The Hypothesis Testing of Decision Making Styles in the Decision Making Process

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Abstract:

The objective of this study is to test the effectiveness of various decision making styles in the decision-making process. Four broad categories of decision making styles are utilized in this simulation study. The methodology is illustrated with a complex, semi-structured problem often used to train and evaluate management personnel. In order to test the efficacies of these styles, two prototype systems will be constructed. The Decision Support Systems architecture serves as a control and the Just-in-time intelligent Decision Support Systems as the experimental architecture. The experiment will test whether the use of either of the two systems offers a significant improvement in the process of and outcome from the four decision-making styles. The paper closes with a conclusion on the results of the experiment and their implications on Information Systems Research in relation to the decision making process.

Keywords: Decision Making, Decision Making styles, Decision-making Process, Simulation, simulation modeling

Introduction

The decision making process is directly linked with the need for problem solving and or decision making. The right choices we make in solving problems and making decisions depends on how correctly we follow the steps through in the decision making process. This paper addresses the effectiveness of the process and outcomes of decision-making styles, in the decision-making process, puts forward a methodology for determining their effectiveness.

The merits of Non-subject Designs

The non-subject design approach assumes that human subjects will not be used in gathering data for the simulation study and in evaluating information system architectures. Using human subjects can present some serious scientific, technical, and economic problems. It will be time consuming and potentially costly to get human subjects because of the selection, training, and motivational issues involved in the acquisition of subjects (Power, 2002); (Hoover and Perry, 1990); (O'Kane and Spenceley, 1999). In addition, there may be political considerations (obtaining consent from subjects and going through bureaucratic hurdles from the Institutional Research Board - IRB) involved in selecting and utilizing human subjects in experiments. Also, humans in an experimental setting may not behave the same way as they would in practice. Moreover, it will be difficult to obtain a representative sample of human subjects. Even if the sample is representative of the defined subject group, it may not be representative of the population of potential information system users. As a result, it may be difficult to generalize the results from the subject-based experiment.

