Levels of Decision making

Strategic decision-making determines the objectives, resources and policies of the organisation. A major problem at this level of decision making is predicting the future of the organisation and its environment and matching the characteristics of the organisation to the environment. This process generally involves a small group of high level managers who deal with complex, non-routine problems.

Decision making for **management control** is principally concerned with how efficiently and effectively resources are utilised and how well operational units are performing. Management control requires close interaction with those that are carrying out the tasks of the organisation. It takes place within the context of broad policies and objectives set out by strategic decision making and the behaviourists have described, it requires an intimate knowledge of operational decision making and task completion.

Knowledge based decision making deals with evaluating new ideas for products and services, ways to communicate new knowledge and ways to distribute information throughout the organisation.

Decision making for **operational control** determines how to carry out the specific tasks set forth by strategic and middle management decision makers. Determining which units in the organisation will carry out the task, establishing criteria for completion and resource utilisation and evaluating outputs all require decisions about operational control.

Types of decisions: Structured versus Unstructured

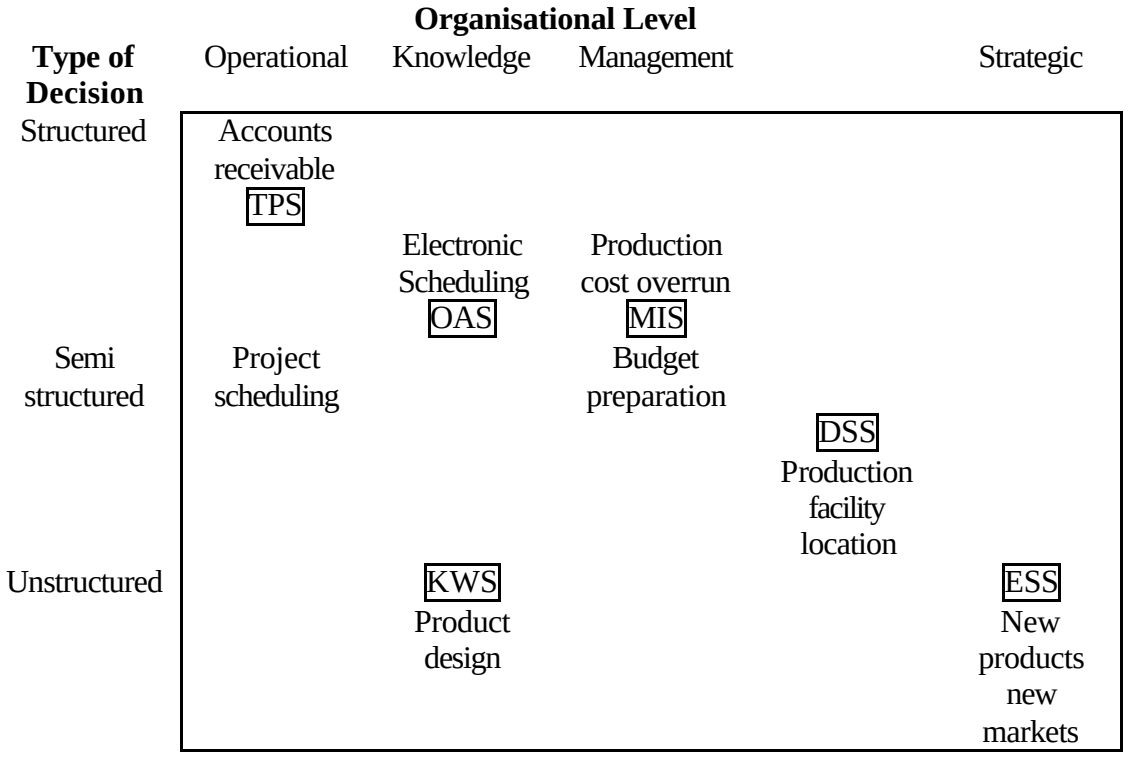
Within each of these levels of decision making, Simon (1960) classified decisions as being either programmed or non programmed. Other researchers refer to these types of decisions as structured or unstructured. *Unstructured* decisions are those in which the decision maker must provide judgement, evaluation and insights into the problem definition. These decisions are novel, important and non-routine, there is no well understood or agreed upon procedure for making them. *Structured* decisions by contrast are repetitive, routine and involve a definite procedure for handling so that they do not have to be treated each time as if they were new. Some decisions are *semi-structured* decisions; in such cases only part of the problem has a clear cut answer provided by an accepted procedure.

