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# Design and Development of a Role-Oriented, Web-based Planning Decision Support System: PlanningDSS.com

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*ABSTRACT.* A research project is in progress to develop a process-oriented, role-based planning decision support system. The broad vision for building the website PlanningDSS.com was to create a comprehensive, general purpose system for structuring a collaborative contingency planning and decision-making process. The intention is to support analysis and choice of competing courses of action associated with a contingency either when the contingency occurs or when it is anticipated. This article summarizes the history, the design concept, and current status of this design research project.

*KEYWORDS:* DSS, Planning Support, Decision Support System

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## **Introduction**

A wide variety of computerized decision support systems have been developed in the past 40 years. Knowledge-driven, process-oriented DSS have only recently become feasible to deploy in enterprise environments (cf., Power, 2002; Pontz and Power, 2002). Design research can increase the capabilities of such systems and help assess the usefulness of them.

This article summarizes the what, how and why associated with creating a process-oriented, role-based planning decision support system. The broad vision for building the website PlanningDSS.com was to create a comprehensive, general purpose system for structuring a collaborative contingency planning process and for supporting analysis and choice of competing courses of action associated with a contingency either when the contingency occurs or when it is anticipated. The following major sections summarize the history, the design concept, and current status of this design research project.

## **Project History**

PlanningDSS.com is an extension of prior software design research projects. Almost 30 years ago, a computerized decision support research program began with three major objectives (Power, 1977) that are still being pursued:

- 1) to develop a decision support system (DSS) for use in actual strategic decision situations in organizations;
- 2) to develop an experiential instructional system that will help people improve their decision making and inference behavior in strategic decision situations; and
- 3) to conduct research that may explain how individuals and groups make decisions and how decisions should be made.

The name PlanningDSS.com summarizes the purpose of the web site -- it is a planning decision support system. At the web site, one finds the following introductory message: "Welcome to the Planning Decision Support System. This Web-based planning and decision process structuring program has been designed to improve contingency course of action (COA) planning decisions and selection decisions. The Planning Decision Support System (PDSS) is a prototype built using open source web tools. This website, PlanningDSS.com, is still under development, so your suggestions and feedback are most welcome. We are trying to identify 'alpha' testing opportunities." The HELP menu provides links to General, Planner, Decision Maker, Analyst and Observer help. PlanningDSS.com is a role-based, multi-user decision support system. It is also an integrated decision structuring application with knowledge-driven and model-driven decision support subsystems.

The following paragraphs are a quick synopsis of a 30 year research project. PlanningDSS.com is the most recent incarnation of an idea or a vision for a computerized decision support application from Fall of 1975. Certainly the idea has evolved as technologies have changed and as more has been learned about DSS design and about decision making behavior. But looking back the goals have remained remarkably unchanged. A summary of the research covering the period 1975-1984 is at DSSResources.com (Power, 1998). The project is also reported in Power and Rose (1976) and Power and Rose (1977). An empirical study using a Personal Computer version of the system was reported in Aldag and Power (1986).

The DECision AID application was initially developed using the Hewlett-Packard 2000 Access system and then the Apple II. "The DECAID idea was that questions could be used to build models of the decision making processes. These questions could then be programmed using an interactive programming language to aid people in making decisions (Power, 1977, p. 28)".

In 1986-87, another related project involved designing some applications for the Decision Assistant series from Southwestern Publishing Company. These small decision aid applications were focused on specific decision aiding tools rather than upon providing process support and hence helped identify the need for both approaches in a more integrated decision support environment. In the mid-1990s, an brief attempt was made to develop a new, more integrated decision aid in Visual Basic, but it was eventually abandoned. A number of other false starts occurred in continuing the process structuring decision research. In July 2004, the prior programming was reviewed and some PHP/MySQL programming began on a web-based application. That version was called DA3000 and the artifact is still on the web at <http://www.planningskills.com/da3000> . This work demonstrated the feasibility of a new web-based DSS, but showed the need for a more extensive and systematic development effort. In Fall 2004, the decision was made to make another attempt to update and modernize the earlier decision support application using open source software and a web platform. DSSResources.com/Power Enterprises volunteered as a client for the Information Systems Development project course at the University of Northern Iowa. The instructor, Betsy Hoffman, agreed to supervise the web DSS project.