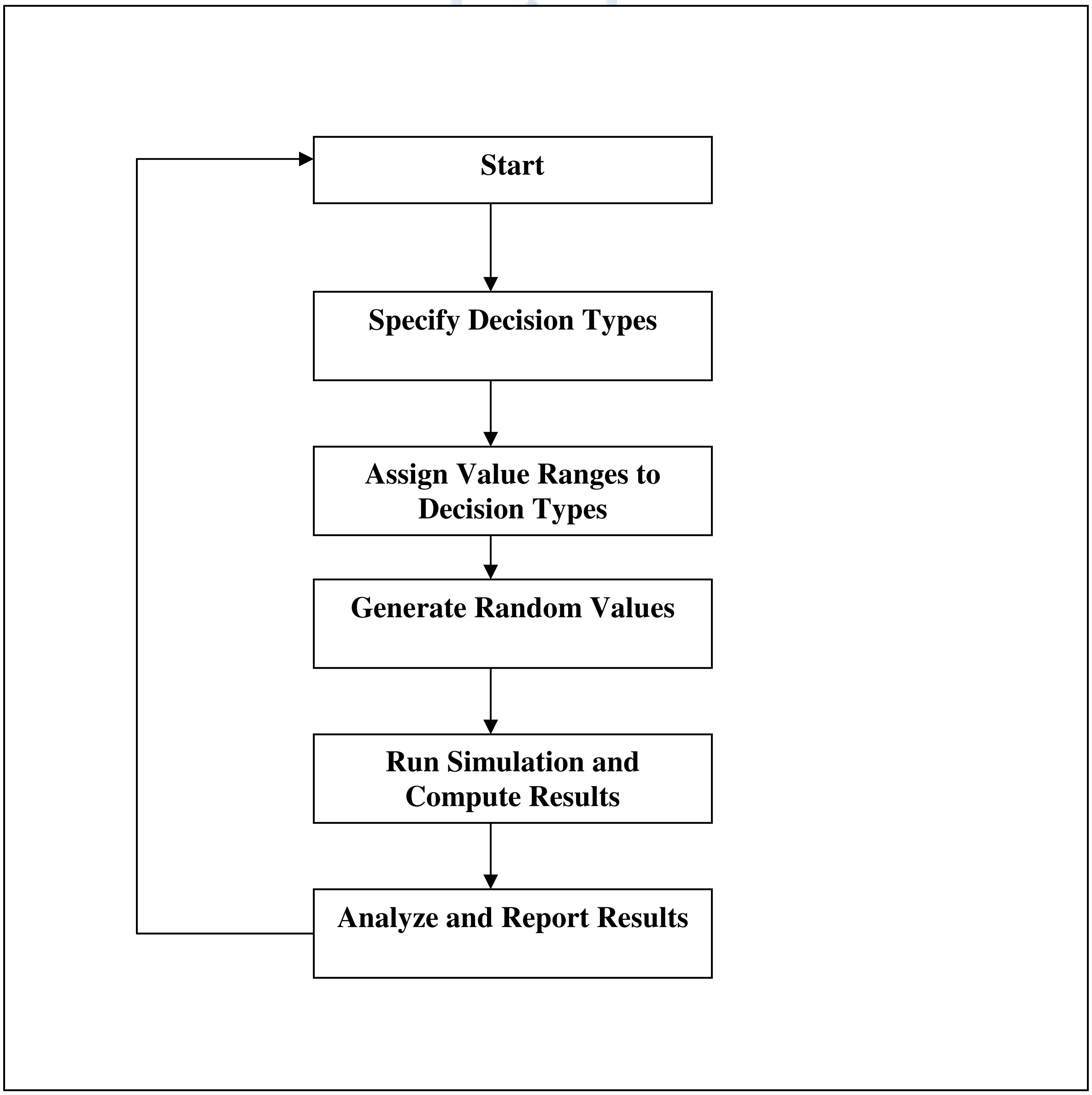
Human subjects, however, may be unnecessary to conduct simulation studies of information systems, especially when information is available about user behavior. One such instance involves studies that involve decision making support systems (DMSS). There are various studies that define decision making behavior for the general population. Different decision-making styles will be generated based on a stochastic process (based on random variables). This is regulated by means of the hypothesized decision-making styles as found in the literature and specifically in: Turban and Aronson's Decision Support Systems and Intelligent Systems (1998) pp. 62-3. Decision Style is the way and manner in which decision makers think and respond to or address problems. Decision style is also about their cognitive response to decision situations and their individual and situational differences in beliefs and values. Decision making is not linear. That is to say the emphasis, time allotment and priorities differ from individual to individual and as well as from situation to situation. Gordon et al [1975] identified 40 processes in looking at 9 types of decision and (Mintzberg, 1973) identified 7 basic styles with a lot of variations. (Turban and Aronson, 1998).

Once a simulated manager or decision maker is assigned to a certain decision-making style category, the corresponding choice logic (parameters) will be applied to his or her decision behaviors within the simulation model. Based on these parameters, values for decision variables and uncontrollable variables will be generated and entered. The simulation results, such as values for profit after tax, investment, marketing and Research and Development will be obtained for the simulated quarter or quarters. Profit status reports and sensitivity analyses will be utilized in arriving at a recommended policy (set of decision variables) for the simulated business organization.

Since each simulated user will be utilizing the alternative information system architectures, the inferences need not be precise. Moreover, sensitivity analysis can be used to test outcome and process sensitivity for inferred values.

The suggested approach can be used to generate a very large number of simulation runs for the full variety of potential users within a very short time. More importantly, the approach is timely and cost effective. Since all potential, rather than a sample of users is considered, the approach is likely to be more generalizable than human subject based experiments (Conteh and Forgionne, 2003a).

Figure 1 Simulation: Experimental Design



Prototype DSS and IJDSS

The methodology is illustrated with a complex, semi-structured problem often used to train and evaluate management personnel. The problem being simulated here involves a market in which an organization competes for a product's four-quarter total market potential on the basis of price and marketing. The demand for the organization's software products will be influenced by, (1) its actions, (2) a major competitor's behavior, and (3) the economic environment.

The market simulation process is centered on the formulation of a software development policy that would generate as much total profit as possible over a four-quarter planning period. Policy making requires: (1) setting the levels of four decision variables (the product price, marketing budget, research and development expenditures, and plant expansion investment) and (2) forecasting the levels of four key uncontrollable variables, that comprises the competitor's price, marketing budget, a seasonal product sales index, and an index of general economic conditions. These eight variables will jointly influence the profitability of the simulated business organization.

