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CHAPTER 1

System Decision Making Overview:

INTRODUCTION

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The late 1970s the 'Decision Support Systems' first coined by P.G.W. Keen, a Decision Support Systems: An Organization Perspective where the subject as computer systems have impact decisions where computer and analytical can value manager's judgment is essential. The Information Systems (IS) technologists and researchers developed and investigated Decision Support Systems (DSS) for over thirty years.

Van Schaik early 1970 as era of DSS concept during the period the concept DSS introduced. The DSS new philosophy how computers could used to support managerial decision-making. Philosophy unique and exciting ideas design and implementation of such systems.

(Averweg, 2015)

Decision Support Systems

The decision support system origin of notion originated following terms:

* **Decision** emphasizes primary focus on decision- making problem situation rather than subordinate activities information retrieval, processing or reporting;
* **Support** clarifies computer's role aiding rather than replacing decision maker; and
* **System** highlights integrated nature approach overall, a wider context machine, user and decision environment.

The advances in computer technology, ways and means computer-assisted decision-Making was born. As result over passage time, different DSS definitions arose:

* Little (1970) defines DSS 'model-based set for processing data and judgments assist manager in decision making"

* Classical definition DSS, by Keen and Scott Morton (1978), say 'Decision Support Systems intellectual resources individuals capabilities of computer to Improve Decisions. Its computer-based support system management decision makers deal with semi-structured problems'

* Bidgoli (1989) define DSS "computer-based information system consisting hardware/software and human element designed assist decision-maker at any level. The emphasis on semi-structured and unstructured task".

* Turban (2005) broadly define DSS a "computer-based information system models and data to solve semi-structured and unstructured problems user involvement".

These definitions seems basis defining DSS been developed from perceptions what DSS does (it support decision-making semi-structured or unstructured problems) and how DSS's objective can accomplished (components required an and development processes). Several DSS which embrace a definition of DSS these are:

- Required hardware;
- Required software.
- Required human elements (designers and end-users).
- Is designed support decision-making.
- Should help decision makers all levels.
- Emphasises semi-structured and unstructured tasks.

Evolution of DSS

Today DSS view as third generation computer-based applications. Sprague and Watson (1996) note there different conceptualization about DSS. Few scholars and organizations develop and research DSS characterized an *interactive* computer based systems *help* decision utilize *data* and *models* solve *unstructured* problems. The contribution DSS resulted these key words, problem arose the words certain "intuitive validity" system support a decision (any way) a "Decision Support System". Neither the restrictive broad DSS definition provide guidance for understanding a DSS.

The DDM Paradigm

The technology DSS consist of three sets capabilities areas of **d**ialog, **d**ata and **m**odelling Sprague and Carlson call DDM paradigm. It easy to use allow non-technical

decision makers interact with system. It have access to wide variety of data and provide analysis and modelling in many ways. Sprague and Watson suggest early systems adopted name DSS were strong only one area and weak in other. Figure 1 relationship between components in detail that models in model based linked with data in database. Models draw coefficients, parameters, and variable from databased enter results model's computation in database.

In Figure 1 show components of three dialog function the database management system (DBMS) and model base management system (MBMS) function to manage database and model respectively. Dialog generation and management system (DGMS) manages interface between user and rest of system.

