Policy implications of organizational decision support systems

Conference Paper · February 1996

DOI: 10.1109/HICSS.1996.495311 · Source: IEEE Xplore

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Abstract

Many organizations are consolidating their data, models and information resources to create an organization-wide system, called organizational decision Support system (ODSS). This paper discusses issues related to ODSSs and their policy implications. Issues are identified from ODSS definition. Specifically, we group the issues as data, model/tool and overall systems and consider policy related to each of these in the context of ODSS.

Introduction

It is expected that by the twenty-first century technology convergence will lead to a seamless any time, any place environment. One outcome of this convergence will be explosive domestic and global competition. To meet this challenge organizations are responding with consolidations, partnerships, acquisitions and expansions. For example, Baby Bells are aligning with the entertainment industry to provide home entertainment on demand; Banks are expanding into insurance businesses; IBM is consolidating by acquiring LOTUS; and Oil companies are acquiring credit card businesses. This is having a profound effect on organizational structure and organizational decisions.

Organizational decisions are becoming more frequent with shorter cycles. Managers are demanding organization-wide data and models which can be accessed and manipulated with little effort. Organizational Decision Support Systems (ODSS) are an attempt in that direction. Since the early 90's much has been written about ODSSs in the literature [George (1991-92), George, Nunamaker and Valacich (1992), Scheer and Hars (1992), Whiteair, Campbell, Prabhu and Nilakanta (1993), Chung, Mahapatra and Gabriela (1993), Aggarwal and Mirani (1995)]. However, it is still not clear what constitutes an ODSS? How can we recognize one in an organization? What are the policy implications of them? This paper discusses policy implications of an ODSS.

ODSS:

Irrespective of ambiguity surrounding the concept or definition of an ODSS, almost all researchers agree on the following ODSS features:

.An ODSS supports organizational tasks or activities or decisions that affect several organizational units or corporate issues

.An ODSS may cut across organizational functions or hierarchical layers

.An ODSS almost necessarily involves computer-based technologies

.Single or multiple decision makers

.Multiple decisions types

.Multiple organization units including **global** units

.An ODSS **must** involve some form of communication

.Supports multiple organizational processes

.Consists of "toolkit" to support a range of processing tasks

.Evolves continually based on user interaction

.Consists of public and private data

.Consists of public and Private models

Based on the above commonalities, we define an ODSS as:

"A computerized system that provides public and organization-wide data and model access to support users making organizational decisions in an interactive user-friendly environment".

Decisions may be independent, interdependent or pooled; spanning locally or globally; may cut across levels; and may involve single or multiple decision makers. Decision makers, themselves, may be locally or globally dispersed. This definition of ODSS **includes** all systems that provide "borderless" and "seamless" decision making support across functional/ divisional/national boundaries. The next section discusses policy implications of an ODSS.

POLICY IMPLICATIONS:

Since ODSSs are relatively new, they create a different set of issues. Also, ODSSs cover a wide range of organizational decisions which necessitate different policies and different analysis and design procedures than decision support systems (DSS), group decision support systems (GDSS) or executive information systems (EIS). So far, not much has been written about issues and policies for ODSSs in the literature. We discuss policy implications of an ODSS in terms of information technology, data, model, design, users and policy makers themselves. Our approach is to identify ODSS characteristics and use them to identify requirements, challenges or issues it creates for the organization. Once issues are identified its policy implications are discussed.

Table 1 identifies and summarizes ODSS characteristics that are used in this discussion.