In both systems, twelve additional variables, including plant capacity, raw materials inventory, and finished goods inventory, will remain fixed from trial to trial and thereby become the scenario for decision-making. As in any competitive business environment, this problem is dynamic in nature, i.e., a decision made in one quarter affects decisions and outcomes in the current and subsequent quarters. In this dynamic environment, it also is difficult to recover from initially poor decision strategies within the simulated time frame.

In this situation, the major focus of the users will be on the key uncontrollable events – competitors' marketing and price, the seasonal index, and the economic index – and the major controllable actions – price, marketing, research and development, and production. Ranges for these values are available for scenarios specified in the training exercises. A DMSS in general, can test alternatives and events specified by the user, offer information about the relationships between the variables, guide users toward a desirable action, or more. Different architectures can be specified for these capabilities, and the alternative architectures are the major test issue in the simulation experiment.

For each architecture, the user would specify the major controllable actions and key events. Table 2 below discusses cognitive style decision approaches and attempts to characterize the different decision styles based on their various problem-solving dimensions. Specifications for the variables as described above in the forgoing paragraph would be inferred from Table 2's characteristics. For example, an analytic user might select values of price close to the competitor's values. On the other hand, an autocratic user might gamble with a higher than competitive price. A simulation model of the problem will be necessary to test the specified controllable actions and key events for any of the alternative DMSS architectures

Decision Situation

Two systems are constructed: one for the base DSS, which is the control system and another one for the Intelligent Just-in-time Decision Support Systems (IJDSS) which represents the experimental system. Guidance in the experimental system will be elicited by selecting pushbuttons that will aid in the setting of some inputs for the problem analysis, evaluation and profit reports.

- Each of the two systems includes a basic strategic-management-specific DSS, which has
    (1) internal organizational data,
    (2) external competitive data,
    (3) environmental data,
    (4) a model base of mathematical expressions and,
    (5) profit status reports and sensitivity analyses
- Users in the experimental group (IJDSS) will elicit guidance by accepting advice from the IJDS.

Simulation Models

The objective of this simulation study is to test whether Intelligent Just-in-time Decision Support Systems (IJDSS) offers a significant improvement in the process of and outcome from decision-making in comparison to other existing Decision Support Systems. Table 1, which is adapted from Aronson and Turban's *Decision Support Systems and Intelligent Systems* (1998) pp. 62-3, summarizes the variety of potential behaviors.

Table 1 Cognitive Style Decision Approaches

Problem-Solving Dimension	Heuristic	Analytic
Approach to Learning	Learns more by acting than by analyzing the situation and places more emphasis on feedback	Uses a planned sequential to problem-solving; learns more by analyzing the situation than by acting and places less emphasis on feedback.
Search	Uses trial and error and Spontaneous action	Uses formal rational analysis
Approach to Analysis	Uses common sense, intuition, and feelings	Develops explicit, often quantitative, models of the situation
Scope of Analysis	Views the totality of the situation as an organic whole Rather than as structure constructed from specific parts	Reduces the problem situation to a set of underlying causal functions.
Basis for Inferences	Looks for highly visible situational differences that vary with time	Locates the similarities or commonalities by comparing objects.

In effect, Table 1 defines classes of users for DMSS and their potential behaviors. In a simulation study, ranges of values for the controllable actions and key events can be obtained. Using the characteristics from Table 1, we can draw reasonable inferences about the values of actions and events within the ranges for the various classes of users.

