SEMESTER MASTER OF COMMERCE (M.Com) EXAMINATION
DISCIPLINE CORE - 1- M21CM01DC - RESEARCH METHODOLOGY
(CBCS - PG)

MODEL QUESTION PAPER- SET- A

2023-24 - **Admission Onwards**

Time: 3 Hours **Max Marks: 70**

SECTION A

Answer any five of the following questions in one or two sentences each. Each question carries 2 marks.

(5X2 = 10 Marks)

1. What is the inductive approach?
2. What is a research gap?
3. Differentiate between census and sampling techniques.
4. What is plagiarism?
5. Explain snowball sampling with an example.
6. What is content validity?
7. Differentiate between dependent and independent variables.
8. What is bivariate analysis?

SECTION B

Answer any six of the following questions in half a page each. Each question carries 5 marks.

(6x5=30 Marks)

9. Explain the process of preparing a research proposal.
10. Explain the sampling theories.
11. Explain the desirable properties of measurement scales.
12. What are the major contents of a research report?
13. What are the different types of random sampling techniques?
14. Distinguish between the inductive and deductive approaches used in social science research.
15. What is a research problem, and what is its importance?
16. Briefly explain sampling bias and its causes.
17. Explain the various stages of data processing.
18. What are the various sources of errors in measurement?

SECTION C

Answer any two of the following questions in detail. Each question carries 15 marks.

(2x15= 30 Marks)

19. What is research, and what are the types of research?
20. What are the various factors that determine the sample size? Explain the characteristics of an optimum sample size.
21. Describe the methods used for collecting primary data.
22. Explain the importance of data analysis and what are its different types?

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FIRST SEMESTER MASTER OF COMMERCE (M.Com) EXAMINATION
DISCIPLINE CORE - 1- M21CM01DC - RESEARCH METHODOLOGY
(CBCS - PG)

MODEL QUESTION PAPER- SET- B

2023-24 - Admission Onwards

Time: 3 Hours **Max Marks: 70**

SECTION A

Answer any five of the following questions in one or two sentences each. Each question carries 2 marks.

(5X2 = 10 Marks)

1. What is meant by coding of data?
2. Differentiate between applied research and action research
3. Explain confidence level.
4. What do you mean by pre-testing?
5. Distinguish between bibliography and reference.
6. What is deductive approach?
7. Describe dichotomous variable?
8. Explain the terms population and sample.

SECTION B

Answer any six of the following questions in half a page each. Each question carries 5 marks.

(6x5=30 Marks)

9. Briefly explain the types of research on the basis of methods.
10. What is meant by sampling? What are the characteristics of a good sample?
11. Explain with examples the various types of variables based on cause and effect relationship.
12. What is measurement? What is the process involved in measurement?
13. Elucidate the various types of scales of measurement.
14. What is an optimum sample size? What are its essential characteristics?
15. Describe the various stages involved in data processing.
16. What are the types of research report?
17. Describe research design? Explain the need for preparing a research design.
18. What is editing? What are its various types?

SECTION C

Answer any two of the following questions in detail. Each question carries 15 marks.

(2x15= 30 Marks)

19. What is research? Explain the process involved in conducting research?
20. Describe research report? Explain the contents involved in a research report?
21. Explain the types of scaling techniques?
22. Explain the various types of probability and non-probability sampling techniques.

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FIRST SEMESTER MASTER OF COMMERCE (M.Com) EXAMINATION
DISCIPLINE CORE - 1- M21CM02DC - BUSINESS ETHICS AND CORPORATE GOVERNANCE
(CBCS - PG)

MODEL QUESTION PAPER- SET- A

2023-24 - Admission Onwards

Time: 3 Hours **Max Marks: 70**

SECTION A

Answer any five of the following questions in one or two sentences each. Each question carries 2 marks.

(5X2 = 10 Marks)

1. List out the sources of ethics.
2. State the qualification of a Board of Director.
3. What is trusteeship?
4. What is Whistle-Blowing?
5. Why is an ethical committee important?
6. What is Corporate Social Responsibility?
7. Explain code of ethics?
8. Who is a knowledge worker?

SECTION B

Answer any six of the following questions in half a page each. Each question carries 5 marks.

(6x5=30 Marks)

9. Explain Friedman's Economic Theory, discuss its influence on business organisations, and state its criticisms.
10. What is corporate excellence, and how can one achieve it in the corporate workplace?
11. Write a short note on the Indian Contract Act of 1872.
12. What are the internal factors that affect business ethics?
13. Explain the Ackerman Model of CSR.
14. Describe the significance of business ethics in the modern world.
15. Explain ethical models used for making business decisions.
16. What is corporate image, and how can a strong corporate image be built?
17. Elucidate the consequences of weak corporate governance.
18. Briefly explain the stages of ethical decision-making.

SECTION C

Answer any two of the following questions in detail. Each question carries 15 marks.

(2x15= 30 Marks)

19. What is business ethics and explain various theories associated with business ethics?
20. Why knowledge management is considered an important element of the organisation? What are its objectives?
21. What is information governance? Explain its functions and key components.
22. Explain ethical committee and its functions.

