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Americas Conference on Information Systems (AMCIS)

8-25-1995

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Introduction

One of the most difficult tasks in designing information systems is the determination of system requirements. Requirement specifications must deal with three basic questions (1) What should requirements be? (2) How should requirements be derived? (3) How should requirements be stated? Although a number of professionals have discussed the first and third questions, few researchers have addressed the second question (YADAV and Chand, 1989). The analyst remains essentially unassisted in the process of deriving systems requirements. With the advances in IS technology, it seems reasonable to believe that an intelligent support system could assist the systems analyst with this task.

Background

In 1989, Yadav and Chand recognized that the process of determining information requirements had been neglected. Yadav and Chand's Expert Modeling Support System (EMSS) provided a formal notation to describe a model of organizational functions and a knowledge base to assist the analyst/project team in building the organizational model. Specifically the Yadav/Chand conceptualization of an EMSS was intended to provide automation to the structured analysis and design technique (SADT), delineate a formal technique for model verification and provide criteria for terminating the recursive SADT process. In 1992, Dalal and Yadav extended the Chand/Yadav EMSS to provide support for the analyst in the determination of requirements for the design of effective information systems (Dalal and Yadav, 1992). Although these systems strive to support the analyst, they still fail to provide direct support during the process of data gathering. The dynamic nature of MIS mandates that an analyst support system be able to help the

analyst in similar and dissimilar situations. An adaptive expert analyst modeling support system (AEAMSS) could use learning to improve support over time. But, to date, no one seems to have provided an architecture for such an adaptive support system to aid the analyst in carrying out the major activities of fact gathering.

Research Questions

The research questions of interest are: (1) What are the activities an analyst goes through in determining system requirements? (2) What knowledge is necessary for an AEAMSS to assist an analyst in his/her activities in determining the characteristics of an organization and a set of IS characteristics to support the organization? (3) What kind of analyst support should the AEAMSS provide?

In order to satisfy these research questions, this study proposes a list of the activities and the underlying knowledge needed to insure the proper gathering of facts about the organization and determine the IS projects scope. In addition, a logical architecture for an AEAMSS is proposed.

Partial List of Fact Gathering Activities

There are four approaches to gathering facts about an organization that help determine system requirements: (1) asking, (2) deriving from a current IS, (3) synthesis from the characteristics of the using system, and (4) discovering from experimentation with an evolving IS (Davis, 1992). While systems analysis discussions treat these areas in a generalized manner, we have developed for this study a partial list of the analyst activities involved in determining information system requirements consists of twenty six elements.

1. Determining the name and position of the project sponsor. <u>Knowledge Required:</u> Organizational structure and Organizations Personnel list.

2. Determining when the project must be completed and accepted. <u>Knowledge Required:</u> Project time table or schedule.

3. Identifying who or what group will make project decisions. <u>Knowledge Required:</u> Organizations decision making structure.

4. Identifying any planned or contemplated follow-on projects. <u>Knowledge Required:</u> Organizations IS planning staff, IS goals and plans.

5. Determine the amount of time per week managers have available to devote to the project. <u>Knowledge Required:</u> Managerial schedules for key managers involved with the project.

6. Determine the amount of time per week users have available to devote to the project. Knowledge Required: Manager/Supervisor identity and level of support for making key users available.

7. Determine who or what group will make the final acceptance. Knowledge Required: Organizational project team and Decision maker structure.

8. Determine the monetary limits on the project (if any). Knowledge Required: Organization's Fiscal Structure and identified funding for the project.

9. Identify the organizational areas, functions, or objects to be included in the project. Knowledge Required: Organizations structure, functional responsibilities, IS goals and objectives.

10. Identify the current IS equipment to be used and any new equipment to be purchased or leased. Knowledge Required: Hardware and Software structure of current IS and critical success factors for new/revised system.

11. Determine the relocatability of current equipment. Knowledge Required: Location and mobility of current equipment. Availability of in house or outside expertise needed to move present equipment and support resources.

12. Identify the organization's goals supported by the project (IBM, 1975), (THIERAUF, 1982). Knowledge Required: Organizations goal met or problems solved if the project critical success factors are achieved.

13. Compose a list of tentative business functions or objects ("Resources that exist to satisfy the mission, goals,and objectives of the business")(KATZ, 1990, p. 517). Knowledge Required: Organizations mission, functions, processes, goals and objectives.

14. Interview project sponsor. Knowledge Required: Identity of the project sponsor, appointment/work schedule, project mile-stones or decision points. The degree of flexibility and control the sponsor has over the project.

15. Review organization's current business process standard operating procedures (SOPs) and policies. Knowledge Required: Location and means of accessing organization's current business process standard operating procedures (SOPs) and policies.

16. Determine the key managers involved with the business processes. Knowledge Required: Organizational personnel structure and owners of the business processes.

17. Identify the key users for each business function to be supported by the IS. Knowledge Required: Key business functions requiring IS support.