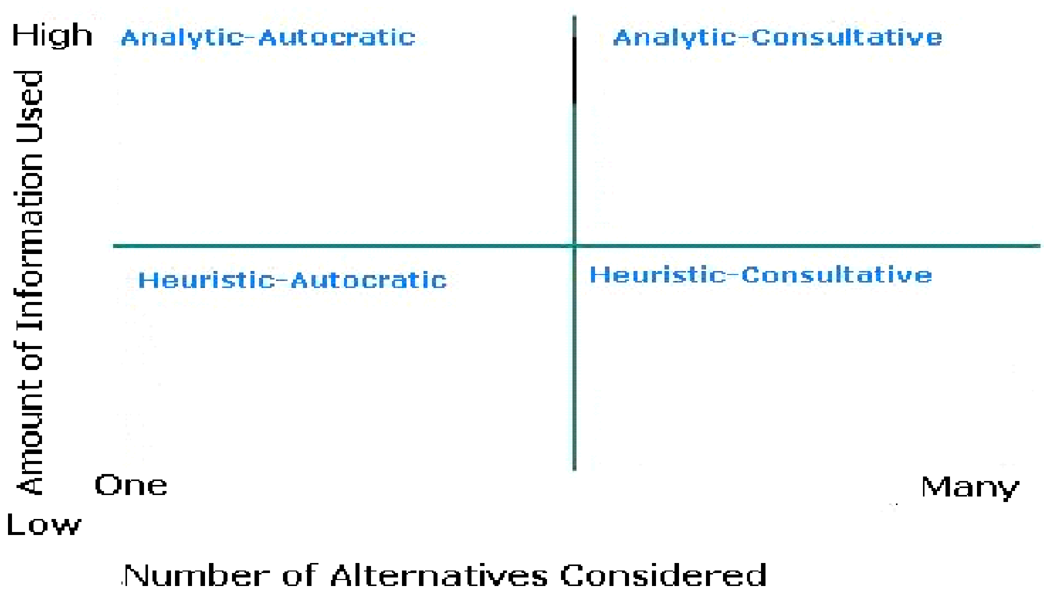
Decision Making Matrix

A specific problem scenario was used to test the efficacy of each DMSS. The scenario is described in Table 2. It will serve as a drawing board for the reader to have an idea of the scenario data and the values for the various variables in the previous quarter prior to the quarter for which the actual market simulations are being carried out. Furthermore, an analytic type decision maker was assumed, for example, as characterized in the preceding sections would want to consult with such data.

Table 2 Firm's Scenario Data: Internal and Environmental Data

Controllable Actions	Key Events
Price = $ 100	Economic Index = 1.00
Plant Investment = $ 500,000	Seasonal Index = 1.00
Marketing= $ 550,000	Competitor Price = $ 100
R&D = $ 600,000	Competitor Marketing= $ 500,000

From table 2 above, the following user types were proposed to be utilized for the purpose of assigning values for input into the interface for the decision variables and uncontrollable variables: Analytic-Autocratic, Heuristic-Autocratic, Analytic-Consultative and Heuristic- Consultative types.



Decision making style Matrix

The figure above describes the decision making styles on the basis of two dimensions: 1) the amount of information used and (Analytic/Heuristic) 2) the number of alternatives considered (Consultative/Autocratic). Using the matrix in figure 2 above, four classes of decision styles were proposed based on the combined influence of these two dimensions (Hunsakers, 1981).

The amount of information used

Heuristic managers, for example, generally base their decisions on minimal information. They do not normally stay long searching for information. They believe: (1) that additional information will only aid in confirming what they already know, (2) that the data will be too slow in arriving, (3) that additional information will be confounding and distracting. Analytic managers, on the contrary spend more time exhaustively analyzing information before reaching conclusions about decisions to be made.

Number of alternatives considered

Autocratic managers or users, for example, are called “satisficers”. This is because, they stop searching after finding one satisfactory solution to their problems and then adopt that solution. Consultative managers continue to explore multiple or additional solutions and consider a range of feasible alternatives to the problem at hand before making a decision. They are called “maximizers.”

Autocratic and heuristic managers focus on speed, efficiency and consistency of their decisions. They are highly action-oriented. The plans of these managers tend to hinge on short-range objectives and they prefer to work in an organizational structure with clearly defined rules and specific plans.

Decision Making Styles

The following sections will treat how values for the various variables are allocated and will also attempt to justify why these values were assigned. The major considerations are the decision-makers’ inclinations to risk-taking which is reflected by high value ranges. On the contrary, the conservative ranges represent the non-risk taking or non-gambler types. A combination of these two extremes will mean the assignment of moderate or midranges. Other assumptions are their propensity to compare with the range of prices of their competitors in the market, ranges in the previous quarters and above all, consulting with colleagues and co-workers.