In mid-January 2005, a project team of University of Northern Iowa MIS majors was assigned to work on the web-based, action planning DSS project. To get them started, they reviewed a concept paper and eventually the team used the 1983 version of the decision aid, tried the Decision Assistant applications and the JavaScript decision aids. A Scope of Work was developed for the project. For three months, the team of Branimir Peitel, Bryce Paulson, Luke Thompson and Chun-yi Wu worked on the project. They elaborated upon an initial list of Use cases. Each team member worked on the Use cases for a specific role in the system: Planner, Analyst, Decision Maker or Observer. The system also has an Administrator role. The team members were conscientious in seeking feedback on Entity-Relationship diagrams for the application database, the proposed screen designs, and their plans

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for documentation. Their diligent work resulted in a prototype that shows what is possible. A complete planning process has been programmed and some functionality has been developed for all five roles.

#### **Design Concept**

The original decision aid project was very ambitious in the days of mini-computers and then standalone PCs, but the Web and open source development tools have created new possibilities to develop a more sophisticated system for either a single user with many roles in the planning process or for multiple users assuming different roles in the process (Katz and Kahn, 1966). The process owner is the designated Planner who organizes and structures the information, participants and tasks in the planning process. The Planner is responsible for monitoring every activity in the process and ideally the software protocol helps the Planner manage the process.

PlanningDSS.com can help implement "Best Practices" in strategic decision processes and inform participants about their roles and tasks. The current focus is on the flow, organization, use and transformation of text descriptions, ratings, values and preferences. Five user roles are currently implemented: 1) Planner; 2) Analyst; 3) Observer; 4) Decision Maker; and 5) Administrator. As part of the development effort detailed Use cases were specified for each specific role in the system. The current implementation has 16 tables in the data model and the Web pages are implemented using PHP. Data is stored in a MySQL data base.

#### **General Overview**

At PlanningDSS.com, you will see a short welcome message, a place to enter a Username and Password, a menu bar at the top, and a footer with information on copyright, contacts, disclaimer and privacy statement links. The drop down menus contain links for navigating through PlanningDSS.com. Before logging on, however, only two links work: Help and Credits. Help includes the User Manual.

The Planner creates most of the user accounts, but the Administrator can create accounts and must create Planner accounts. After logging on, a user is directed towards a personal PlanningDSS.com home page. PlanningDSS.com users have the opportunity to create a User Profile with First Name, Last Name, Email, a short biographical statement, and a picture. The goal is to have a complete profile with picture for each user to help personalize the system. The assumption is that most users will interact with PlanningDSS.com repeatedly. The PlanningDSS.com tools menu also allows any user to view all of the users of the system. This works in a dedicated single organization setting, but is inappropriate in an application service environment. Currently, users can change their password. When a user is done using

PlanningDSS.com, and wishes to log out, they simply place the mouse over "File" in the Header menu, and click the Logout option.

A user's personal home page also lists all Planning Topics a user is associated with and related status information. What is a Planning Topic? It is the focus of the planning effort. It is the descriptor for the planning situation called the Topic Title, for example "Merger" might be the topic and then a Topic Description is "evaluating possible companies to acquire". Topics are associated with planning/decision-making tasks like "Selecting a new CEO" or with contingencies like a "Hostile takeover bid".

After clicking the "view" link for a specific Planning Topic, a user sees that Topic's description page. This page explains the Topic, the Decision Question(s) that pertain to the Topic, the Alternatives for each Decision Question, and the criteria for evaluating Alternatives associated with a Decision Question. To the right of each decision element is a link titled "Comments". This link opens a window where a user can submit a comment on a particular content element.