18. Interview key managers and users to define and finalize all business functions. Use an unique identifier for each interviewee. Determine the process(es) with which they are

involved and the frequency of involvement. Use initial process list as a starting point. Modify process list as needed for completeness. Determine the data views needed for each identified process. Knowledge Required: Organizational functions, personnel responsibilities, processes and extent cases.

19. Prepare questionnaires for users and managers not reachable for interviews. Knowledge Required: Questionnaire building techniques and questions.

20. Issue questionnaires. Knowledge Required: Distribution systems internal and external to the organization.

21. Observe the current system at the managerial level. Knowledge Required: Organizations managerial structure.

22. Observe the current system at the user level. Knowledge Required: Organizations functions, processes, and users.

23. Participate in the use of the current system if possible. Knowledge Required: Current system operating procedures.

24. Analyze interview, questionnaire, observation and participation results. Knowledge Required: Organiztional analysis techniques.

25. Determine list of required inputs and outputs of business processes requiring IS support. Knowledge Required: Organizational resources for business processes and reports, graphics, screens.

26. Brainstorm with managers and users over Analysis results and possible process and data view additions that may be needed. Knowledge Required: Brainstorming techniques.

AEAMSS ARCHITECTURE

The Expert Modeling Support System proposed by Dalal and Yadav (Dalal and Yadav, 1992) supports the analyst in studying the organization as a whole and modeling the information system in the context of the overall organization's goals and needs. We have extended and modified that system to make an adaptive (learning) expert modeling support system designed to assist the analyst with fact gathering and model generation.

There are a number of methods which may be used to include learning in an application. These methods rely on strong domain knowledge as a foundation for learning. The methods vary from explanation-based learning to the genetic algorithm. The method which appears to be most suited for our purposes is case-based reasoning. This method de-emphasizes the use of general rules and stores solutions in a case base. In practice the AEMSS would only resort to the general rules when a close match to the analyst's current project cannot be found in the case base. In general the case-based management system must:

1. Retrieve a model from the case base that most closely resembles the parameters input by the analyst.

2. Modify the retrieved model to match the current project.

3. Apply the transformed model to the current project.

4. Store the new model in the case base after acceptance by the analyst (Luger, 1993). (see Figure 1).

The Application Base, Case Base, Model Base and Knowledge Base management subsystems can communicate with each other and access information stored in an Application Base, Case Base, Model Base and Knowledge Base respectively.
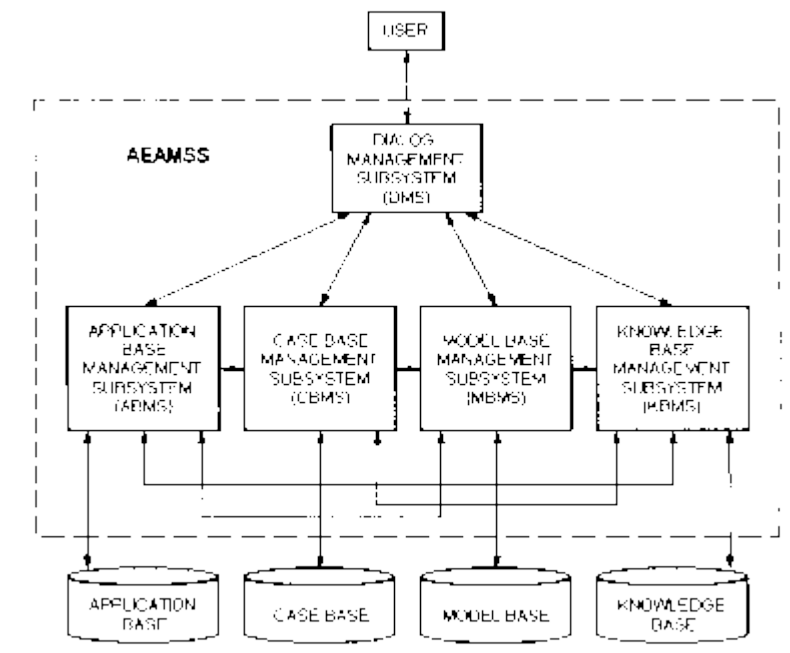
The Application Base contains:

1. Information gathered by the analyst specific to the organization under study.

2. A proposed formal model that is being developed for the subject organizations object system.

3. An organizational description.

4. An existing system model if one exists.

The Case Base contains specific IS requirement models for

previously analyzed organizations.

The Model Base contains:

1. Models of general organizational functions.

2. Analysis models for correctness, completeness, and consistency.

3. Models to generate reports.

4. Models for requirements specification.

The Knowledge Base contains:

1. Templates, knowledge and metaknowledge about organizational ISs.

2. Inference rules.

3. Declarative knowledge in the form of facts, assertions, and frames. This is knowledge about organizations in general. It is the back ground knowledge the analyst and the AEAMSS need to perform an analysis of organizational IS needs and complete the analyst activities for determining IS requirements.

4. Procedural knowledge in the form of rules. T his is knowledge about how analyst activities should be completed.

A list of references and a longer version of this paper are available on request.