Types of Decisions and types of systems

Combing these two views of decision making produces the grid below. In general operational control personnel face fairly well structured problems. In contrast strategic planners tackle highly unstructured problems. Many problems encountered by knowledge workers are fairly unstructured as well. Nevertheless each level of the organisation contains both structured and unstructured problems.

In the past most success in modern information systems came in dealing with structured, operational and management control decisions. But now the most exciting

applications are occurring in the management, knowledge and strategic planning areas, where problems are either unstructured or semi structured.

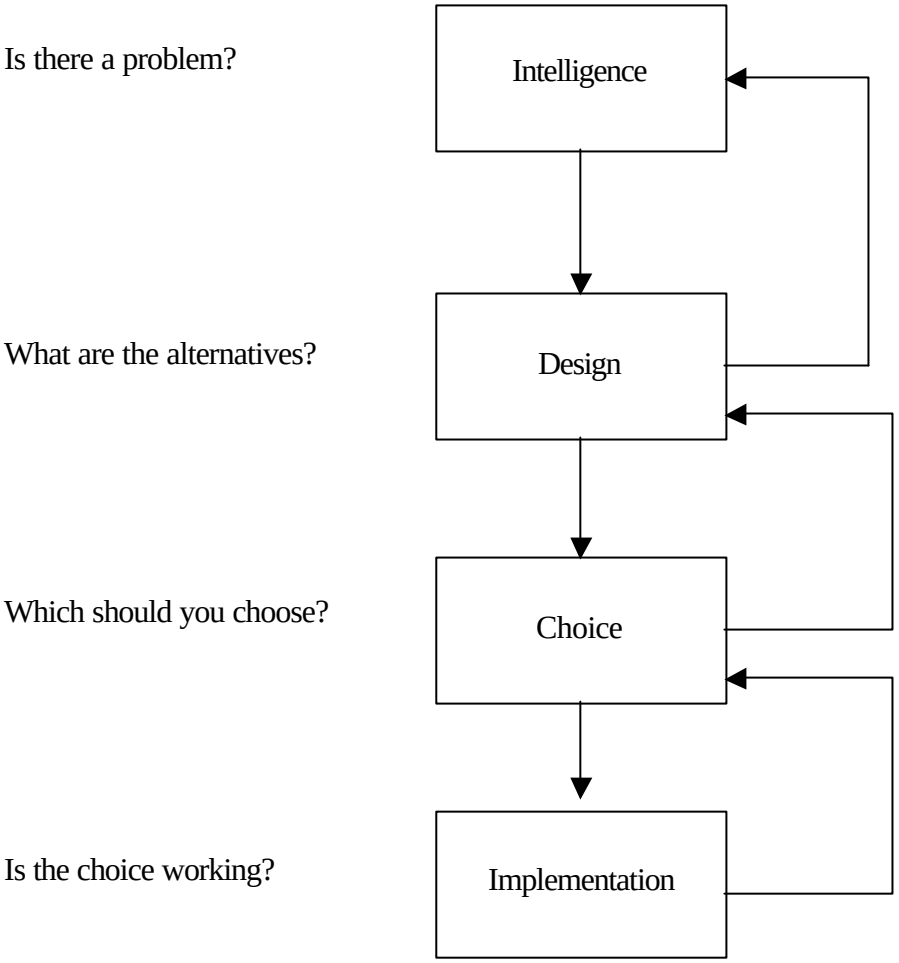


Key: TPS – Transaction processing system
OAS – Office automation system
KWS – Knowledge work system
MIS – Management Information System
DSS – Decision support system
ESS – executive support system

Stages of Decision making

Making decisions consists of several different activities that take place at different times. The decision maker has to perceive and understand problems. Once perceived solutions must be designed, once solutions are designed choices have to be made about a particular solution, finally the solution has to be implemented. Simon described 4 different stages in decision making: intelligence, design, choice and implementation.

