Unit 2 Decision Making and Decision Support System (DSS)

Introduction to Decision Making and DSS

What is Decision Making?

Decision-making is a **cognitive process that involves selecting the most appropriate choice from several alternatives to achieve a desired outcome**. It is **not just about choosing** an option, but also about **evaluating the consequences, risks, and benefits of each option**.

Decision-making is fundamental to **both everyday life and business operations**

Examples of business decisions:

– What items to stock?

– What insurance premium to change?

– To whom to send advertisements?

Examples of data used for making decisions

– Retail sales transaction details

– Customer profiles (income, age, gender, etc.)

The process typically involves:

1. Identifying the problem or opportunity**.**
2. Gathering relevant information**.**
3. Evaluating the alternatives**.**
4. Selecting the best alternative**.**
5. Implementing the decision**.**
6. Monitoring and reviewing the results**.**

- ## Components of a Decision Support System

1. Database (or Knowledge Base):

The documentation subsystem of DSS can be called a database since it is responsible for the accumulation of necessary data that are required for the decision-making process. It involves own data of the organization (transactional data, records, customers' data etc.) and external data sources (trends, economic data, data of the competitors etc.).

Purpose:

- **Data Storage and Integration:** The database employs multiple heterogeneities to put together various data, which is crucial when analyzing the interconnectivity of the fields in question.

- **Data Quality and Consistency:** It provides data consistency so that information generated before and after is correct and in the timeline.
- **Accessibility:** Enables efficient access and handling of information for use by decision-makers and other supporting systems.
- **Example:** In the case of a retail decision support system, the database could contain past selling details, current and past stock records, customers' attributes, and macro trends. It also accumulates unified data to analyze matters concerning price range, promotions, and merchandise stock.

2. Model (Decision Context and User Criteria):

The model component is therefore a constituent of the knowledge-based DSS that contains all the logical and functional elements of the DSS apparatus. It comprises several models, algorithms, and methods, which analyze data and turn it into valuable information and decision-making proposals. Such models can be as simple as statistical models, to a more complex of optimization models and even simulation tools.

Purpose:

- **Analysis and Prediction:** It involves the use of models to examine the data to find relationships to be of great help to the decision-makers.
- **Scenario Evaluation:** They enable post-processor event-based analyses and drive scenarios on results about set parameters by the users.
- **Optimization:** Decision models help in determining the best choice out of all the available options based on certain measures that are laid down before choosing them such as cost, effectiveness and risk factors.
- **Example:** Whereas a financial DSS, may contain models like forecasting models to show a future balance of cash, risk evaluation models on portfolio and others may be optimization models for the optimum utilization of resources.

3. User Interface:

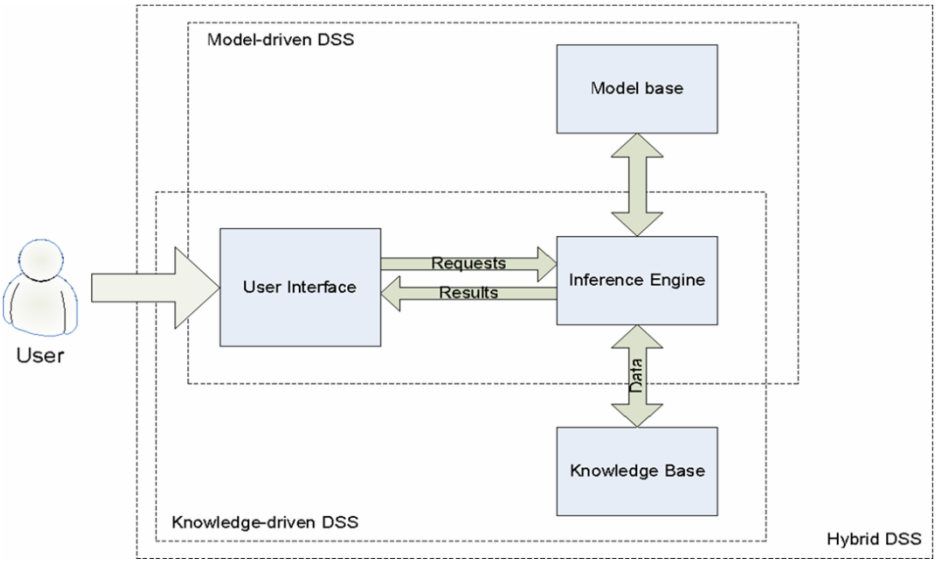
The UI component is the way by which users execute control over the DSS and the mode through which communication is done. It offers interfaces through which one can feed data, set options, perform computations, generate graphics, and analyze findings.