TABLE 1: Characteristics of an ODSS

. Cuts across functional areas
. Cuts across hierarchical levels
. Consists of a "toolkit" to support a range of information processing tasks
. Focuses on process rather than users
. Evolves continually
. Consists of public and private data
. Consists of public and private models
. Supports multiple decisions/decision makers
. Involves computer-based technologies

Cuts Across Functional Areas:

A process-based ODSS may cut across functional areas. For example, an ODSS for customer support may include order, production, invoice, delivery and payments cutting across many functional areas. An obvious issue raised by this cross functionality is data/model **confusion** in terms of multiple definitions, formats and ownerships. Different functions may be using different names for the same data items or may be collecting the same data item separately. For example, customer's name may be used by both the marketing and the shipping department but under different name. In addition different departments may be building similar models. Marketing may have a scheduling model to schedule sales and production department may also have a scheduling model to schedule production. How can the data/model be standardized?

Since ODSS cuts across functions, others issues arise as well 1) Departmental politics, which function will have data/model ownership? Which function, if any, will dominate decision making, especially if it is a group decision? 2)organizational structure itself, Should the organization be organized around the process rather than on the personal links?

As a policy, an overall data model is needed to avoid duplication and confusion. Enterprise-wide data/model (EWDM) architecture is helpful in avoiding data/model confusion [scheer, 1992]. Standards must be set and single data/model ownership should be identified, preferably at the site of origination. Some of the politics of decision making can be avoided by providing a computerized group decision making platform. This will allow for anonymous inputs and may result in some form of consensus. If ODSS is designed along major organizational processes, it may be beneficial to restructure the organization along processes. In addition, a process based ODSS may have virtual or task oriented teams with membership changing from task to task. This will require moving away from functional to a process-based orientation.

Cuts Across Hierarchical Levels:

A function or a hierarchy-based ODSS will cut across hierarchical levels. For example, an ODSS for the marketing department will include sales people, sales manager and the marketing manager. The biggest issues here will be inappropriate data/model usage and resulting analysis. Inaccurate analysis at one level could affect decision-making at other levels. Is the data accurate? Is the

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model validated? How much trust can be placed on the analysis? If needed, could data/model along with the analysis be transported at higher levels? Should the organization be organized along functions?

Once again EWDM is needed. Data/model ownerships (responsibilities) should be clearly defined. Data validation for completeness and accuracy is needed at multiple points. In addition, model validation for robustness is needed. Validation can be at the individual, group and locus of control (LOC) levels. Extent of validation will depend on the extent of output usage from these models. Organizations, themselves, may want to restructure along functions if ODSSs are also function based.

Consists Of "Toolkits":

An ODSS, irrespective of its scope, will consist of a set of tools which will facilitate and support information processing tasks. At a minimum, they will consist of numerous user-friendly tools which will support filtration, extraction, access, manipulation and analysis of data [Miller et al, 1993]. In addition, users may have their own private "toolkit". A private toolkit may consist of two types of tools; tools favored by the user (in lieu of tools provided by the organization) and tools not available through the organizational toolkit.

There are three potential problems; one is matching the right tool for a given task, second is the abundance of choices and third is the validation of the personal toolkit. There is always a danger that users may get overwhelmed by choices and may engage in inefficient search for solutions. If users are allowed a personal toolkit they may use tools that are not necessarily the best for a given task. In addition, other issues like user training and learning need to be addressed. What software list should be provided in what circumstances? Should the full or partial list be provided? Who maintains the list? What user training and learning is appropriate? Should a "private" toolkit be allowed?

Planning for EWDM should incorporate the "nature" and "type" of software tools needed for making organization-wide decisions. Appropriateness of toolkit can be created based on task and user expertise. Following is one way of organizing toolkits:

1.**First Level toolkit** may provide basic model building/data manipulation capabilities. Almost all capabilities can be automated. These may be useful for higher level executives who are primarily interested in trends, consolidation, projection and monitoring. Examples may include spreadsheets, databases, simple statistical models, graphs, charts capabilities.

2.**Second level toolkit** may provide a combination of basic and some advanced model/data manipulation capabilities. These may be good for users, groups or LOCs who are performing in-depth analysis. Examples may include linear programming, regression, ANOVA and query languages.