Stages in Decision making, Information requirement and supporting information systems		
Stage of Decision making	**Information requirement**	**Example system**
Intelligence	Exception reporting	MIS
Design	Simulation prototype	DSS, KWS
Choice	What if simulation	DSS; large models
Implementation	Graphics, charts	PC and mainframe decision aids.



Intelligence consists of identifying the problems occurring in the organisation. Intelligence indicates why, where and with what effects a situation occurs. This broad set of information gathering activities is required to inform managers how well the organisation is performing and to let them know where problems exist. Traditional MIS that deliver a wide variety of detailed information can help identify problems, especially if the systems report exceptions.

During design the individual designs possible solutions to the problems. This activity may require more intelligence so that a manager can decide if a particular solution is appropriate. Smaller DSS are ideal in this stage of decision making because they operate on simple models, can be developed quickly and can be operated with limited data.

The third stage, choice consists of choosing among alternatives. Here a manager can use information tools that can calculate and keep track of the consequences, costs and opportunities provided by each alternative designed in the second stage. The decision maker might need a larger DSS to develop more extensive data on a variety of alternatives and to use complex analytic models needed to account for all the consequences.

The last stage in decision making is implementation. Here managers can use a reporting system that delivers routine reports on the progress of a specific solution. The system will also report some of the difficulties that will arise, will indicate resource constraints and will suggest possible improvement actions. Support systems can range from full-blown MIS to much smaller systems as well as project planning software operating on PCs.

In general the stages of decision making do not necessarily follow a linear path from intelligence to design, choice and implementation. At any point in the decision making process you may have to loop back to a previous stage. For instance one can often create several designs but may not be certain about whether specific design meets the requirements for the particular problem. This situation requires additional intelligence work. Alternatively one can be in the process of implementing a decision only to discover that it is not working. In such a case one is forced to repeat the design or the choice stage.

Individual models of Decision making

The Rational model

The rational model of human behaviour is built on the idea that people, organisations and notions engage in basically consistent, value maximising calculations or adaptations within certain constraints. The rational model works as follows, an individual has goals and objectives and has a payoff, utility or preference function that permits that person to rank all possible alternative actions by the actions contribution to the desired goal. The actor is presented with and understands alternative courses and actions. Each alternative has a set of consequences. The actor chooses the alternative and consequences that rank highest in terms of the payoff functions, that is, that contribute most to the ultimate goal. In a rigorous model of rational action, the actor has comprehensive rationality, can accurately rank all alternatives and consequences, and can perceive all alternatives and consequences.

Three criticisms

1. Most people cannot specify all alternatives that exist.
2. Most individuals do not have singular goals and a consciously used payoff function and they are not able to rank all alternatives and consequences.
3. In real life the idea of a finite number of all alternatives and consequences makes no sense.

Despite these the rational model remains a powerful and attractive model of human decision making. It is rigorous, simple and instructive.

Bounded rationality and satisficing

March and Simon (1958) and Simon (1960) proposed a number of adjustments to the rigorous rational model. Rather than optimising which presumes comprehensive rationality, Simon argues that people partake in satisficing – choosing the first available that moves them toward their ultimate goal. Instead of searching for all the alternatives and consequences (unlimited rationality), Simon proposes bounded

rationality, that people limit the search process to sequentially ordered alternatives (alternatives not radically different from the current policy). When possible people avoid new uncertain alternatives and rely instead on tried and true rules, standard operating procedures and programs. In this way, rationality is bounded.

Muddling through

In an article on the science of "muddling through", Lindblom (1959) proposed the most radical departure from the rational model. He described this model of decision making as one of "successive limited comparisons". First individuals and organisations have conflicting goals – they want both freedom and security, rapid economic growth and minimal pollution, faster transportation and minimal disruption due to highway construction and so forth. People have to choose among policies that contain various mixes of conflicting goals. The values themselves cannot be discussed in the abstract, they become clear only when specific policies are considered.