Purpose:

- **Ease of Use:** Regarding the user interface, it is laid out to be very accessible and should not require IT support from its users.
- **Visualization and Reporting:** They come in the format of charts, graphs, reports, and dashboards that make it easier for the user to understand the data analysis figures and thus aid in decision-making.

- **Interactivity:** Enables more data and scenario exploring features, and enables users to go into the detail and tweak the values in real-time.

Example: Healthcare DSS may include a clickable map of a patient's body showing their overall state and an opportunity to input the patient's symptoms and get some suggestions on the treatment based on the analysis of previous cases.



- ## Types of Decision

Decisions can be classified in terms of two main dimensions :

- Nature
- Scope

1. According to Nature Decisions are classified into
    - Structured
    - Unstructured
    - Semi-Structured

Type	Description
Structured	Routine, repetitive, clearly defined problems.
Unstructured	Novel, complex problems requiring judgment.
Semi-Structured	Combines structured and unstructured elements.

Structured Decision Making:

- **Description**: These are **routine, repetitive decisions made in environments** where the problem is **clearly defined, and the process for solving it is straightforward**.

- **Examples**: Reordering office supplies, processing payroll, or scheduling routine maintenance. These **decisions have well-established procedures, and the outcomes are predictable.**
- **Nature of Decision**: These types of decisions are often **automated or handled by rules-based systems.**

Unstructured Decision Making:

- **Description**: These **involve complex, unique problems where the path to a solution is unclear and requires judgment, creativity, and intuition**. These decisions often **arise in new situations with no predefined solutions.**
- **Examples**: Deciding the **overall strategy for a business expansion, entering a new market, or developing a new product.** These are often **strategic decisions**.
- **Nature of Decision**: There are **no clear, predefined steps, and the decision-maker may need to rely on expert judgment and experience**.

- **Semi-Structured Decision Making:**
  - **Description**: These decisions fall in **between structured and unstructured decisions**. They involve both **known and unknown elements and may require some judgment** but **are not as complex as unstructured decisions**.
  - **Examples**: Deciding on the **pricing strategy for a product**, managing a project, or **responding to customer complaints**. These decisions **might rely on some quantitative analysis (like data models) combined with qualitative input (like team feedback**).

2. **Nature of Decision**: While there are some **clear procedures, a degree of judgment and flexibility is required.**

According to Scope Decisions are classified into :

a. **Strategic**
b. **Tactical**
c. **Operational**

Decision Environments

Decision environments refer to the **level of certainty and information available to a decision-maker**. These environments affect how decisions are made.

1. **Certainty – All facts are known.**

- In this environment, the decision-maker knows a**ll relevant facts and information about the situation, and the outcomes of all alternatives are predictable**.

- **Example**: A factory that **knows exactly how many units of product it will sell based on historical data.**
- **Nature of Decision**: The decision-making process is straightforward because there is **little to no uncertainty or risk involved**.

2. **Risk - Probabilities of outcomes are known**

   In this environment, **decision-makers know the probabilities of different outcomes**, even if the **specific outcomes are not certain**.
   Example: An **investor who knows the historical returns of stocks** and **can assess the risks associated with a potential investment**.
   Nature of Decision: While outcomes are **not guaranteed**, decision-makers can weigh **options based on likelihood**, helping to make informed choices even when some uncertainty remains.

3. **Uncertainty** – Neither outcomes nor probabilities are known.

   This environment is **characterized by a lack of knowledge about the future**. Neither the **outcomes of different alternatives nor the probabilities of those outcomes** are known.

   Example: A company **launching a new product in a foreign market where the demand is uncertain.**
   Nature of Decision: Decisions in this **environment require intuition, experience, and flexibility, often leading to more risky choices.**

What is a Decision Support System (DSS)?

