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DESIGNING OF A SCALE FOR DECISION SUPPORT SYSTEM PROJECTS' PLANNING: A CASE STUDY

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Abstract:
In this study, a scale is derived as a result of a literature review for the planning phase of the Decision Support System. In this framework, the steps have been demonstrated through the application in a concrete case study in the field of civil aviation education. A literature review reveals the decision support system concept and design approaches for the decision support system. The literature review and the case study are compared. In the final part of the research, suggestions regarding the planning of decision support systems are made. At the result of the study a scale for decision support system projects' planning is suggested.

Key words:
decision support system design, project planning, project management institute (pmi), information system design, civil aviation education.

INTRODUCTION

The main purpose of decision support systems (DSS) is to assist and support people when they make decisions. Through the development of information technologies, decision support systems have been used in daily life. In modern technologies, the processes of decision-making and decision implementation require human involvement. The reason is that perception, intelligence, aesthetics and flexibility are too sophisticated to be provided solely by today's technologies.

The design of decision support technology requires a multidisciplinary approach of engineering and social sciences. To begin with, when designing, the decision problem should be determined, and then the decisions in the problem-solving process should be observed. As a result, information gathering through this process is the foundation of the decision model. The data, information and information flows that are used in the decision process should be presented systematically. In addition, communication networks and distinctive decision styles should be examined in the process. At this stage, designing decision support projects have generally benefited from the social sciences. For the designing of the decision model, one or more of the statistical, financial, optimization and simulation models may be used. The decision support model is introduced to users using correct hardware and software architecture. Finally, corrections and improvements are made through feedback in the decision support system. At this stage, engineering sciences are generally used.

DSS projects are composed of five phases. In the first phase, a project is at its conception stage. In the second phase, project ideas are defined, and the purpose and vision are established. The third phase involves planning to attain the purpose. As part of the planning phase, strategies are established, execution is planned and risk management methods are determined. The fourth phase is the execution stage, where planned works are applied and monitored, and modified in cases of plan deviation. The last phase is where the project is closed. Project completion reports are drawn up, budgets are closed, and the tasks and responsibilities of the project team relating to that project are concluded [1].

This study tries to determine the planning steps of decision support for system design to help the project manager choose a way to improve project. This steps cannot compare methodology based on heuristic approach with simulation technique and benchmarking. As part of the research, identification of the planning steps explored in the DSS literature is attempted. The case study technique has been used to compare these steps with a sample DSS project plan developed under the Anadolu University Scientific Research Project. In this way, a scale has been developed that will be used to evaluate other project plans of DSS.

The first part of this research conducts a literature review to identify the steps that should be followed at the planning stage of DSS projects (Figure 1). In the second part, the case study technique is used to focus on a case to analyze the dynamics of an event.

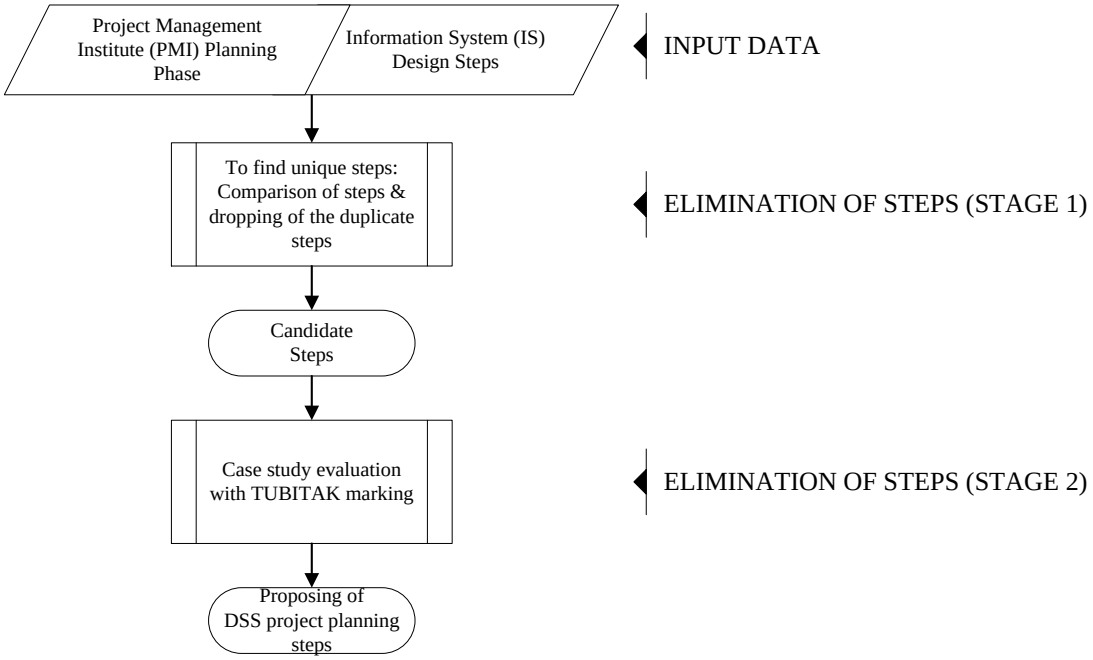

Fig.1 *Methodology of the Study*

This technique is often used in the analysis of data extracted from archives, interviews, surveys and observations [2]. In this context, the findings obtained through the literature review are identified in the tables. Each listed item is evaluated with a 5-level scale from inadequate to very good. For the development of the project, suggestions are given by taking into consideration the results of the evaluated DSS project plans.