Because there is no easy means-end analysis and because people cannot agree on values the only test of a good choice is whether people agree on it. Policies cannot be judged by how much of X they provide, but rather by the agreement of the people making the policies. Labour and management can rarely agree on values, but they can agree on specific policies.

Because of the limits on human rationality Lindblom proposes incremental decision making, or choosing policies most like the previous policy. Finally choices are not made. Instead decision making is a continuous process in which final decisions are always being modified to accommodate changing objectives, environments, value preferences and policy alternatives provided by decision makers.

Psychological Types and frames of reference

Modern psychology has provided a number of qualifications to the rational model. Psychologists find that humans differ in how they maximise their values and in the frames of reference they use to interpret information and make choices.

Cognitive style describes underlying personality dispositions toward the treatment of information, the selection of alternatives and the evaluation of consequences. McKenny and Keen (1974) described 2 cognitive styles that have direct relevance to information systems, systematic versus intuitive. Systematic decision makers approach a problem by structuring it in terms of some formal method. They evaluate and gather information in terms of their structured method. Intuitive decision makers approach a problem with multiple methods, using trial and error to find a solution and tend to not structure information gathering or evaluation. Neither type is superior to the other, but some types of thinking are most appropriate for certain tasks and roles in the organisation.

The existence of different cognitive styles does not challenge the rational model of decision making. It simply says that there are different ways of being rational.

Organisational models of decision models

Decision making often is not performed by a single individual but by entire groups or organisations. Organisational models of decision making take into account the structural and political characteristics of an organisation.

Bureaucratic models

The dominant idea of a bureaucratic model of decision making is that whatever organisations do is the result of standard operating procedures honed over years of active use. The particular actions chosen by an organisation are an output of one or several organisational subunits (e.g. marketing, production, finance, HR). The problems facing any organisation are too massive and too complex to be attended by the organisation as a whole. Problems are instead divided into their components and are parcelled out to specialised groups.

Each organisational subunit has number of standard Operating Procedures (SOPs) – tried and proven techniques – that it invokes to solve a problem. Organisations rarely change those SOPs they may have to change personnel and incur risks.

SOPs are woven into the programs of each subunit. Taken together they constitute the range of effective actions that leaders of an organisation can take. These are what the organisation can do in the short term.

Although senior management and leaders are hired to coordinate and lead the organisation they are effectively trapped by parochial subunits that feed information upward and that provide standard solutions. Senior management cannot decide to act in ways that the major subunits cannot support.

Some organisations do change, they learn new ways of behaving and they can be led. But these changes require a long time. In general organisations do not choose or decide in a rational sense, instead they choose from among a very limited set of repertoires. The goals of organisations are multiple not singular, and the most important goal is the preservation of the organisation itself. The reduction of uncertainty is another major goal. Policy tends to be incremental, only marginally different from the past because radical policy departures involve too much uncertainty.

Political models of organisational choice

Power in organisations is shared; even the lowest level workers have some power. At the top power is concentrated in the hands of a few. For many reasons leaders differ in their opinions about what the organisation should do. The differences matter, causing competition for leadership to ensue.

In a political model of decision making what an organisation does is as a result of political bargains struck among key leaders and interest groups. Actions are not necessarily rational except in a political sense, and the outcome is not what any individual necessarily wanted. Instead policy organisational action is a compromise, a mixture of conflicting tendencies. Organisations do not invent solutions that are

chosen to solve some problem. They develop compromises that reflect the conflicts, the major stakeholders, the diverse interests, the unequal power and the confusion that constitutes politics.