3.**Third level toolkit** may provide advanced model/data manipulation capabilities. These will be useful for broad and in-depth analysis of a specific task. Examples may include MANOVA, simulation, sophisticated data manipulation, stochastic models, model building languages, heuristic modeling capabilities.

In addition, intelligence which provides a list of tools for a given task type, could be built-in at each level. This list could be created from tools used for similar tasks in previous situations. This list may not be unique since different users may use different tools for a similar task. However, this will **reduce** the number of tools **suitable** for a given task and may not overwhelm users. Users should always have the choice of demanding different toolkit lists. Private toolkits, if possible, should be independently verified and should become part of the built-in intelligence for tool/model selection.

User training on the tool-kit could be at two levels; basic and advanced. Basic training should include the first level toolkit and should be provided to all users. Advanced training should include the second level toolkit and should be provided to users involved in in-depth analysis. Tools in the third level are highly sophisticated and it may not be feasible to provide in-house training. In some cases users may already be familiar with these tools or help from vendors is always available.

Focus on Process Rather Users:

Many organizations are function based and continue to operate that way. ODSSs, however, may be process based. Processes are more stable and remain the same even if users or functions change. Processes may be decision or task oriented and may be hierarchical, vertical or LOC based. However, user preferences should not be ignored. An unfriendly user interface may result if user are not taken into consideration. A process based ODSS may require a process based organization. Several issues are of concern here. What user interface should be provided? Should organization be restructured along processes? functions? or users?

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A major implication of process focus is not to forget the user. A flexible interface should be provided so as to avoid non-usage of the system. An organization may be restructured if the process focus will result in evolving task or decision oriented teams. This in turn will require user reorientation from function to process focus.

System Evolves Continuously

Like any dynamic system, ODSS must evolve continuously. As processes, users, and decisions change there are corresponding changes in inputs, processes and outputs. Since an ODSS encompasses many subsystems, a change in one may necessitate change in others. The rippling effect in ODSS will be much larger than any other system. Major issues will be how to design subsystems? link subsystems? How much flexibility is needed to minimize rippling effect? What's the trade-off between flexibility and dynamicity?

As a design and development policy, ODSS design should be modular with tight cohesion and loose coupling (De Marco 1978). This will allow module addition and/or deletion with minimum disturbance. The program/data independence concept of databases could be used to allow extensions without major modular changes. Objects could be used as the ODSS building unit to allow flexibility in the system. The key policy should be that the user should not have to learn a new system everytime a module is changed. All this should be transparent to users.

Public/Private Data:

ODSS may consist of public/private data. Aggarwal et al (1995) define three data types; internal, external and private. Internal data consists of organizational data external to the building block (an LOC, an object, a node) and data within the building block. Public or external data is external to the organization. Personal or private data is user's own data. Public and internal data are used enterprise-wide whereas personal data is used by individual(s). Major issues here are data ownership, security and validation.

1.**Ownership**: Which building block is responsible for maintaining what data? Should one organization-wide unit be responsible for maintaining data or should place of origination keep control?

2.**Security:** Since an ODSS contains all organizational data, security is a big issues. Should sensitive data be stored with other data? How can unauthorized access be denied, detected and data protected? How can data be protected from intended and unintended corruption?

3.**Validation**: For repetitive decisions, users may find it easier to access private data without consideration to accuracy or currency. This may result in decisions based on old or wrong data creating serious ripple effects. How can private data be checked for consistency and accuracy?

As a policy, data should be current, clean and accessible at all times to all authorized users. Data may have to be extracted from various sources and filtered before presenting it to the users (Miller and Nilakanta, 1993). EWDM can be helpful in identifying and organizing data. This will require establishing policies and standards uniform across ALL data types. Private data sources should be reported and currency verified by independent users. Depending on the importance of data, verification could be at the individual, the building block or at the function/process level.