A **Decision Support System (DSS)** is a computer-based system that **helps in making decisions, particularly in situations that are semi-structured or unstructured.**

It **enhances the decision-making process by providing useful data, models, and user interfaces** to support the decision-maker.

The core idea of a **DSS is to help users make informed decisions in uncertain or complex situations**. Rather than **just automating decision-making, it assists the human decision-maker in evaluating the alternatives and understanding potential consequences.**

Key features of a DSS include:

- **Interactivity**: It allows users to interact with the system to explore different alternatives.

- **Flexibility and Adaptability**: The system can adjust based on changing requirements or new data.
- **Support for semi-structured and unstructured decisions**: It provides tools to handle complex situations where rules and processes are not predefined.

Characteristics of DSS:

- Supports semi-structured and unstructured decisions

  A DSS is particularly useful when the decision-making process is not entirely routine (structured) and is more complex or ambiguous (unstructured). It provides tools and models that help navigate uncertainty.

- **Combines data, models, and user-friendly interfaces**

  Data: The system uses data (historical, real-time, or external) to provide insights.
  Models: DSS can incorporate quantitative models, simulations, or predictive models to analyse data and generate potential outcomes.
  User Interface: It offers easy-to-use interfaces, so users don't need to be technical experts to use it.

- **Enhances human judgment**

  A DSS does not replace human decision-making. Instead, it supports and enhances human judgment by providing more accurate data, better modeling, and simulations to help decision-makers assess various alternatives and their impacts.

- **Performs sensitivity and "what-if" analysis**

  Sensitivity Analysis: This feature helps to understand how different variables or inputs affect outcomes. For example, how changes in sales volume or production costs would impact profitability.
  What-If Analysis: This allows decision-makers to test different scenarios by adjusting certain parameters. For example, a manager might want to see the effect of a price increase on customer demand or profitability.

- **Types of Decision Support Systems**

1. **Model-Driven DSS:**

- **Description:** These DSSs stress the existence of access to or capability to manipulate a mode or algorithm that enables users to assess decision variables and options.

- **Functionality:** They apply optimisation models, simulation models, and forecasting models in the decision-making processes within the organisation.
- **Example:** Procedures that imply the usage of forecasting indicators in the organization of the financial and organizational processes and that deal with investment portfolios are also a part of the present category.

2. Data-Driven DSS:

- **Description:** These DSSs stress the aspects of data access and modification, where users obtain and transform data into a form that enables them to produce reports and carry out queries.
- **Functionality:** They give capacities for populating databases, processing and creating reports and analyses out of historical and current data for decision making.
- **Example:** Sales analysis BI systems that leverage aspects such as sales and customer data or facts in decision-making, and SNP: MKT trends typically come under this category.

3. Document-Driven DSS:

- **Description:** These DSSs stress the availability and the capability for changing the documents and other non-structured information assets.
- **Functionality:** They assist decision-making by offering methods for the retrieval, processing and manipulation of text and graphics documents and/or multimedia documents stored in documents, web pages, multimedia databases etc.
- **Example:** This category includes Legal DSS that assists the lawyers in the location and analysis of legal support for the decision-making processes of lawyers in the form of documents, case histories and precedents.

4. Knowledge-Driven DSS:

- **Description:** These DSSs highlight the availability and ability to change the expert knowledge and heuristic rules that embody human expertise.
- **Functionality:** They assist in decision-making because they connect the user to knowledge or rule-based information in specific areas to help the user decide.
- **Example:** Systems that incorporate the specialist knowledge and decision rules to help the clinician diagnose illnesses and prescribe treatment solutions come under this category.

5. Communications-Driven DSS:

- **Description:** These DSSs concentrate on communication, cooperation, and information and knowledge exchange among users in the course of a particular task or decision.
- **Functionality:** They accommodate group decision-making by offering the tools, details and ways of passing and sharing information in support of the teams in their decision-making process.
- **Example:** The applications of GDSS that are utilized in organizational settings for conducting group discussions, teleconferences, idea generation, and group decision-making are included in this type.