Figure 1.1

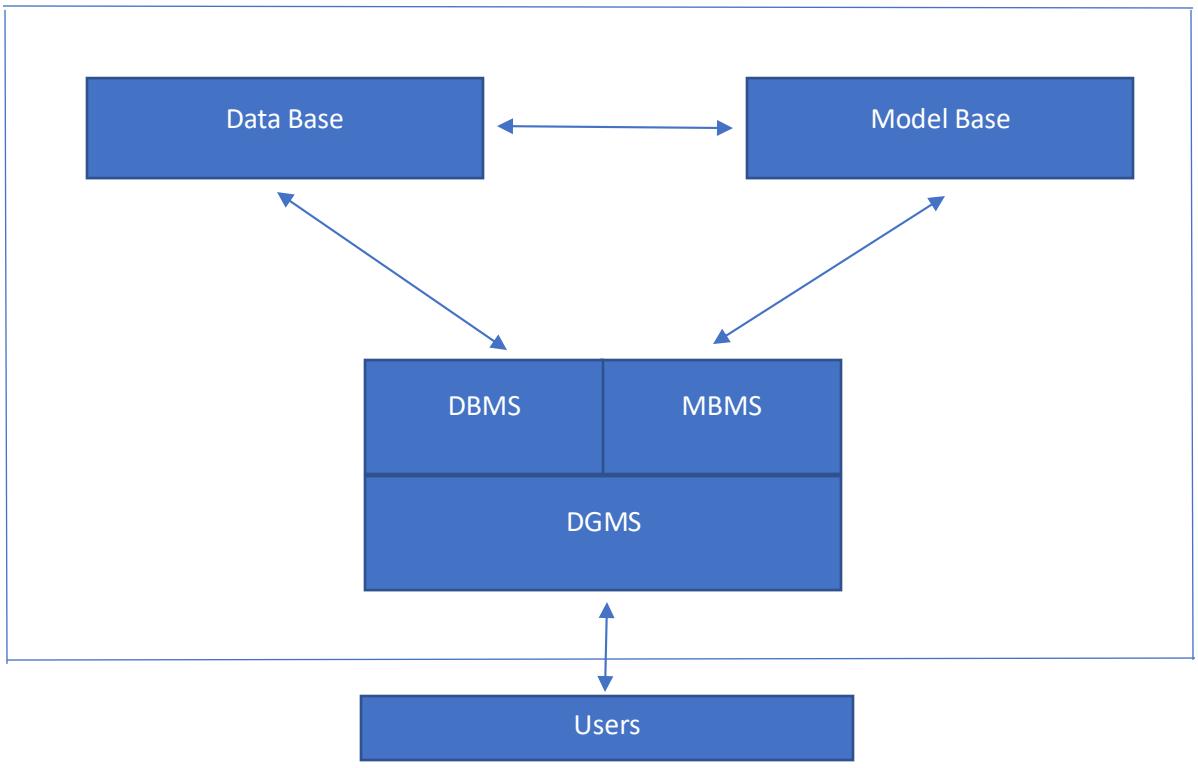

Figure 1.1 Components of DSS

Levels of Technology

The three levels of technology for developing DSS and of configuring *DSS tools* into *DSS generator* which used to develop variety specific DSS quickly and easily for decision makers Figure 1.2. System that accomplishes the work known as *specific* DSS It's the software/hardware that decision maker to deal with set related problems. Second level of technology known as *DSS generator*. This package related hardware and software provides set capabilities quickly and easily build specific DSS. The third level technology *DSS tools* is development of either DSS generator or specific DSS.