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FIRST SEMESTER MASTER OF COMMERCE (M.Com) EXAMINATION
DISCIPLINE CORE - 1- M21CM02DC - BUSINESS ETHICS AND CORPORATE GOVERNANCE
(CBCS - PG)

MODEL QUESTION PAPER- SET- B

2023-24 - **Admission Onwards**

Time: 3 Hours **Max Marks: 70**

SECTION A

Answer any five of the following questions in one or two sentences each. Each question carries 2 marks.

(5X2 = 10 Marks)

1. Describe the term business ethics.
2. State the criticisms against Kant's theory.
3. What is moral framing?
4. Explain Utilitarianism principle.
5. State the meaning of corporate governance.
6. What do you mean by Corporate Social Reporting?
7. Distinguish data and information.
8. Explain corporate excellence.

SECTION B

Answer any six of the following questions in half a page each. Each question carries 5 marks.

(6x5=30 Marks)

9. What are the various sources of business ethics?
10. Explain the features of trusteeship.
11. Briefly explain the components of code of ethics.
12. Describe the role of ethics committee.
13. Write a short note on the principles of corporate governance.
14. Explain the strategies in the adoption of CSR.
15. Mention how Corporate Social Reporting becomes vital in contemporary business scenario.
16. State the responsibilities of Board of Directors.
17. Explain why corporate image is considered important.
18. What is the role played by the Board of Directors in achieving corporate excellence?

SECTION C

Answer any two of the following questions in detail. Each question carries 15 marks.

(2x15= 30 Marks)

19. Explain in detail the factors influencing business ethics.
20. What is ethical decision making? Explain the factors influencing ethical decision making.
21. What is corporate governance? How is it important? Explain the key issues in corporate governance.
22. Who is a knowledge worker? Briefly explain how they are important. Also explain the various types and functions of knowledge workers.

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FIRST SEMESTER MASTER OF COMMERCE (M.Com EXAMINATION
DISCIPLINE CORE - 1- M21CM03DC - LEGAL ASPECTS OF BUSINESS

(CBCS - PG)

MODEL QUESTION PAPER- SET- A

2023-24 - **Admission Onwards**

Time: 3 Hours **Max Marks: 70**

SECTION A

Answer any five of the following questions in one or two sentences each. Each question carries 2 marks.

(5X2 = 10 Marks)

1. What is carbon credit?
2. Differentiate public and private law.
3. Explain Directorate of Enforcement.
4. What is industrial design?
5. Who is an Authorized Person under Section 10 of the FEMA Act, 1999??
6. Explain the concept of abuse of dominant position.
7. What is the role of National Green Tribunal in India?
8. What is meant by an electronic signature?

SECTION B

Answer any six of the following questions in half a page each. Each question carries 5 marks.

(6x5=30 Marks)

9. Explain the classification of law.
10. Explain the role and responsibilities of the Adjudicating Authority as per Section 16 of the FEMA Act, 1999.
11. What are the various laws and regulations addressing air pollution and water pollution in India?
12. Explain the procedure for obtaining a patent.
13. What is copyright, and what is the legal protection afforded to copyrights?
14. Explain the legal issues and challenges associated with e-commerce.
15. What are the types of online contracts?
16. Explain government policies related to environmental protection.
17. Explain the opportunities created by the FEMA Act, 1999 for Indian companies.
18. Explain the merger process under the Competition Act in India.

SECTION C

Answer any two of the following questions in detail. Each question carries 15 marks.

(2x15= 30 Marks)

19. What is the legal environment, and what are its components?
20. Explain the regulation and management of foreign exchange under the FEMA Act, 1999.
21. Explain the Environmental Protection Act, 1986, including its objectives and provisions.
22. Explain the relevance of the Competition Commission of India (CCI) and detail its powers and functions.

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FIRST SEMESTER MASTER OF COMMERCE (M.Com) EXAMINATION
DISCIPLINE CORE - 1- M21CM03DC - LEGAL ASPECTS OF BUSINESS

(CBCS - PG)

MODEL QUESTION PAPER- SET- B

2023-24 - **Admission Onwards**

Time: 3 Hours **Max Marks: 70**

SECTION A

Answer any five of the following questions in one or two sentences each. Each question carries 2 marks.

(5X2 = 10 Marks)

1. What do you mean by unascertained goods?
2. What is biodiversity?
3. Briefly explain the role of Directorate of Enforcement.
4. State any two objectives of IT Act 2000.
5. What is meant by repatriation of foreign exchange?
6. How is copyright different from patent?
7. Describe an online contract.
8. Mention the key sources of air pollution.

SECTION B

Answer any six of the following questions in half a page each. Each question carries 5 marks.