Garbage can model

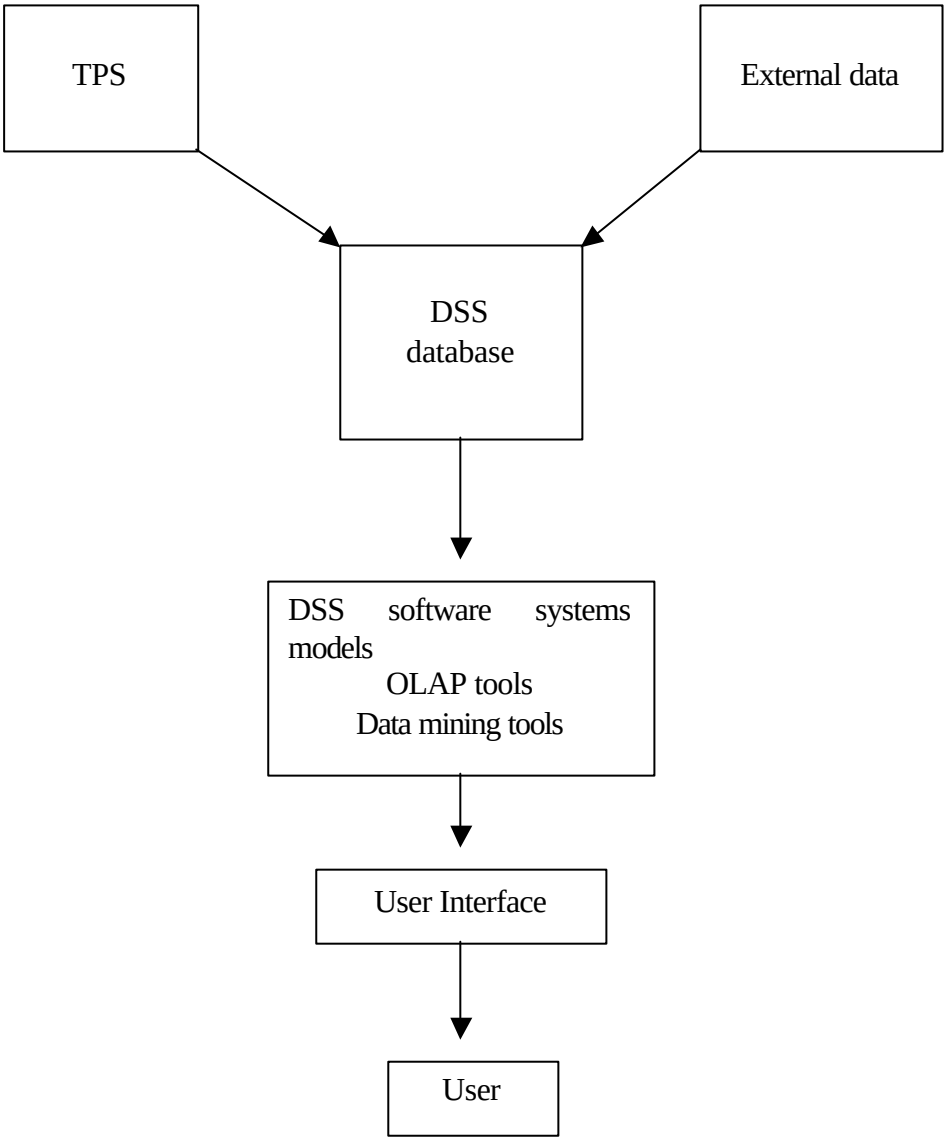
States that organisations are not rational. Decision making is largely accidental and is the product of stream of solutions, problems and situations that are randomly associated. That is solutions become attached to problems for accidental reasons, Organisations are filled with solutions looking for problems and decision makers looking for work.

If this model is correct it should not be surprising that the wrong solutions are applied to the wrong problems in an organisation, or that, over time a large number of organisations make critical mistakes that lead to their demise.

Types of Decision Support Systems

Two basic types, model driven and data driven. Early DSS systems developed in the late 70s and 80s were model driven. **Model driven DSS** were primarily stand-alone systems isolated from major organisational information systems that used some type of model to perform "what if" and other kinds of analyses. Such systems often developed by end user divisions or groups not under central IS control. Their analysis capabilities were based on strong theory or model combined with a good user interface that made the model easy to use.