### **Planner Role**

The Planner role creates and enters the planning content into the system. For example, the Planner identifies contingencies that may impact the organization. For each contingency, a planner enters basic planning information including potential courses of action and relevant comparison criteria. A planner follows the prescribed heuristic process and inputs situation specific information for subsequent assessment and evaluation by users who have other roles to play in the process. A Planner can monitor task activity of Analysts and the designated Decision Maker.

When designated as a Planner by the Administrator, the first task is to enter a new Topic. The first page outlines the requirements for creating a new planning topic. A checklist details the information needed for each topic. After checking the required checkbox, a Planner proceeds to create a new planning topic. The first required element is the Planning Topic label, then the Topic description. One or more Decision Questions, with descriptions are then entered. The next step is to create Alternatives Courses of action associated with a Decision Question. Each Planning topic requires a Decision Question with at least two Alternatives. Users can add additional information for each alternative, for example "Add Image" or "Add Document".

A Planner also specifies the Criteria or factors that will be used to evaluate and score each Alternative. Each Criterion has an associated Title, Description (optional), Importance Weight, and Anchors for the best and worst outcomes and their associated descriptions.

Once the content of the Topic is entered, a Planner must specify the users that are going to help you in the Decision Process. There are two ways to do this. One is to

add already existing users as Analysts or as the Decision Maker. These users are listed in a pull down menu. The second way is to fill out the "Add User" form.

Each Topic requires at least one Analyst, one and only one Decision Maker, and optionally Observers. Conceivably one person could have the roles of Planner, Analyst and Decision Maker for a topic. In that situation PlanningDSS.com is supporting an individual's planning decision making. The general expectation is that the Planner will not be an Analyst or the Decision maker and that most topic situations will involve multiple analysts.

Clicking on the "Complete" button makes the Planning Topic available to the selected Analysts, and then the Planner can not change the content of the Planning Topic. If the situation changes significantly, a new Topic needs to be created.

The screenshot shows the 'Criteria Scoring Page' for the topic 'Website Design Selection'. The page has a header with the system name and a menu (File, Tools, Help, Credits). Below the topic title, it shows the 'Alternative Title: In-House with Frontpage'. There are three criteria sections, each with a 'Criteria Selection' input field, a 'Criteria Explanation', and a 'Scale Explanation' with a 1-100 scale. The first criterion is 'Cost', with 'Expensive' at 1 and 'Inexpensive' at 100. The second is 'Ease of Use', with 'Complex' at 1 and 'Simple' at 100. The third is 'Aesthetics', with 'Very Bad' at 1 and 'Very Nice' at 100. A 'Review In-House with Frontpage Scoring >>>' button is at the bottom. A footer contains copyright information for 2005.

Figure 1: Criteria Scoring Page

## Analyst Role

The Analyst role can and should be assumed by multiple people knowledgeable about the focal organization and its current and future situation and the Decision Question of interest. Analysts are designated by the Planner to complete tasks associated with assessing planning elements. For example, Analysts compare Alternatives on Criteria. Logging in as an Analyst gives a user an extra option on the personal home page. This option is to "Score" a Topic. To "Score" a Topic means the Analyst will assign ratings on each Alternative to a Decision Question for a set of Criteria (see Figure 1).

## Decision Maker Role

The Decision Maker role has tools for "What-If Analysis" and "Pro-Con Analysis". The decision maker is assisted in "seeing the big picture" and in evaluating intangible, hard to quantify aspects of the specific decision situation that is evolving.

**Planning Decision Support System**

File Tools Help Credits

### What-If Analysis Evaluation

Adjust the Criteria Weight to calculate the result

[Click here to open the help Window](#)

Click on [here](#) to see the topic and description detail.

Inputs		Criteria		
ID	16	17	18	
Titles	Cost	Ease of Use	Aesthetics	
Weights	8	4	7	
Alternatives	Scores			Result
In-House with Frontpage	63	63	60	62
In-House with Flash	45	25	88	57
Spin-U-Tech	48	85	75	66
Power Enterprises	70	85	45	64

[Calculate](#)

In-House with Frontpage: 62

In-House with Flash: 57

Spin-U-Tech: 66

Power Enterprises: 64

[<<< Return to criteria selection page](#) [Continue with Pro-Con Analysis >>>](#)

Reminder: By clicking "Continue with Pro-Con Analysis", you have agreed to save current choices into database.

