UNIT 149 – UPSC - DSS and RDBMS

Decision Support Systems

Decision Support Systems, briefly called DSS are special category of computerized information system that supports business and organizational decision-making activities. Correctly designed DSS is an interactive software-based system that has aim to assist decision makers compile valuable information from raw data, documents, personal knowledge, and/or business models to identify and solve problems and make decisions. Theorists described DSS as interactive computer-based systems, which help decision makers utilize data and models to solve unstructured problems (Scott Morton, 1971). Decision Support Systems are application of Herbert Simon model. The model has three phases: intelligence, design and choice. Decision Support Systems basically help the intelligence phase where the objective is to identify the problem and then go to the design phase for solution (Jawadekar, 2009). Sprague and Watson (1996) also stated conceptual models or frameworks are vital to understanding a new or complex system. DSS is broadly a computer based system to assist decision-makers to use data and models to solve ill-structured, unstructured or semi-structured problem.

DSS is essential for corporation because decision-making involves a complex sequence of activities over time. Decision support systems couple the intellectual resources of individuals with the capabilities of the computer to enhance the quality of decisions. It is a support system for management decision makers who deal with semi-structured problems (Keen and Scott Morton, 1978). Decision support system is an organized collection of people, procedures, software, databases, and devices working to support managerial decision making. The major objectives of DSS are to increase the effectiveness of the managers' decision-making process. Supports the manager in the decision-making process but does not replace it and improve the directors' effectiveness of decision making.

When reviewing history of DSS, it is found that Information Systems researchers and technologists have developed and investigated Decision Support Systems (DSS) since many decades. Decision Support Systems evolved in the beginning of the period of distributed computing. Such systems began in about 1965 and it became important to start formalizing a

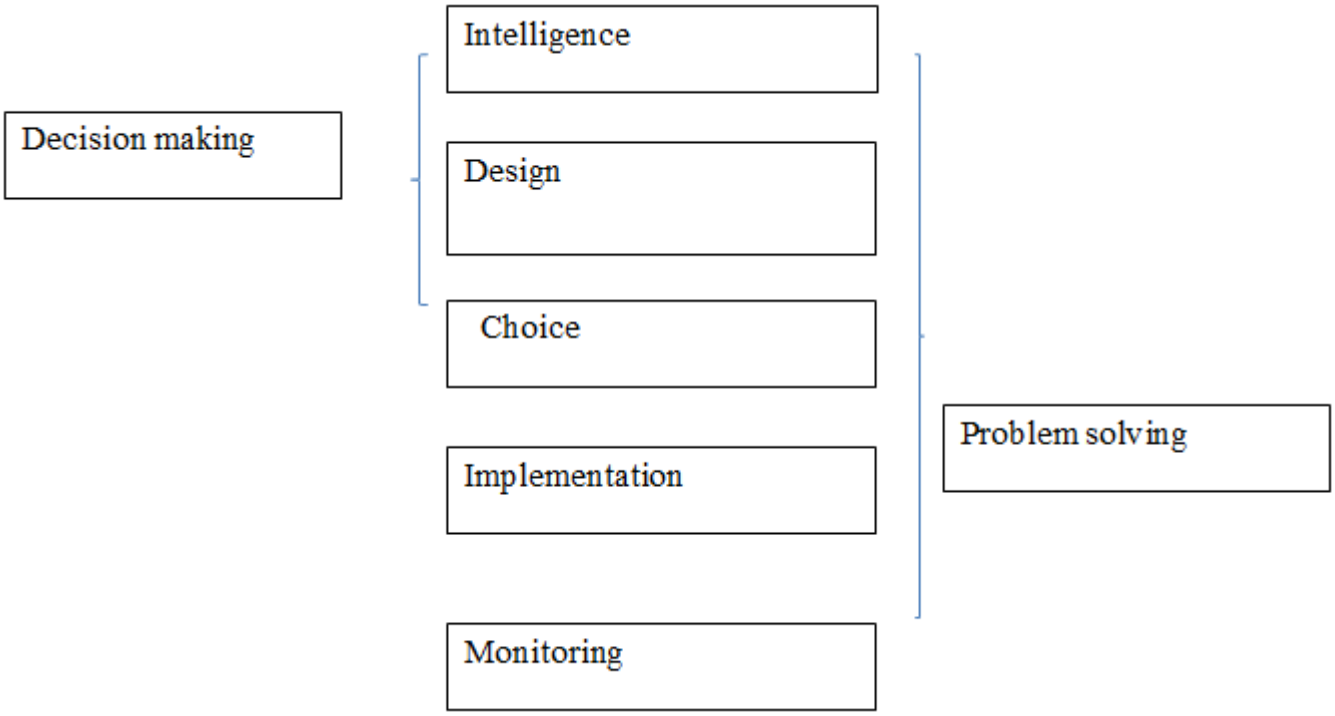
record of the ideas, people, systems and technologies involved in this important area of applied information technology.