Analytic-Autocratic:

These are users who are highly analytic in terms of information processing. They are also autocratic with regards to their choice of alternatives and their propensity to consult with others. They utilize a large amount of information before making a decision. On the other hand, they consider very few alternatives, and consult little with other staff members. In other words, they are unilateral in their decision making. This makes them rather autocratic. Based on this combination of attributes, and given their analytic inclinations, it is assumed that they are moderate risk takers. They would analyze information with regards to the firm’s scenario data and specifically the product prices of their organizational competitors. These reasons account for the choice of value ranges for the analytic-autocratic decisions style as espoused in table 4 below. For example, the analytic-autocratic decision maker, being a moderate risk taker, would enter values that are not high. This risk taking tendency is furthered tempered by the fact that in combination they are analytic. Therefore looking at the ranges in the price column, "P" for instance, this type of decision style has the next-to-lowest range ($150 - $175), after the analytic-consultative style users, who are most conservative in their choice of values. It is assumed the user will compare and analyze prices of the competitors in the market, the market conditions, and the firm's product prices in the previous and current quarters. The competitor's price in this case is $110 and the product price in the previous quarter was $100. It is also assumed the autocratic gambler type would input $200 but the analytic attribute would influence this user to input mid-way values of the range $150-$175. Such considerations and analyses will temper the user's liberal price ranges and bring them down mid-way. This explains my choice of values for this decision style user in the table 5 below. Furthermore, looking at the marketing column "M", this decision style user also has the next-to-lowest range ($650000 - $750000) after the analytic-consultative style whose range is $500000 -$600000.

Heuristic-Autocratic

A manager with a *Heuristic-Autocratic style* uses minimum amount of data to arrive at a reasonably satisfactory decision. *Heuristic-Autocratic* managers when making their decisions prioritize certain factors like on speed, efficiency and consistency. They are highly active and results-oriented. Their plans are centered on short-range objectives and they prefer to work in a well-structured organization with well-defined rules and detailed plan descriptions. They spend very little time consulting with their work colleagues and other professionals. They tend to like reports that are brief and precise and discard or ignore long and detailed reports.

The table below shows values that a Heuristic-Autocratic user would enter for variables based on his or her predefined preferences above. Looking at the values in table 5, the decision style user is not only autocratic but heuristic with the highest ranges in price "P" ($180 - $200); marketing "M" ($800000-$900000); Research and Development "R&D" ($750000 - $850000) etc. Like in the previous decision style discussed above, the competitor's price is $110 and product price in the previous quarter was $100. It is assumed that this decision type user neither analyzes information adequately nor consults to obtain information about market conditions. The user would therefore be liberal in assigning input values. That is why, this user inputs a high value, in fact the highest value for the product price in the range of $180 - $200. The same is true for this user's input for virtually all the remaining variables. This means, the user neither analyzes a reasonably large amount of information, nor consults and collaborates with others. In addition, the user does not consider a wide array of alternative choices; does not compare with prices of the competitor or the external environmental data. This is also, because the user is rather hasty, and has to make quick decisions. This makes the user both autocratic and non-collaborative. This also means that the user is a very high risk-taker.

Analytic-Consultative

Managers with an *Analytic-Consultative decision style* like to process extensive information as they consider several feasible options or alternatives. They are creative and seek variety. They tend to be contemplative and rather cautious in taking action. They also utilize or adopt a long-range perspective with regards to organizational planning, and their plans are adaptive because of the many alternative choices that they consider.

Analytic-Consultative managers prefer to work in organizations that are well-structured with high degree of flexibility and delegation of duties. These managers like to receive long, detailed and analytic reports. Because of these qualities, they are able to use consultative and participative decision making effectively, thereby maximizing the availability of information for decision making and problem solving.