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Figure 2: What-If Analysis Evaluation

A Decision Maker has a "decide" link that allows the user to begin the Decision Making part of the process. The first task is to identify from 2-5 criteria that will be used to evaluate the Alternatives. The "What-If Analysis" tool displays the summary of analyst ratings for the selected Criteria and the Decision Maker can change the weights of the Criteria to help make a decision (see Figure 2). After changing the weights, the Decision Maker clicks the "Calculate" button to update the total scores for the Alternatives and the graph of scores. The Decision Maker must select at least two alternatives to continue with the "Pro-Con Analysis". The user is asked to choose the number of Pro Arguments for an Alternative. After selecting the number of arguments, that number of available spaces appear on a form. The user enters Arguments, and the weights of each, and clicks "Continue" to move onto the Con Arguments. The review page for the Pro-Con Analysis lists all of the arguments for each Alternative, followed by an option to edit or remove each. Editing a score and reloading the page will change the graph shown at the bottom. After reviewing the Pro-Con Analysis results, another graph is shown giving the results of the final Analysis, followed by the option to make a decision. Clicking on the "Save Final Decision" button take the Decision Maker to a decision confirmation page.

### **Observer Role**

The Observer role is a read-only view of the planning database with the opportunity to comment upon and annotate information for the Topic. For example, an observer can suggest additional contingencies or Alternatives. An Observer can comment on aggregated assessments of analysts.

### **System Administrator Role**

The Administrator is tasked to maintain the planning database and ensure its performance. The administrator designates Planners and maintains their basic user information including user name, password, and privileges. Users must maintain their own current background and contact information. The Administrator can purge or archive branches in the database. The Administrator can give a Planner access to an existing database or have the Planner start with an empty database. The Administrator can monitor the use of PlanningDSS.com by any user. The system provides Web-based administration.

### **Current Status**

PlanningDSS.com helps define a network of ideas and assessments/predictions associated with a specific Planning Topic for a specific focal organization. Planners can be trained to structure planning situations using PlanningDSS.com and they can do that for many diverse situations. Analysts should require little training and many

diverse users should potentially be able to participate as Analysts. The Decision Maker role is more specialized and the user interface needs to support a user who potentially has limited familiarity with computerized decision support.

Currently, PlanningDSS.com is best suited for use with important selection decisions and course of action evaluations. We may develop a more specific process protocol for corporate strategic planning that would involve 5 major tasks: define and evaluate the mission, conduct a SWOT analysis by assessing strengths and weaknesses and identifying opportunities and threats, set goals and objectives, develop tactical and operational strategies, and evaluate the strategies. In the future, we may also create specialized versions of PlanningDSS.com with knowledge about a specific domain like Disaster Planning and Recovery, Military contingency planning, Business Continuity Planning, or Information Technology contingency planning.

PlanningDSS.com is in alpha testing. We are currently checking the code, making minor enhancements and preparing a list of additions, improvements and new Use cases.

## **Conclusions**

PlanningDSS.com can be used for both laboratory experiments and field studies and the goal is to focus on the following problems/questions:

1. Can users better understand their planning and decision making tasks and perform them more effectively with computerized support.
2. Can we better understand how people are evaluating alternatives?
3. Can anchors and criteria be defined for use in asynchronously evaluating alternatives in important decision situations?
4. How does Web technology affect decision-making and planning behavior?
5. What are the relationships between the decision-maker's characteristics and the decision process and planning outcomes?
6. Is it possible to use a normative multi-criteria decision making framework in a multirole planning environment?

Potentially research using PlanningDSS.com can help us answer these and related problems/questions. PlanningDSS.com is an ambitious project that requires a team approach. Creating innovative, process-oriented, role-based planning decision support systems can potentially improve the rigor of the planning process and the quality of the plans that are developed.

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