There are mainly three functions of DSS:

1. The capability of capturing and saving information from previous activities;
2. Data processing capability;
3. Data retrieval capability.

Components of DSS: These systems are an application of Herbert Simon model. Model has three phases that include intelligence, design and choice. This model basically helps the information system in the intelligence phase where the objective is to identify the problem and then go to the design phase for solution. The choice of selection varies from problem to problem (Waman Jawadekar, 2009).

Decision making as an element of problem solving



Types of DSS

DSS can be categorized into numerous types (Waman Jawadekar):

1. Status inquiry system: The number of decisions in operational management and some at middle management are such that they are based on one or two aspects of a decision making situation. It does not call for any elaborate computations, analysis, choice for decision making. If the status is known then decision is automatic. It means status and solution has unique relations.
2. Data analysis system: These decision systems are based on comparative analysis and use of formula or an algorithm. But these processes are not structured and therefore vary. Some examples include cash flow analysis, inventory analysis and personal inventory

system. The use of simple data processing tools and business rules are required to develop this system.

3. Information analysis system: In this system, data is analysed and information reports are generated. The reports might be having exceptions as a feature. The decision makers use these reports for assessment of the situation for decision making.
4. Accounting system: These systems are not necessarily for decision making but they are desirable to keep track of major aspects of business or function. The content of these systems is more data processing leading to formal reporting with exceptions if necessary. In these systems, account item include cash, inventory, personnel and relate it to a norm developed by management for control and decision.
5. Model based system: These systems are simulation models or optimization models for decision making. These decisions are one time or infrequent and give general guidelines for operation management. Some examples include the product mix decisions, material mix, the job scheduling rules and resource or asset or facilities planning system.

Types of DSS (Source: Jawadekar, 2009)

System	Input Source	System	Hardware	User
Inquiry	A. Database B. Conventional files	Query system	PC servers and clients	Clerks, Assistance
Data analysis and other files	Database and systems	Packages of DP and servers, PCs	Mainframe or managers	Operations
Information analysis	Processed data files	Analysis program and use of simple methods	Mainframe, Mini, Super mini, Servers, client PCs	Middle managers
Accounting ROI database	Transactions master files	Transactions processing system	Mini, mainframe, client/servers	Middle and top management
Model based control	Inventory database and external data	Development of OR or business model	Mainframe, mini, client/servers	Middle and top management

It can be shown in management literature that DSS are developed by users and system analysts jointly. Decision support system uses the principle of economics, science and engineering and also the tools and techniques of management. The data used in Decision support system is drawn from the information system developed in company. The Decision support systems are developed in isolation and form an independent system subset of management information system. The most common use of the Decision support system is to test the decision alternatives and also to test the sensitivity of result to change in the system and assumption. The data and information for the Decision support system are used for the internal sources such as the database and conventional files and from the external sources (Waman Jawadekar, 2009).

Characteristics of DSS

Facilitation: DSS facilitate and support specific decision-making activities and/or decision processes.

Interaction: DSS are computer-based systems designed for interactive use by decision makers or staff users who control the sequence of interaction and the operations performed.