Advantages of a Decision Support System

- **Improved Decision Quality:** DSS delivers detailed information on a certain subject and complex models, therefore they result in more efficient, faster, and better decisions. They assist managers to compare different solutions to a problem and select the most appropriate solution.
- **Efficiency and Speed:** Since DSS involves automation of the data collection, analysis and reporting process, they greatly cut down the time and energy needed for decision-making. This allows a faster response to changes in the business context and, respectively, to the opportunities that appear in this context.
- **Enhanced Productivity:** DSS helps cut down the decision-making cycle that in turn enables the managers and employees to spend their time and efforts on other important facets and not mere computation and analysis of the data.
- **Better Data Management:** DSS incorporates data from all the sources in a way that makes the information that the decision-makers use accurate, current, and consistent. Such a united and overlapping system of data management prevents mistakes and in turn, enhances the accuracy of the decisions to be made.
- **Facilitation of Complex Analysis:** DSS use sophisticated techniques for calculating and implementing solutions for problems that are poorly structured and might be hard to solve with the help of conventional paper and pencil. This capability enables organisations to solve intricate problems and situations.
- **Support for Strategic Planning:** DSS contribute to long-term strategic planning by being used in planning and modelling in the organization. It assists organizations to make future predictions in a particular field and make preparations for this at the right time.
- **Enhanced Collaboration:** Most DSSs have embedded communication components to assist the decision-makers during the decision-making process. Such tools facilitate the

features of information sharing, discussion, and decision-making leading to better decisions.

- **Increased Flexibility and Adaptability:** DSS is usually designed to fit the particular needs of a certain user or a certain department of an organization. Thus, flexibility helps maintain the system's applicability across different settings and in solving different problems.
- **Reduction of Uncertainty:** The vast amount of information reported as well as the forecasts contained in DSS minimize uncertainty in the decision-making process. Decision-makers can get acquainted with several consequences and qualitative results with various choices and decide with confidence.
- **Cost Savings:** DSS can assist in achieving cost reduction after enhancing efficiency, productivity, and quality of decisions. Opting for an improved decision-making formula will help cut down on waste and enhance the usage of resources within an organization leading to impressive performance standards.

Disadvantages of a Decision Support System

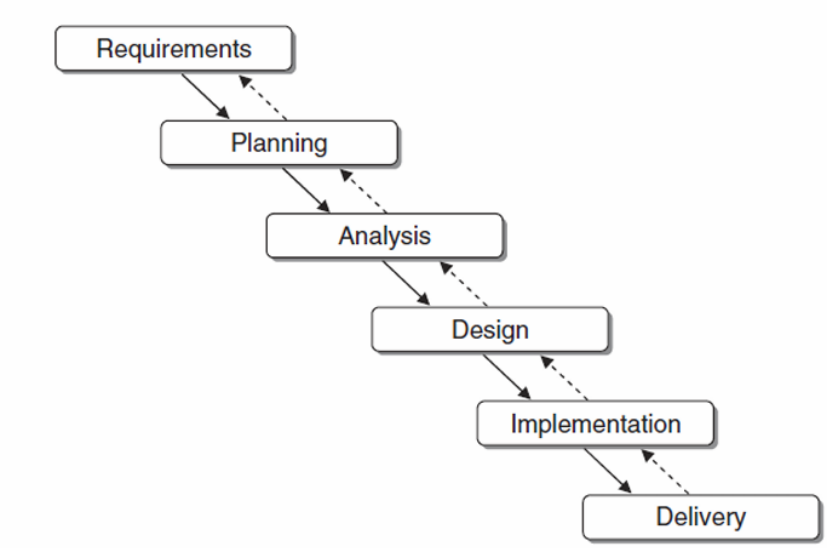
- **High Cost:** In addition to initial costs, creating and sustaining a DSS can be costly. These are the costs of the hardware, software, data acquisition, incorporating your system's unique requirements as well as the costs of support and maintenance.
- **Complexity:** DSS is not always an uncomplicated approach to design and utilize and may not be very easy to implement. These may demand professional skills in designing and implementing as well as the users of the system may need to be trained on how to use the system.
- **Data Quality and Integration Issues:** Data quality is very crucial and plays a key role in the effectiveness of the DSS that feeds on it. The integration of data could also be complex and when the quality of data is low then one can be given wrong information.
- **User Resistance:** Resisters can lack information, knowledge, or skills on the benefits of adopting and implementing a DSS, fear change, or insecurity of job loss. This is a form of resistance and can only be tackled with diligence on the part of change management, and user training.
- **Dependence on Technology:** The main disadvantage of DSS is over-dependency on technology in decision-making. This can be decisively negative if the system malfunctions, or if the users over-rely on the system's outputs without assessing the situation with the help of their experience and tools.
- **Data Security and Privacy Concerns:** Implementing a DSS can involve accumulated and gravely important information to which individuals and organizations may feel their privacy is being infringed by storing their information in the DSS. Being able to have a