Figure 1.2

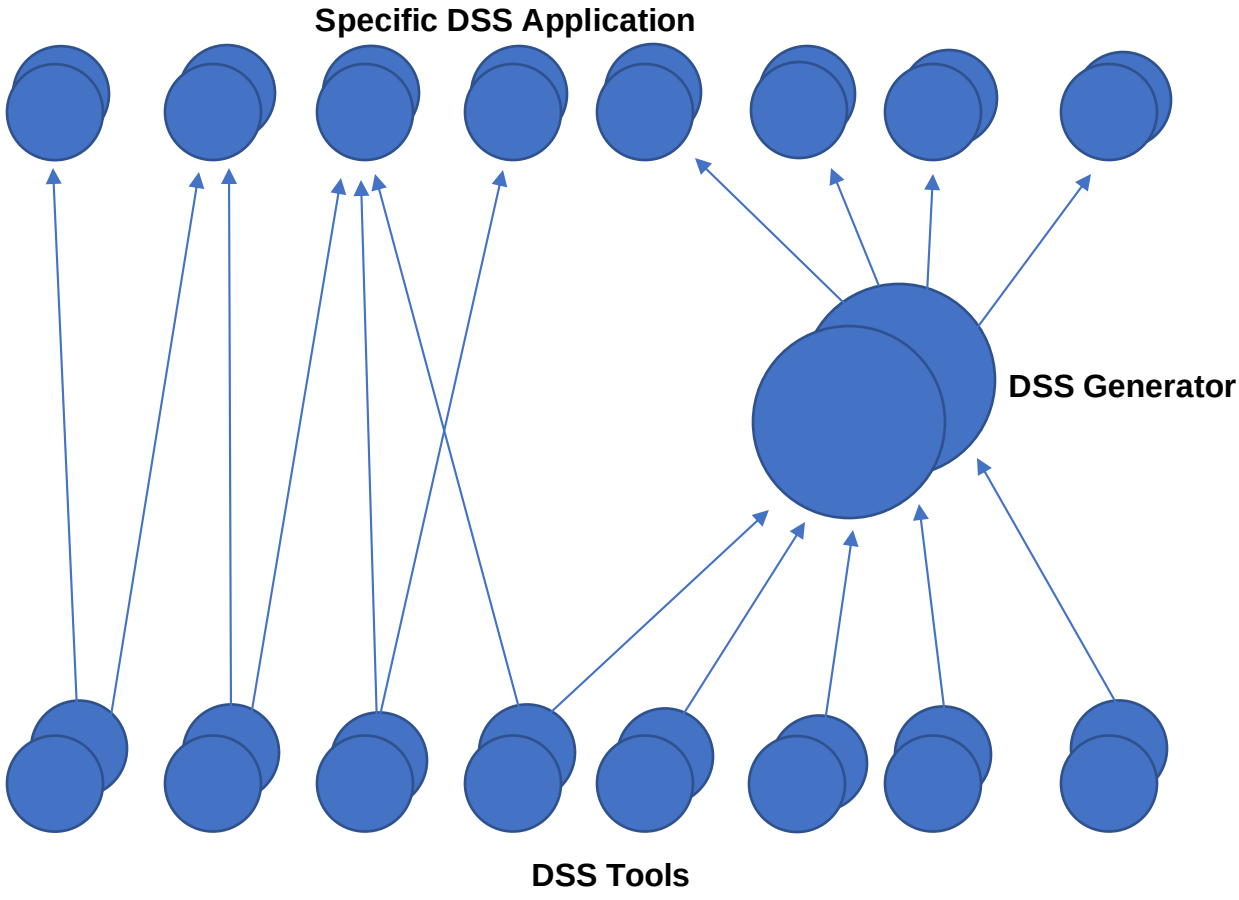

Figure 1.2. The three Levels of DSS Technology

- **Iterative Design**

  Instead of traditional development process, DSS require development that allows to evolve and change as problem or decision changes. It build with short feedback from users ensuring that proceeding done correctly. The developed is to permit change quickly and easily.

- **Organizational Environment**

  The DSS development requires organization strategy build an environment which systems can originate and evolve. This environment have a group of people interacting roles, software and hardware technology, set data sources and set analysis models.

This IS called DSS not the same. The DSS differ in capabilities and targeted users specific system how the DSS implemented is called (Power, 2003a) The DSS some focus on data, some models and facilitating collaboration and communication. The DSS sometime differ in terms of target users, “primary user” “generic users”.

The five identified type of DSS:

Text-oriented;

Database-oriented

Spreadsheet-oriented

Solve-oriented; and

Rule-oriented;

The classified DSS as ad hoc DSS or intuitional DSS supports problems which not expected to reoccur. The institutional DSS supports decisions that reoccur. Hackathon and Keen. Identified DSS in three categories:

Personal DSS

Group DSS; and

Organizational DSS.