Data driven DSS analyse large pools of data found in major organisational systems. They support decision making by allowing users to extract useful information that previously was buried in large quantities of data. Often data from Transaction processing systems (TPS) are collected in data warehouses for this purpose. On line analytical processing (OLAP) and data mining can then be used to analyse the data. Companies are starting to build data driven DSS to mine customer data gathered from their websites as well.



Components of DSS

DSS Database
Collection of current or historical data from a number of applications or groups. It may be a small database residing on a PC that contains a subset of corporate data that has been downloaded and possibly combined with external data. Alternatively it may be a massive data warehouse that is continuously updated by a major organisational TPS. The data in DSS databases are generally extracts or copies of production databases so that using the DSS does not interfere with critical operational systems.

DSS software systems
Contains software tools that are used for data analysis. It may contain various OLAP tools, data mining tools or a collection of mathematical and analytical models that easily can be made accessible to the DSS user. A model is an abstract representation that illustrates the components or relationships of a phenomenon. A model can be a physical model, a mathematical model or a verbal model. Each DSS is built for a

specific set of purposes and will make different collections of models available depending on these purposes.

Perhaps the most common are libraries of statistical models. Such libraries usually contain the full range of expected statistical functions including, means, medians, deviations and scatter plots. The software has the ability to project future outcomes by analysing a series of data. Statistical modelling software can be used to help establish relationships, such as relating product sales to differences in age, income or other factors between communities. Optimisation models often use linear programming, determine optimal resource allocation to maximise or minimise specified variables such as cost or time. The advanced planning system uses such software to determine the effect that filling a new order will have on meeting target dates for existing orders. A classic use of optimisation models is to determine the proper mix of products within a given market to maximise profits.

Forecasting models are often used to forecast sales. The user of this type of model might supply a range of historical data to project future conditions and the sales that might result from those conditions. The decision maker could vary those future conditions to determine how these new conditions might affect sales. Companies often use this software to attempt to predict the actions of competitors. Model libraries exist for specific functions such as financial and risk analysis models.

The most widely used models are **sensitivity analysis** models that ask "what if" questions repeatedly to determine the impact of changes in one or more factors on outcomes. "What if" analysis – working forward from known or assumed conditions – allows the user to vary certain values to test results in order to better predict outcomes if changes occur in those values. Desktop spreadsheet software is often used for this purpose. Backward sensitivity analysis is used for goal seeking.

The DSS interface permits easy interaction between users of the system and the DSS software tools. A graphic easy to use flexible user interface supports the dialogue between the user and the DSS. The DSS users are generally corporate executives or managers, people with well-developed working styles and individual preferences. Often they have little or no computer experience and no patience for learning how to use a complex tool, so the interface must be relatively intuitive. In addition what works for one may not work for another. Many executives offered only one way of working simply will not use the system. To mimic a typical way of working a good user interface should allow the manager to move back and forth between activities at will. Building a successful DSS requires a high level of user participation and often the use of prototyping to ensure these requirements are met.

Examples of DSS applications

Organisation	**DSS application**
American Airlines	Price and route selection
General Accident Insurance	Customer buying patterns and fraud detection
Bank of America	Customer profiles
Burlington Coat Factory	Store location and inventory mix
Southern Railway	Train dispatching and routing
US department of Defence	Defence contract analysis

MRPII – Manufacturing resources planning, includes applications such as master production scheduling, purchasing, material requirements planning and general ledger. Many MRPII are too large and slow to be used for "what if" analysis.

APS – Advanced planning system, gives the user DSS functionality using the data from existing MRPII systems. Allows a range of "what if" processing by pulling the relevant data from the manufacturing software and performing calculations based on user-defined variables.

GIS – Geographic Information Systems, are a special category of DSS that can analyse and display data for planning and decision making using digitised maps. The software can assemble, store, manipulate and display geographically referenced information, tying data to points, lines and areas on a map. GIS can thus be used to support decisions that require knowledge about the geographical distribution of people or other resources in scientific research, resource management and development planning.