Managers who use an *Analytic-Consultative* decision style tend to be well-informed and open to new information. They possess a broad vision of the organization and its distinctive mission, and they tend to generate creative solutions to organizational problems. Co-workers of *Analytic-Consultative* decision makers are likely to describe them as empathetic and cooperative. The values in the table show that the analytic-consultative user as the name implies considers a wide range of alternative choices, consults with colleagues and analyzes a lot of information before inputting values. That is why this decision style user has the lowest ranges in all the columns which are closely similar to those in the scenario table 5. The values that this user inputs compare closely to those of the competitor's product price which is $100 and also the product values in the previous quarter as mentioned at the value of $110. The assumption is that such a user is abreast of market information, does a lot of consultations with co-workers and colleagues and above all analyzes a lot of information regarding the product prices of competitors. These considerations will therefore lead the user to utilize informed judgment to be able to input values close to those of the competitor and the previous quarter. This user is therefore not the gambler type who is liberal with the values that she or he enters. For instance, this decision style user has the lowest price "P" ranges ($100 - $125); marketing "M" ($500000 - $600000); research and development ($500000 - $600000); the economic index "EI" (1.25-1.35); and the seasonal index "SI" (1.1 – 1.40). These are all values in the region of the competitors' preferences in terms of parameters. This goes to show that this type of decision maker inputs values close to how the competitors price their products. And this decision maker also consults with co-workers and does exhaustive or ample research on market trends.

Heuristic-Consultative

Managers who use a *Heuristic-Consultative decision style* also rely on minimum information. They are willing, however, to consider several alternatives and reinterpret the information to arrive at possibly different conclusions. These managers are also speedy and active in discharging their duties. They exercise some degree of flexibility and adaptability in their decision making. *Heuristic-Consultative* managers prefer to work in an organization with a structure that allows them the freedom to change directions depending on the conditions. *Heuristic-Consultative* managers also prefer to receive from subordinates precise communications that contain a variety of specific steps or solutions to consider during decision making or problem solving. They also prefer to work within settings that permit collaborative interactions between people and other staff member or junior co-workers. They use their popularity and charm to influence and win others, and they also induce co-workers by providing them with incentives. Given the preferences of this decision style user, the assumptions are that this user is consultative but does not consider large number of alternative choices nor analyzes a lot of information. This makes this user a semi-satisficer, in that the user's tendency to accept the first satisfactory solution to the problem that comes up is tempered by the user's consultative attribute. In other words, if the price of the competitor is $110, the heuristic attribute may lead the user to enter a 100% increase putting the price at $220. The consultative tendency will however bring it down to $155 -$180. The below table (5) shows values (controllable actions and key events) that managers or users belonging to this user type would enter based on the preferences as defined above.

In the table below - 5, this user has the second highest ranges, following the heuristic-analytic type, with the exception of competitor marketing "CM" starting from price "P" ($155- $185); marketing "M" ($600000 - $780000); economic index "EI" (1.2 – 1.5); research and development "R&D ($700000 - $820000) and so on. It has though the highest competitor's marketing which is $600000 - $780000; the reason being that this user is consultative and considers a lot of alternative choices. This makes this user to try to outsell his or her competitors by increasing the competitor marketing range.

Table 3 below shows a summary of the characteristics of the various decision styles discussed in the foregoing sections. It specifically details out the major considerations that were used in defining the decision styles.

Table 3 Decision Making Styles

Decision Style	**Risk taker (gambler type)**	**Consults with colleagues**	**Conducts research in the market**	**Analyzes historical data**
1. Analytic-Autocratic	0/X	0/X	0/X	X
2. Heuristic-Autocratic	X	0	0	0
3. Analytic-Consultative	0	X	X	X
4. Heuristic-Consultative	0/X	X	0/X	0/X

Legend:
0 = Not Applicable
X = Applicable
0/X = Moderate / Partially Applicable

The DSS Research Simulation

Unlike the previous market simulation in the forgoing sections, this section deals with simulation of subjects as a research methodology. It specifically treats the methodology and input ranges of values for the variables in the respective four quarters into the DSS and IJDSS systems by the simulated subjects. For this research, 100 simulated subjects will be utilized. Trial runs with larger sample sizes of 1,000 and 10,000 would be simulated. The essential outputs are represented by profits generated through the use of simulation runs of the architectural models to be analyzed, results interpreted and conclusions drawn in the following section. The input values are illustrated in table 5 below. In keying in the scenario and decision elements, only the following data ranges are allowable and acceptable to the model:

- Plant capacity – 1 through 9999999
- Production Units – 1 through 9999999
- Raw materials inventory – 0 through 9999999
- Finished goods inventory – 0 through 999999
- Price, competitor price – 0 1 through 999
- Plant investment – 0 through 9999999
- Marketing, competitor marketing – 1000 through 999999
- Market potential – 0 through 9999999
- Economic index – 0.00 through 9.98
- Seasonal index – 0.00 through 9.98
- R&D – 0 through 9999999

Table 4 Values based on decision making styles in the DSS architecture

DM Style	DSS							
	DV				UV			
	P	PI	M	R&D	EI	SI	CP	CM
AA	150-175	0	650000-750000	650-780000	1.5-1.75	1.5-1.75	150-175	650000-800000
HA	180-200	0	800000-900000	750000-850000	1.75-2.5	2.0-3.0	200-300	630000-900000
AC	100-125	0	500000-600000	500000-600000	1.25-1.35	1.1-1.40	110-140	550-600000
HC	155-185	0	600000-780000	700000-820000	1.2-1.8	1-1.7	90-180	600000-780000

Legend: DM = Decision Making; DSS = Decision Support Systems DV = Decision Variables; UV = Uncontrollable Variables; P = Price; PI = Plant Investment; M = Marketing; R&D = Research and Development; EI = Economic Index; SI = Seasonal Index; CP = Competitor Price; CM = Competitor Marketing; AA = Analytic-Autocratic; HA = Heuristic-Autocratic; AC = Analytic-Consultative; HC = Heuristic-Consultative

After having entered the values, for the DSS architectures as shown in the table above, the percentages of simulated subjects for each decision type of simulated subjects were determined. To do this, a random uniform percentage of 25 were allotted to each of the four decision types. It is assumed that the four decision styles are randomly distributed in the population. In this case, a random uniform distribution is a distribution, in which any number between the minimum and maximum values is equally likely to occur. This assumption is based on the principle of insufficient reason from the probability theory. That is, if there is no empirical evidence to indicate otherwise, it is reasonable to assume that the values will be uniformly distributed within the range.
To execute this in SAS, the following macro code was used:

```
data test;
 %macro create(howmany);
   %do i=1 %to &howmany;
x&i = RANTBL(-127968, .25, .25, .25, .25);

   %end;
%mend create;

%create(10,000);
run;
```

Another code was written to obtain the probability distribution of values in their respective ranges, input by simulation subjects for each of the variables. The example below is for the price variable range only ($150 - $175).

```
data Price;
 %macro create(howmany);
   %do i=1 %to &howmany;
x&i = 150 + (25 * RANUNI(-127968));

   %end;
%mend create;

%create(10,000);
run;
```

The examples being used here contain 10,000 simulated subjects. Further, both of the two macros above were merged with the following code:

```
data Price;
set test;
 %macro create(howmany);
   %do i=1 %to &howmany;
X&i = 150 + (25 * RANUNI (-127968));
 %end;
%mend create;
%create(10,000);
run;
```

The results obtained for these simulation runs are then embedded into the conceptual architecture of the model contained in the appendix below. This model was used to run the simulations and sensitivity analysis in order to obtain the final results and the profit before and after tax. Comparisons among the four decision styles and between the two systems (DSS & IJDSS) are made through the help of descriptive and inferential statistical analysis and conclusions drawn in the ensuing sections.

The IJDSS Research Simulation

Like in the DSS research simulation, 10,000 subjects were simulated. Input values for each simulated user were entered are based on predetermined values ranges obtained from the Academic Information Systems (AIS) manual. The design of the marketing simulation used for both the DSS and IJDSS cases comes from a software package developed by AIS. Academic information systems (AIS) provides computing, library, instructional services, instructional technology support, and web management, multimedia support services for learning and research and other information-based resources to students, instructors, and researchers. The software package used in this study for the design of the market simulation for both the DSS and IJDSS was supplied by the Academic Information Systems.

These values, which generate maximum profits, represent the advice rendered to the simulated subjects by the IJDSS (McLeod, 1986).