good, sustainable security system and following the rules and regulations regarding data protection is very important.

- **System Limitations:** It is also important to point out that a DSS may not be sufficiently suited to all forms of decision-making needing such elements as intuition, creativity or subjective assessment. It may also have limitations, in that, it may not be suited to processing real-time data or to responding to events that are out of the norm.
- **Risk of Information Overload:** DSS can refer to a huge chunk of data and information and if handled and presented poorly it can even baffle the users. Instead of helping in decision making it leads to confusion and even opponents to decide not to decide at all.
- **Maintenance and Updates:** Maintaining the latest data, models, and technologies, that are needed for a DSS can be a difficult task. They may also require frequent upgrading so that they stay relevant as this is a costly affair.
- **Potential Bias:** It has also been ascertained that the use of a DSS involves; This means that the models and algorithms used in a DSS can propound biases if they are not well, designed and tested. This was especially important in our case because biased models can cause the production of biased statistics thus warranting wrong decisions.
- **Inflexibility in Dynamic Environments:** There emerge cases whereby a DSS may fall behind in the changes that are occurring in the environment, especially in dynamic environments. To be effective, it may need to be changed quite often, which by itself may be difficult to handle.

Phases in the development of a DSS

- Planning: The main purpose of the planning phase is to understand the needs and opportunities, translate them into project & later into DSS.
- Analysis: Define detailed functions of DSS to be developed responses to the questions like What should the DSS accomplish, and who will use it, when and how?
- Design: How will the DSS work. Hardware + network + Software tools
- Implementation: Implementation + installation + testing



Phases in the developement of a decision support system

Factors that may affect the degree of success of DSS:

• Integration: The design and development of a DSS require a significant number of methodologies, tools, models, individuals and organizational processes to work in harmony.

• Involvement: The exclusion or feeling of isolation from the project team of knowledge workers who will actually use the system once it is implemented is a mistake that is sometimes made during the design and development of DSS.

• Uncertainty: Implementation cost is less but driving more effective decisions may cost more.

Applications of DSS

DSS is used across various industries and business functions.

Examples of DSS Applications:

Domain	Applications
Marketing	Market segmentation, Campaign planning, Sales forecasting
Finance	Budget planning, Investment analysis, Loan approval systems
Operations	Inventory management, Supply chain optimization, Production scheduling
Human Resources	Workforce planning, Training needs analysis
Healthcare	Diagnosis support, Treatment planning, Resource allocation
Agriculture	Crop selection, Irrigation planning, Fertilizer application
Government	Urban planning, Emergency response, Policy simulation

Role of Business Intelligence (BI) in DSS

Business Intelligence (BI) refers to the technologies and processes used to collect, analyze, and present business information to support better decision-making.

How BI Enhances DSS:

1. **Data Integration:**
    - Combines data from various sources into a central data warehouse for easy access.
2. **Data Visualization:**
    - Dashboards, charts, and graphs help users understand complex data quickly.
3. **Real-time Data Analysis:**
    - Enables dynamic decision-making using up-to-date information.
4. **Predictive Analytics:**
    - Uses historical data to forecast future trends.
5. **Improved Reporting:**
    - BI tools generate insightful reports for strategic planning.
6. **User Empowerment:**
    - Non-technical users can analyze data and create reports without relying on IT.
7. **Performance Monitoring:**
    - Helps in tracking key performance indicators (KPIs) and aligning decisions with organizational goals.