DSS frameworks

Power (2003a) suggests DSS frameworks categories the DSS that is in use:

- **Communication-driven DSS**. System build using communication, collaboration and decision support technologies;
- **Data-driven DSS**. The systems analyse large "pools of data" that is in major organizational system that support decision-making so users can extract information previously buried in large quantities of data. From various transactional processing systems (TPS) collected data warehouses purpose. Online analytical processing (known as OLAP) data mining used analyze the data.
- **Document-driven DSS**. The systems integrate variety of storage and processing technologies provide complete document retrieval and analysis.
- **Knowledge-driven DSS**. These systems have problem-solving expertise Where 'expert' have knowledge on particular domain (understanding of problems with that domain) 'skill' solving of problems; and
- **Model-driven DSS**. The DSS early developed in 1970 and 1980s model driven as primarily standalone systems isolated from organizational IS used a type of model to perform. System developed by end-user groups or divisions not under IS central control . The DSS not a block box – it provide end-user control of the models and interface used. Model-driven DSS having access and manipulation of model.

Future trends going forth

The traditional DSS applications will extended a larger amount of applications that data required only interim stage or subset information required for decision. This construction of DSS the end – user focus or concentrate on variables interest in decision while "other" processing is performed without need end – user interaction. Future trends DSS have been suggested:

- Organizations consolidate in a single environment reduce administrator and license costs. Consolidate organizational data into Web visualization application, better decision support;
- all organizations with metrics and key performance indictors to business and remain competitive. The Web-based technologies (e.g. portal technologies), decision support portal is able present key information to audience.
- The future of data collection and analysis be automated. It will "free up" domain experts validity and verifying data from TPS and data warehouses so they act on information from DSS instead;
- there is going to be an increase visualized information with user-centric displays. Having data most recent correlated and aggregated, allow better decisions to user's current conditions;
- there be a use advanced techniques display highlight key issues. The future design of DSS interfaces should receive greater prominence interface will bring to important almost immediately; and
- decision support technology continue broaden is monitoring, tracking and communication support process overall unstructured problem solving. This broadening of technology a result an increased availability mobile computing and communication. (Averweg, 2015)

Foundations of Intelligent Decision-making Support Systems

The person that makes decision sometime faced with increasingly stressful environments – competitive, near real-time, face-paced overloaded information, data throughout distributed enterprise, and multinational scope. With a combination of Internet enabling access and speed, and artificial intelligence techniques, has aids support decision making risky and uncertain conditions. These have decision improve making suggesting solutions better than those make by human alone. The available increasingly from diverse fields' medical diagnosis control traffic to engineering applications.

Table 1.1 Process and outcome measures literature i-DMSS

Process Measures	Outcome Measures
Supports real-time decision 1,32	Improved organizational outcome 9, 10, 18 22, 23 24, 30, 31, 33, 34, 37, 48 51
Enhanced understanding of the problem 7, 8, 21, 29, 38, 42, 44, 49	Comparison to a 'gold standard' 13
Ability to generalize 40	Comparison to expert option 2,6,12,14,19,32,36,45,54,56
Faster decision 1, 11,16,17,20,25,35,43,46,50	More accurate 26,27,28
More efficient 4,5,55	
Systematic approach 41	
User satisfaction 15,39,52	
Organization satisfaction 47,53	

We called it intelligent decision-making support systems (**i – DMSS**). These systems affect both process of and outcome from, decision making. The propose both factors be considered in the evaluation.

The traditional decision support systems (DSS), Forgionne (1999) found that studies on process-oriented or outcome-oriented evaluation measures, not both are the same study. The quantitative outcome measures often for evaluation, can increased profit or decreased cost. Multiple measures used, the outcome and process-oriented measures presented as individual with no integrative assessment overall value of DSS. The i-DMSS multiple evaluation is particularly relevant. The outcome of decision affected using intelligent techniques, increasing use of Web-based and real-time DSS features, decision-making process well affected. The system enhance and extend traditional DSSs features like just-in-time information, real-time processing, online transaction processing, connectivity and globally up-to-date information (Phillips Wren and Forgionne).

The DMSS been researched extensively, some studies addressed unifying architecture evaluation of i-DMSS. The multicriteria DMSS evaluation been reported in literature. The multicriteria include perspectives of different constituencies or stakeholders. Adelman (1992) multifaceted evaluation for DMSS and expert systems having subjective, technical and empirical evaluation methods. Subjective methods assess the system from perspective users and sponsors; the technical evaluation method is the analytic methods used in DMSS; and empirical methods focused comparison of performance with and without system. Current approach suggesting unifying architecture evaluation using analytic hierarchy process (AHP), focusing on support of decision making.