Web based DSS – DSS based on the web and the internet are being developed to support decision making providing on line access to various databases and information pools along with software for data analysis.

CDSS – Customer decision support systems, support the decision making process of an existing or potential customer. People use more information from multiple sources to make purchasing decisions.

Group Decision Support Systems (GDSS)

A GDSS is an interactive computer based system to facilitate the solution of unstructured problems by a set of decision makers working together as a group.

GDSS were developed in response to the growing concerns over the quality and effectiveness of meetings. The underlying problem in group decision making have been the explosion of decision maker meetings, the growing length of those meetings and the increased number of attendees. Estimates on the amount of a manager's time spent in meetings range from 35 –70%.

Meeting facilitators, organisational development professionals and information systems scholars have been focusing on this issue and have identified a number of discrete meeting elements that need to be addressed:

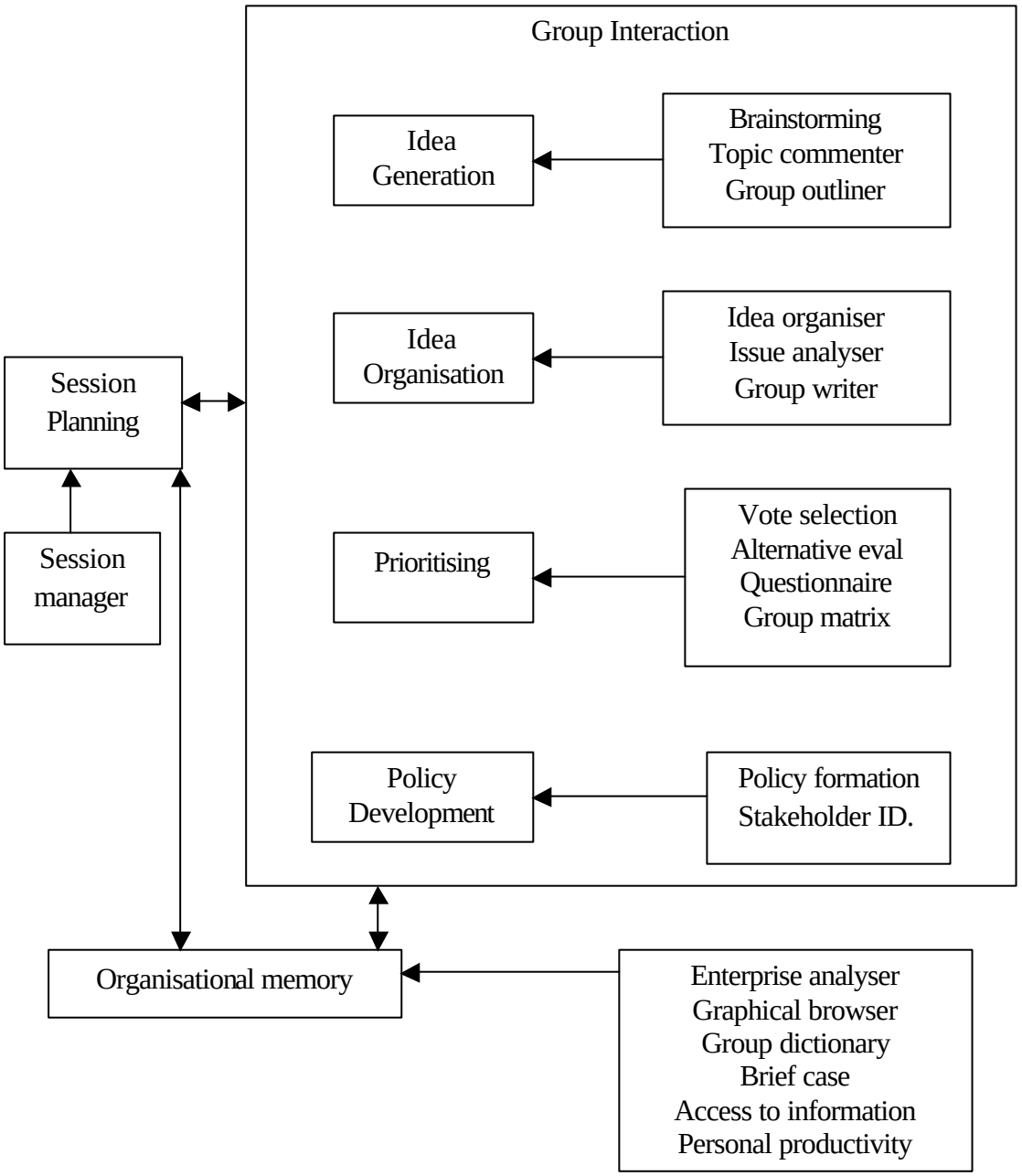
1. Improved preplanning to make meetings more effective and efficient.
2. Increased participation so that all attendees will be able to contribute fully even if the number of attendees is large.
3. Open, collaborative meeting atmosphere, in which attendees from various organisational levels feel able to contribute freely. The lower level attendees must be able to participate without fear of being judged by their management, higher status participants must be able to participate without having their presence or ideas dominate the meeting and result in unwanted conformity.
4. Criticism free idea generation, enabling attendees to contribute without undue fear of feeling personally criticised.