Ancillary: DSS can support decision makers at any level in an organization. They are NOT intended to replace decision makers.

Repeated Use: DSS are intended for repeated use. A specific DSS may be used routinely or used as needed for ad-hoc decision support tasks.

Identifiable: DSS may be independent systems that collect or replicate data from other information systems OR subsystems of a larger, more integrated information system.

Task-oriented: DSS provide specific capabilities that support one or more tasks related to decision-making, including, intelligence and data analysis; identification and design of alternatives; choice among alternatives; and decision implementation.

Decision Impact: DSS are intended to improve the accuracy, timeliness, quality and overall effectiveness of a specific decision or a set of related decisions.

Supports individual and group decision making: It provides a single platform that allows all users to access the same information and access the same version of truth, while providing autonomy to individual users and development groups to design reporting content locally.

Comprehensive Data Access: It allows users to access data from different sources concurrently, leaving organizations the freedom to choose the data warehouse that best suits their unique requirements and preferences.

Easy to Develop and Deploy: DSS delivers an interactive, scalable platform for rapidly developing and deploying projects. Multiple projects can be created within a single shared metadata. Within each project, development teams create a wide variety of re-usable metadata objects.

Integrated software: DSS's integrated platform enables administrators and IT professionals to develop data models, perform sophisticated analysis, generate analytical reports, and deliver these reports to end users via different channels (Web, email, file, print and mobile devices).

Flexibility: DSS features are flexible and can be altered according to need providing a helping hand in the work process.

Problem Solving Factors in DSS

- Multiple decision objectives
- Increased alternatives
- Increased competition
- The need for creativity
- Social and political actions
- International aspects
- Technology
- Time compression

Benefits of DSS: Decision Support Systems offers managers a powerful tool for decision making. Managers can handle large scale, time consuming and complex business problems. DSS can resolve complex issues in company and save manager's time and effort. Decision Support Systems

improve the reliability of business decisions and reduce the risk of poor decisions. It provides the decision maker more alternatives (Adikesavan, 2014).

Disadvantages of DSS: There are several drawbacks of this system that include, monetary cost, overemphasize decision making, assumption of relevance, transfer of power, unanticipated effects, obscuring responsibility, false belief in objectivity, status reduction, and information overload.

To summarize, Decision Support Systems is an arrangement of computerized tools used to assist managerial decision making. It is a collection of integrated software application and hardware that forms the basis of the decision making process of firms and assist to make decision. This system also helps in performance evaluation. Decision support systems vary greatly in application and complexity, but they all share specific features. A Typical Decision support system has four components: data management, model management, knowledge management and user interface management.

RDBMS (Relational Database Management System)

The MIS is sustained by database in its endeavour to support the management in decision making. Organization needs that MIS would give them a 'competitive strength'. The need is to handle an on-line operation, mission, control applications and exercise the operational and management control. The need demands a tool to successfully manage both the transaction processing and the decision processing requirements. It also requires the capability of dealing with large number of users who are using, and updating a huge database. The need also demands the use of multiple databases residing on the hardware platforms situated at different location-nearby sites and remote site. The decision-making is essential more in a real time environment where the decision-making process, right from the problem definition to solution, needs to be handled quickly. The business environment is distributed and decentralized requiring real time resources (hardware, software, data, information) sharing with a multifaceted data flow. All this processes require the RDBMS which can serve both the decision support and the transaction processing requirements. With the biggest computer hardware and software capabilities, the mechanism of Relational Database Management System becomes popular (Waman Jawadekar, 2009). Major goal of a relational database design is to generate a set of relation schema that allows us to store information without unnecessary redundancy and also to retrieve information easily.

RDBMS is the database system in which the relationships among different tables are maintained. It corresponds to data as two-dimensional tables called relations or files. Each table contains data on entity and attributes. RDBMS solution is necessary when huge amounts of data are to be stored as well as maintained. A relational data model comprises of indexes, keys, foreign keys, tables and their relationships with other tables. Relational DBMS enforces the rules even though foreign keys support by both RDBMS and DBMS. The most popular RDBMS are MS SQL Server, DB2, Oracle and MySQL.