The multi-criteria evolution i-DMSS can provided using AHP both outcome and process

measures provide single metric. Study utilized under AHP metric not been defined, no studies focused on i-DMSS.

Generic Decision-making Process

The decision-making process search paths in searching-space. This suggests the decision making can considered as "*a process of choosing among alternative courses of acting for the purpose of attaining a goal or goal".* Several models reported in literature on decision-making process should be, or actually, conducted (Turban and Aronson 1998,) Most popular based on Simon's Modem phases. See Table 1.2. below

Table 1.2 *Decision-Making Phases and Steps*

PHASE	STEP	DESCRIPTION
Intelligence ("Simon's setting the agenda step")	Data Gathering	Observation of reality and collecting of any relevant qualitative and quantitative data is done for the general situation of interest.
	Problem Recognition	
Design (Simon's representing the Problem step)	Model Formulation	Using the well-focused problem, a predefined model is instanced with a set of courses of action, outcomes criteria, set of uncontrolled events and parameters, and the relationships between these variables. If a predefined model is unavailable, a new model must be developed.
	Model Analysis	Face validity and pilot test of the model is conducted to reduce and potential source of significant error.
Choice (Simon's fining and selecting alternative step)	Generation & Evaluation	With a validated model, all courses of action are evaluated (or dynamically generated) and what-if, sensitivity, and goal-seeking analysis are conducted, in terms of the outcomes criteria.
	Selection	Best course of action is finally suggested, using an optimization, satisfaction criteria, or other approach.

Implementation	Result Presentation	Selected course action reported to top management team final organization authorization. (decision can take not implemented)
	Task Planning	Decision authorization, schedule set specific actions, where financial, human and material resources are estimated.
	Task Tracking	Set specific actions conducted and monitored planned end action is achieved.
Learning	Outcome-process Analysis	The process and outcomes metric collected from decision-making team and organization.
	Outcome-process Syntheses	Learned lessons on decision-making process identified and communicated top management team.

Decision-making process is complex. A continuous and partially interactive the phases may overlap, decision maker may loop back to previous phases (Simon, 1997). The decision making fundamentally process with “design” requiring “intelligence” “choice” needing “design”, and “implementation” following “choice” (Forgionne 1999). The steps repeated iteratively feedback loops until final choice been implemented, identified and communicated.

Concept of Intelligent Systems from AI Literature

The concept intelligence debated psychology and literature. There some literature - Based characteristics “human intelligent”. Like intelligence as learning ability (increase conceptual and procedural knowledge), to make sure communication and understanding of message generate expected responses), making decisions problem solving rational way, developing physical artifacts cope with survival and development society.

Alan Turing (1950), paper title “Computer Machinery and Intelligence”, the Turing Test (TT) is a machine considered intelligent if human being cannot distinguish the interaction (via two computer terminals) between computer program and human being using terminals. Computer program could considered intelligent why because program could imitate rational and intelligent human behavior.

John McCarthy (2002) paper “heuristic hypothesis” of psychologist A. Jensen (1998). The hypothesis, *all normal humans have the same intellectual mechanisms [i.e. “hardwiring “] that difference in intelligence are related to quantitative biochemical and physiological conditions. I see as speed, short term memory, and ability from accurate and retrievable long term memories*”. Intelligent artifacts based on intellectual underling mechanisms put in place by designers.

Decision Support Systems and AI Techniques: Intelligent Decision-Making Support System (iDMSS)

Decision support systems (DSSs) provide decision makers bringing human judgment together and computerized information to improve effectiveness of decision-making. Purpose of DSS can stated as “supplement one or more decision maker’s abilities” The design and intelligent DSS, called knowledge-based decision support systems (KB-DSS), and (second generation DSS oriented to become currents i-DMSS): (a) contains various knowledge describe selected aspects of decision-maker’s (b) it ability to acquire and maintain descriptive knowledge like record keeping and other types knowledge as well; (c) can produce and present knowledge various ways; (d) select knowledge to present or derive new knowledge; (e) can interact directly [intelligently] decision maker.