5. Evaluation objectivity, creating an atmosphere in which an idea will be evaluated on its merits rather than on the basis of the source of the idea.
6. Idea organisation and evaluation, which require keeping the focus on the meeting objectives, finding efficient ways to organise the many ideas that can be generated in a brainstorming session, and evaluating those ideas not only on their merits but also within appropriate time constraints.
7. Setting priorities and making decisions, which require finding ways to encompass the thinking of all the attendees in making these judgements.
8. Documentation of meetings, so that attendees will have as complete and organised a record of the meeting as may be needed to continue the work of the project.
9. Access to external information, which will allow significant factual disagreements to be settled in a timely fashion, thus enabling the meeting to continue and be productive.
10. Preservation of "organisational memory" so that those who do not attend the meeting can also work on the project. Often a project will include teams at different locations who will need to understand the content of a meeting at only one of the affected sites.

GDSS software tools

- Electronic questionnaires aid the organisers in premeeting planning by identifying issues of concern and by helping to ensure that key planning information is not overlooked.
- Electronic brainstorming tools allow individuals simultaneously and anonymously to contribute ideas on the topics of the meeting.
- Idea organisers facilitate the organised integration and synthesis of ideas generated during brainstorming.
- Questionnaire tools support the facilitators and group leaders as they gather information before and during the process of setting priorities.
- Tools for voting or setting priorities make available a range of methods from simple voting, to ranking in order, to a range of weighted techniques for setting priorities or voting.
- Stakeholder identification and analysis tools use structured approaches to evaluate the impact of an emerging proposal on the organisation and to identify stakeholders and evaluate the potential impact of the stakeholders on the proposed project.
- Policy formation tools provide structured support for developing agreement on the wording of policy statements.
- Group dictionaries document group agreement on definitions of words and terms central to the project.

An EMS (electronic meeting system) is a type of collaborative GDSS that uses IT to make group meetings more productive by facilitating communication as well as decision making. It supports any activity in which people come together whether at the same place at the same time or in different places at different times.



Executive Support Systems (ESS)

Helps managers with unstructured problems focusing on the information needs of senior management. Combining data from internal and external sources, ESS create a generalised computing and communications environment that can be focused and applied to a changing array of problems. ESS help senior executives monitor organisational performance, track activities of competitors, spot problems, identify opportunities and forcast trends.

Benefits
These systems put data and tools in the hands of executives without addressing specific problems or imposing solutions. Executives are free to shape the problems as necessary using the system as an extension of their own thinking processes. These are not decision making systems, they are tools to aid executives in making decisions.

The most visible benefit of ESS is their ability to analyse, compare and highlight trends. Executives are using ESS to monitor performance more successfully in their own areas of responsibility. Some are using these systems to monitor key performance indicators. Problems can be handled before they become too damaging.

A well designed ESS could dramatically improve management performance and increase upper managements span of control.