The RDBMS has five main components:

1. The relational algebra model defines schemas, relations, and declarative specifications of query operations.

2. The SQL compiler includes the parser, definitions for SQL abstract syntax, a denotational specification for SQL in terms of the model, and semantics-preserving SQL optimizations.
3. The SQL execution engine interprets the optimized SQL expression as a series of operations over imperative finite maps. Correctness is established using Hoare-style reasoning relating imperative finite maps to the relations they represent.
4. The B+ tree implementation provides finite map operations for insertion and lookup of key-value pairs, and iteration (amongst others)..
5. The storage interface is responsible for deserializing or serialization relations to disk and establishing integrity constraints. The storage manager includes a proof that deserializing the serialized form of a relation R results in R, under the assumption that disk operations do not fail.

Features of RDBMS

1. RDMS supports relational data structure.
2. RDBMS has Data Manipulation Language at least as powerful as the relational algebra.
3. In RDBMS, data is stored in a set of tables.
4. Tables are joined by relational links.
5. RDBMS Reduces Duplication of data in database (Normalization).
6. RDBMS facilitates greater flexibility and efficiency.
7. In RDBMS, each table must have unique references for each record called Primary key.
8. Replicating these into other tables creates the Foreign Key.
9. These foreign keys form the Relationship that links the tables together.
10. Each RDBMS table consists of database table rows. Each database table row consists of one or more database table fields.
11. In RDBMS data needed only be updated once as it would only have been entered once.
12. RDBMS reduces the problems in using Flat file databases.

The modern version of RDBMS systems has two sub-systems or parts. One tackles the data management and transaction processing which is independent of its applications in the information processing. The second part provides a set of tools to develop and utilize on-line application for the decision support. This is controlled by the client-server architecture which separates the data management functions from its application. The data management function is handled by the server and the applications are handled by the client. The server centrally imposes all integrity, security and autonomy rules and the client (user) makes use of the database over the network of heterogeneous hardware. Contemporary trend in the information technology is to offer simple computing for the end user, easy to understand and easy to use. The notion is extended to the system analyst and programmer, where the RDBMS provides the tools, saving, development and processing time. It allows the business rules of the organization, standard transactions and queries to be programmed once and makes them available to all the users and developers as a stored procedure in the data dictionary. These stored procedures can be nested to develop an application. These procedures are both, reusable and sharable and are developed using the standard SQL. The RDBMS is also accomplished through the interface to handle the data sources from the other database and application tools developed on various operating systems.

Latest RDBMS system operates under the client-server environment as against the outmoded master-slave environment. In the traditional DBMS system, a transaction is processed in the database, i.e. the creation, validation and checking the transaction integrity logic. This is done for each transaction separately based on the procedures developed for forced transaction for validity and integrity checks. In the up-to-date RDBMS system, the third step of the integrity checking is done through a stored procedure common to all types of transaction.

Modern RDBMS facilitates greater security through offering various tools to the system administrators, the database owners and the users to grant and revoke permission to the specified users or a group of users on the specified tables, view, columns, stored procedures and commands. In latest RDBMS system, a multiple security is taken care of by one integrated DBMS.

The latest RDBMS allows an online maintenance, fast recovery and software based fault tolerance. These features ensure the availability of the database round the clock as the database maintenance is possible online when the system is in use. The maintenance activity comprises of the following tasks:

1. Backup
2. Diagnostic
3. Integrity changes
4. Recovery
5. Design changes
6. Performance tuning

The fast recovery characteristic also the system administrator to provide a 'time' to go back for recovery of the data if the system fails due to the power failure or network crash. Based on this, time systems automatically go and collect all the changes and writes the risk.