(6x5=30 Marks)

9. Write a short note on geographical indication and its legal protection.
10. What is carbon credit? What are the steps to calculate carbon credit?
11. Briefly explain the objectives and features of FEMA 1999.
12. Explain the provisions for appointment of Central Government officers as Adjudi cating Authorities for holding an inquiry for the purpose of imposing penalty for contravention.
13. "Sustainable development involves creating economic growth that benefits both the business and the society as a whole". Comment on this statement.
14. Differentiate sale and agreement to sell as per Sale of Goods Act 1932.
15. What are the legal issues and challenges of E-commerce in India?
16. Describe online contracts. What are the various types of online contracts?
17. Explain the measures that can be adopted to overcome the adverse effects of FEMA 1999?
18. Write a short note on the various Government policies relating to environmental protection.

SECTION C

Answer any two of the following questions in detail. Each question carries 15 marks.

(2x15= 30 Marks)

19. What is Competition Act 2002? Explain its features and objectives.
20. Explain the concept of Environmental Protection Act and its objectives.
21. Who is an authorized person? What are the provisions under Section 10 relating to authorized persons? Explain power of RBI to issue directions to authorized person.
22. Explain the concept of industrial design highlighting the key provisions and remedies available to the owner of an industrial design. Also state the procedure for applying industrial design.

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FIRST SEMESTER MASTER OF COMMERCE (M.Com) EXAMINATION
DISCIPLINE CORE - 1- M21CM04DC- BUSINESS ANALYTICS

(CBCS - PG)

MODEL QUESTION PAPER- SET- A

2023-24 - **Admission Onwards**

Time: 3 Hours **Max Marks: 70**

SECTION A

Answer any five of the following questions in one or two sentences each. Each question carries 2 marks.

(5X2 = 10 Marks)

1. What is Artificial intelligence (AI)
2. Define Cognitive Analytics.
3. What is Digital Data?
4. Write a short note on Structured Data.
5. What is a Data mart?
6. What is meant by Data Mapping?
7. Explain Ad Hoc Analyses
8. State the benefits of Data Mining.

SECTION B

Answer any six of the following questions in half a page each. Each question carries 5 marks.

(6x5=30 Marks)

9. Explain the functions of Business Enterprise.
10. Differentiate between 'Data' and 'Information'.
11. What are the different forms of data collected by an organisation?
12. Distinguish between OLAP and OLTP.
13. Briefly explain Hybrid OLAP.
14. Write a short note on Executive Information System and its features.
15. Explain the benefits of Data Warehouse.
16. Discuss various issues in Data Integration.
17. What is business report and what are the role of business report in managerial Decision Making.
18. Briefly describe KPI s and the characteristics of KPIs

SECTION C

Answer any two of the following questions in detail. Each question carries 15 marks.

(2x15= 30 Marks)

19. Describe Data Analytics and different types of analytics.
20. Write a note on Relational OLAP (ROLAP) and the advantages and disadvantages of OLAP .
21. What you mean by Data integration and briefly discuss the advantages of data integration and different approaches of data integration?
22. What are the different components of dash board?

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FIRST SEMESTER MASTER OF COMMERCE (M.Com) EXAMINATION
DISCIPLINE CORE - 1- M21CM04DC- BUSINESS ANALYTICS

(CBCS - PG)

MODEL QUESTION PAPER- SET- B

2023-24 - **Admission Onwards**

Time: 3 Hours **Max Marks: 70**

SECTION A

Answer any five of the following questions in one or two sentences each. Each question carries 2 marks.

(5X2 = 10 Marks)

1. What is analytics?
2. Explain the term OLTP.
3. What do you mean by data modelling?
4. What is Data Warehouse?
5. What do you mean by Data Sources?
6. Write a short note on business report.
7. What is meant by KPI?
8. State the meaning of Predictive Analytics.

SECTION B

Answer any six of the following questions in half a page each. Each question carries 5 marks.

(6x5=30 Marks)

9. Discuss the Customer Relationship Management process.
10. Describe the core business processes.
11. Explain the term Descriptive Analytics with examples.
12. Compare structured, semi-structured and unstructured data.
13. What are the important factors to be considered when implementing Multidimensional OLAP?
14. What is MIS and what are its objectives?
15. Discuss the benefits of Data Mart.
16. Distinguish between Data Warehouse and Data Mart.
17. What is Enterprise reporting and what are its different types?
18. What is balanced scorecard and explain the importance of balance score card?

SECTION C

Answer any two of the following questions in detail. Each question carries 15 marks.

(2x15= 30 Marks)

19. Explain Enterprise Resources Planning and the various benefits of ERP
20. Describe the evolution and role of DSS, EIS & MIS
21. What is Data and what are the different types of Data Models ?
22. Explain performance analysis and various steps to conduct a performance analysis

സർവ്വകലാശാലാഗീതം

വിദ്യയാൽ സ്വതന്ത്രരാകണം
വിശ്വപൗരരായി മാറണം
ഗ്രഹപ്രസാദമായ് വിളങ്ങണം
ഗുരുപ്രകാശമേ നയിക്കണേ

കൂരിരുട്ടിൽ നിന്നു ഞങ്ങളെ
സൂര്യവീഥിയിൽ തെളിക്കണം
സ്നേഹദീപ്തിയായ് വിളങ്ങണം
നീതിവൈജയന്തി പാറണം

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ബോധരശ്മിയിൽ തിളങ്ങുവാൻ
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Business Analytics

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