The main DMSS in medical, financial, military, political, and environmental contexts offer combined perspective. The intelligent human-like support need decision-making support, human decision makers is the final and critical decisions. Table 1.3 concept of "intelligent behavior" DMSS literature.

Table 1.3. Definitions intelligent behavior in DMSS below

Concept of human-like intelligent actions	Sources
Intelligent systems should be able to: (i) learn or understand from experience; (ii) make sense out of ambiguous or contradictory messages; (iii) respond quickly and successfully to new situation; (iv) use reasoning solving problems directing conduct effective; (v) deal with perplexing situations; (vi) understanding and in ordinary, rational ways; (vii) apply knowledge to manipulate the environment; (viii) think and reason;	**Turban and Aronson (1998)**
Intelligence as "acting as we would expect people to act" and state that artificial intelligent provides the techniques.	**Brown and O' Leary(1995.)**
Intelligence as "the ability of a system to behave appropriately in an uncertain environment, where appropriate behavior is that which maximizes the likelihood of success in achieving the system's goals." Their definition intended to span spectrum of capability simple to complex and recognizes degrees of intelligence. The degree of intelligence is determined by three factors: **(1)** available computational power and memory; **(2)** sophistication of the underlying processes or models; and, **(3)** the quality and quantity of information and values available to the system.	**Albus and Meystel (2001)**
'Intelligence' in the context of technology systems is not synonymous with 'human intelligence'. The system is referred to as intelligent if it exhibits some of the abilities that are associated with 'intelligent behavior'.	**Pohl (2005)**

(Jatinder, Guisseppi, & Manuel, 2006)

Systems Thinking

What is a system? a system can be seen as collection of thing, entities, or people relate to each other in ways, or organized. The rules of interaction, collectively have purpose given, are strive towards state of balance.

The complexity systems and decision making with systems, we should be thinking difference in a new way. This new thinking has evolved 1940 labelled as 'systems thinking'. Management Science, Operations Research, or Systems Analysis stands this mode that suitable for most of the interactions between various parts system can expressed quantitative terms, like mathematical expressions. Decision aids help analyst explore problems in full complexity, find optimal or the best compromise to problems, and giving answer to important questions. Example 'a solution affected changes in various cost factors?' the decision maker much of information necessary come to informed decision, rather than influenced, emotional , or political consideration only. Political considerations may unavoidable in the end sway to decision one way or another, such decision increases degree of rationality decision maker, in private or public sectors. We are not replacing the decision maker, but provide decision maker with information relevant and or crucial to decision.

OR/MS METHODOLOGY

Some decision making in today's world deal with complex problem situations. Often defined, to conflicting forces and golds. The reasons for this complexity that these problem occur into a system context. These systems are created and controlled by humans. Human element therefore not excluded from decision process.
Without computers our computational abilities are slow and limited. Sometime we have

difficulties tracing complex interrelationships and interactions between elements or factors. Therefore important that decision making should be guided by systematic and comprehensive methodology that help make effective use extensive still limited reasoning power.

Decision making attempted change aspect of the world, decision making does not idealized condition in laboratory, in real world and often messy world. The metrology be able to cope with complexity of real world, flexible and comprehensive, still delivering result in short time frame decision making has occur. Nor is it important that methodology used scientific; more important leads to good decision making. The decision problem clearly identified, the decision maker's objective can be spelled out, decision choices are known or can be developed.

(Hans, 1994)

CONCLUSION

The DSS have impact decision-making in organizations or business that is largely dependent on nature of application. The Web and Internet have developments in decision-making and support system that provide research focus and DSS implementation. Decision Support Systems (DSS) deal with semi-structured problem. Example, when managers in organization or business face with decision in aspects of procedure are known.

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