The modern RDBMS controls the distributed heterogeneous data sources, software environment and hardware platforms. The system is open RDBMS. The modern business activity using the multiple hardware-software platforms, such a business enterprise has multiple databases residing at various locations. The information needs call for the unification and coordination of these databases. The data would get updated in distributed access to the distributed data. RDBMS permits communication at the database level and performs in an integrated manner as a single entity through the updates, and processing would take place at the respective distributed locations. This is accomplished through a software interface across the organization. Since the environment is distributed, it calls for a distributed integrity control and autonomy to perform. The distributed integrity control is accomplished through the stored procedures which guard the database from a remote external update or processing to maintain the autonomy which would be affected by the unauthorized update from distant locations.

Other typical features of modern RDBMS includes hardware independency, software independence, workability under a client-server architecture, a control feature of integrity, security and autonomy and built-in communication facilities to accomplish and open the system features for the management of information system. It offers a very efficient and effective tool to a skilled designer, developer and user to manage the information needs of the business company.

There is numerous benefit of using RDBMS. It improves conceptual simplicity. RDBMS makes easier database design, implementation, management, and use. It is a dominant database management system. Advantages of a relational database are as follows:

1. This system avoids data duplication
2. RDBMS evades inconsistent records
3. In this system, it is easier to change data and data format
4. Data can be added and removed easily in RDBMS
5. In RDBMS, it is easier to maintain security

The usage of relational algebra and relational calculus in the manipulation of the relations between the tables ensures that there is no ambiguity, which may otherwise arise in establishing the linkages in a complicated network type database.

Disadvantages of the Relational Database

The main problem when using a relational database is the complexity that rises when it is first developed. It is absolutely vital that the defined relationships between the tables are correct and that each set of information is linked to its pair. Although less information has to be entered in total than with other databases, making sure every point is set up correctly is a slow process. Furthermore, the relationships can become extremely intricate when a relational database contains more than just two tables.

1. **Performance:** A major limitation in the use of relational database system is machine performance.
2. **Physical Storage Consumption:** With an interactive system, for example an operation like join would depend upon the physical storage also. It is, therefore common in relational databases to tune the databases and in such a case the physical data layout would be chosen so as to give good performance in the most frequently run operations. It therefore would naturally result in the fact that the lays frequently run operations would tend to become even more shared.
3. **Slow extraction of meaning from data:** If the data is naturally organized in a hierarchical manner and stored as such, the hierarchical approach may give quick meaning for that data.
4. **Data Complexity:** Data in an RDBMS exist in multiple tables, which are linked to each other through shared key values. An RDBMS does not force database designers to impose a coherent table structure; inexperienced programmers may design systems that create unnecessary complexity or limit the future development of the database through poorly chosen data types. The flexibility of an RDBMS presents a double-edged sword. Experienced designers work magic, but inexperienced designers wreak havoc on a company's data.
5. **Broken Keys and Records:** Relational databases require shared keys to link information spread across several tables. If the data types linking the keys are different, the database cannot link the records without additional rework by the report developer. Likewise, if a table lacks a unique key, the database may return inaccurate results. If the application

accessing a database isn't coded to lock records during an edit, users could inadvertently corrupt data, leading to broken records.

6. **Developer Expertise:** As the intricacy of a relational database increases, the skill set required by the RDBMS administrator, various users and report developers also increases. A mission-critical database may require proficiency that exceeds the budget of a small business; furthermore, if the developers did not consistently involve in best practice design, a subsequent developer may not understand hidden complexities that could lead to broken queries or inaccurate reports. This risk increases if database and application development is performed by different people.
7. **Hardware Performance:** Complex queries require sophisticated processing power. Although most desktop computers can manage the databases of the size and complexity often encountered in a small business setting, a database with external data sources or very complex data structures may need more powerful servers to return results within a satisfactory response time.

To summarize, Relational database management systems (RDBMS) are a consistent technique of storing and retrieving huge amounts of data, providing a combination of system performance and ease of implementation. RDBMS is the most common type of database used by organizations. It can be said that Relational database management systems (RDBMSs) have become universal components of modern application software. In many of these applications, the RDBMS is used to store data whose integrity and confidentiality must be strictly maintained.