Public/Private Model

An ODSS may consist of public or private individual or organization-wide models. Private models may be developed by individuals, LOCs or informal groups to provide specific capabilities. Public models may be off-the-shelf or developed in-house to provide generic capabilities. Issues here are very similar to data issues with the addition of model robustness and validation. How can we ensure that models will work under all plausible circumstances? What models are appropriate in what situation? How can model validity be checked? How can private models be checked for correctness?

Once again standard validation procedures should be developed for both private and public models. Private models should be reviewed for correctness independently by specialists. In addition, organization-wide models should be checked for organization-wide robustness, i.e., model should work under all conditions for **all** organizational components. This will ensure that a model is workable under different contingencies. In addition, built-in-intelligence for model(s) selection will ensure that users get the right models or sequence of models for a given situation.

Supports Various Decision Types/Decision Makers

An ODSS by its definition supports organizational decisions. These decisions may be sequential, group or independent (Sprague & Carlson 1982). They could be repetitive or ad-hoc. An ODSS may also support politically sensitive and/or confidential decisions. A major issue for decisions involving multiple stages (sequential) is that errors made at various stages would have a cumulative effect on the final output. In group decision making, erroneous data or data unavailability could result in an inefficient or

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suboptimal decision. For politically sensitive decisions users may attempt to rationalize political maneuvering by selectively focusing on data and analysis that reflects favorably on their position. For ad-hoc decisions users may select an easily available or favorite tool rather than one that is most appropriate. For political decisions, what can be done to assure fair analysis? How can errors at various stages be eliminated? Which models should be suggested in which ad-hoc situation?

As a policy, clean data and validated models should be accessible any time and at any place. For politically sensitive decisions, multiple criteria could be used. Redundant analysis should be built into every stage to ensure validity of intermediate and final outputs. Intelligence to match the tool to the task should be built into the tool/model selection process to support ad-hoc decision making.

Involves Computer-Based Technologies

Technically an ODSS could be defined without computer-based technologies. However, such a system will have limited capabilities and use. Since ODSS requirements include any time any place data/model access to all authorized users and data communication between and among building blocks and users, a computerized ODSS is needed.

Many issues need to be resolved in developing a computer-based ODSS. What hardware and software should be used? What is an appropriate response time? How can seamless communication be provided?

As a policy, a seamless environment which allows data/model access and exchange should be provided. However, technology limitations and financial constraints may not allow this. Enterprise-wide planning is needed to identify the scope of ODSS. EWDM is needed to define ODSS architecture and requirements. Technologies like object-oriented databases in client/server environment should be used to provide any time data support.

It is obvious that requirements and policies discussed above are not mutually exclusive and in many cases are linked or complementary. For example, data across functions or stages can only be communicated if we have a seamless environment.

ODSS issues and policies, discussed above, can be summarized in the following three groups:

DATA:
. Enterprise-wide data model
. Standards for public/private data
. Multiple sources of input data
. Independent verification of input data
. Mechanism to ensure currency of private/public data

MODEL/TOOL:
. Categorization of tools based on problem types
. Built-in Intelligence for model selection
. Redundant analysis tools
. Use of multiple criteria for politically sensitive decisions
. Validation of private models

OVERALL SYSTEM:
. Restructure along functions or process
. Move from function (process) to process (function) mentality
. Concept of virtual and/or revolving team membership
. Enterprise-wide planning and data modeling
. Modular design with tight cohesion and loose coupling
. Documentation of decision history

Summary

Technological and resulting organizational convergence is creating new demands on users, designers and policy makers. It requires instant access to organization-wide data/model to make organization-wide decisions. ODSS is one solution.

Much has been written about ODSS in the context of conceptual design and architecture. However, ODSS is still evolving and new theories and issues are constantly emerging. This paper discusses policy implications for ODSSs. These policies are based on issues resulting from ODSS characteristics.

This paper has answered many questions and raised new ones. There are many issues still unanswered. What is an ODSS? How do we recognize one? Are there any existing ODSSs? Is it possible to study existing ODSSs? What are the building blocks of an ODSS? The authors are studying some of these and hope others will also take the challenge.

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