Table 5 Pricing Model Simulation for 4 Quarters (Based on AIS Manual)

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Price	51	51	51	51
Plant Investment	0	0	7,000,000	0
Marketing	300,000	300,000	300,000	300,000
R & D	500,000	0	0	0
Economic Index	1.00	1.00	1.00	1.00
Seasonal Index	1.00	1.00	1.00	1.00
Competitor's Price	100	100	100	100
Competitor's Marketing	600,000	600,000	600,000	600,000

These input values were chosen randomly with a uniform distribution for each simulated user based on values found in the AIS manual. These values are set on ranges. The ranges start somewhere below the values in the manual and increase up to values slightly above those shown in table 6 above. The lower bounds were arbitrarily determined.

For example Price for user 1 (analytic consultative) is given the following range:
Quarter 1 = 45 – 55

Quarter 2 = 40 – 55
Quarter 3 = 43 – 55
Quarter 4 = 42 - 55

The major distinction between the DSS and IJDSS is the capability of the IJDSS to render timely advice in a concise form to the user.

Process Measures

Process tests will be carried out to determine whether the differences in profits were brought about by the process steps. Process tests will be conducted for the uncontrollable variables for the DSS and the IJDSS respectively: DSS Economic Index (E), IJDSS Economic Index (EJ), DSS Seasonal Index (SI), IJDSS Seasonal Index (SIJ), DSS Competitor Marketing (CM), IJDSS Competitor Marketing (CMJ), the DSS Competitor Price (CP), and the IJDSS Competitor Price (CPJ).

The sample t-test for the means of the eight variables will determine whether there are significant differences in the means between the DSS and the IJDSS values of the above-mentioned variables. Significant differences between any of these variables will indicate that the IJDSS profits will be due to advice obtained for the uncontrollable variables and/or the controllable variables being tested. These process measures are based on:

1) In the intelligence phase: Process revolves around guidance on the uncontrollable input selection (Forgionne, 1999).
2) In design phase, process measures involve attaching of parameters to the general model.
3) In the Choice phase, process involves guiding the uncontrollable input selection. In this phase, the values in the DSS are selected randomly. In the IJDSS, if the user accepts advice, then random values are replaced by advised values.

Process measures are determined by the selection of the 8 decision variables that must be set by the decision maker (economic index, price, plant investment, marketing, research and development, seasonal index, competitor's price and competitor's marketing). The simulation generates the values that the simulated users would have set using a DSS, and the values that have been simulated in the IJDSS will generate the advice that the JDSS provides (Conteh and Forgionne, 2004a).

Outcome Measures

Outcome is measured in terms of profit after tax to the simulated organization. There will be a profit distribution from the DSS and a profit distribution from the JDSS. By performing the sample t-test of means on the distributions, there will be a determination whether the IJDSS improved profit. The multivariate canonical correlation analysis was carried out to determine the correlation of the variables with regards to the outcomes.

Statistical Analysis

The SAS (Statistical Analysis software) was used to perform the descriptive and inferential statistical analysis. This study utilized sample T – tests for the means of the profits (DSS and IJDSS) and also multivariate canonical correlation analyses was carried out to determine the correlation of the variables with regards to the outcomes. There was a test to ascertain whether there is a correlation between the two systems and their relation to the respective profits before and after tax and a comparison between the two.

As mentioned above in the hypothesis testing, the null hypothesis will assume that all the population means are equal, while the alternative hypothesis states that the DSS and IJDSS means are different.

The other statistical analyses that were tested were the grand mean, which is carried out by dividing the total of all data values by the total sample size. Furthermore, tests for the number of samples, the sample means, the sample variances, and the sample sizes were carried out (Conteh and forgionne, 2003b).

Conclusions

The broad conclusion from the conducted simulation study is that the IJDSS, relative to the DSS, helps improve the process of and outcome from decision making. Moreover, from the hypotheses tested, it can be inferred that the input of the right values for the controllable variables, which in essence constitute the process steps, led to the improved profit outcomes. The following statements could therefore be deduced from the results, that:

1) The controllable variables of Price, marketing, research and development (R&D), plant investment contributed significantly to the mean differences in profit between the DSS and IJDSS users.

2) The means of the uncontrollable variables were insignificant and therefore the null hypothesis could not be rejected for each one of them.

In summary, the results show that the IJDSS clearly improved organizational performance and at least two decision making steps (design and choice). From the results obtained, of all the decision styles, the consultative style yielded most significantly to the process of and outcome of decision making and in consequence, resulted to improved organizational performance

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