2 LITERATURE REVIEW

Since the 1960s, the concept of the decision support system has been used in conjunction with technological developments. It is accepted that DSS studies started with Morton [3]. A decision support system, using quantitative models, was developed by Little to overcome management problems [4]. The concept of DSS was first articulated by Gorry and Morton [5]. To date, five different types of DSS have been defined; data-based, model-based, communication-based, document-based, and information-based [6] [7] [8] [9] [10]. DSS integrates the functions of traditional information systems and different types of techniques [1] [11].

In the DSS literature, experts prescribe a variety of approaches or methodologies for designing and developing DSS. Everyone does not however agree on what methodology works best for building different types of DSS. If managers and DSS analysts understand the various methods, they can make more informed and better choices when building or buying a specific DSS [12]. The design of DSS have recently focused on approaches of web enablement applications and improvements. The study of Dong and Srinivasan tried to design the key notion address about adaptability in decision makers and web based DSS [13]. Kallestrup et al. developed a framework to show how such a DSS can be designed with the existing organization in mind, and how a decision process and corresponding software can be developed from this basis [14]. Donzelli's approach focused on the managers being supported from complexed DSS in many fields, but these haven't yet entered the software engineering mainstream. A hybrid modeling approach can quickly produce process models that can

provide project managers accurate predictions, help them design the desired project trajectory, and validate process changes [15]. A lot of tools have been developed to assist decision making in construction project management. For example, by the approach of Omar et al.; the fully maximized and utilized technologies are vital to accelerate management process, particularly, in planning phase of DSS project management [16].

Planning is the significant phase of a DSS project. To build and develop information systems, a multidisciplinary project plan at the cross-section of people, organization and technology is required [17] [18]. For example, the service science approach focuses on interactions between service providers, their clients, and consumers as important interacting components of a service system. Because of that the approaches to DSS design are constrained in terms of their ability to adapt to changes in user requirements and to provide support for the evolution of systems. DSS projects are complex sociotechnical systems whose behavior is the result of many technical and human factors, from personnel skills to development tools and processes to business goals [13]. By considering these factors, DSS development require engineering, communication framework, data management and interoperability, and software usability [16]. Behavioral sciences are required to project and explain various theories regarding people or organizations [19]. An engineering approach is utilized to conduct system analyses, develop software/hardware architecture and to establish algorithms of suitable solutions. Design sciences help to improve the skills of people and organizations with innovative designs [20]. Project managers must identify the right combination of these factors to obtain the desired results.

The project management team has to respect contractual commitments, in terms of deadlines and budgets that are often two antagonistic objectives [21]. The process of project planning begins with definitions [22]. Project planning processes can be defined as the steps of needs gathering, scope determination, work breakdown structure, activity definition, activity listing, activity resource definition, activity resource estimation, work program development and cost estimation according to the PMI (Project Management Institute). Sub-plans are developed at the project planning phase. The most critical of the project sub-plans include planning of communications, procurement, risk, quality, human resources and project management [23].

3 PROJECT PLANNING PROCESS IN DSS

DSS integrate information technologies and have seven fundamental principles with the perspective of design science as follows [20]:

1. Design as an artifact: Information systems are designed as structures, models, methods or samples. In this sense, each information system is distinct from another.
2. Problem relevance: Information systems develop technology-based solutions to important problem of business. Therefore, problems to be solved by information systems must be clearly defined.
3. Design evaluation: An evaluation method should be established that will thoroughly measure the designed information system in terms of utility, quality and efficiency. Therefore, the performance of the information system can be evaluated.
4. Research contributions: Multidirectional research should be conducted to ensure an effective design. Research should provide clear and verifiable contributions in terms of the design artifacts, design foundations, and/or design methodologies.

5.Research rigor: Rigor should be observed in the construction and evaluation stages of information systems.
6.Design as a search process: Rules and steps should be established to achieve problem solving for effective research.
7.Communication of research: The designed information system should be effectively presented to both technology-oriented and management-oriented shareholders.

4 ANALYSIS OF A CASE STUDY

The planning phase of decision support system projects is explored by the help of a case study to determine the basic steps of the planning. In this study, an Anadolu University Scientific Research Project is selected as a case study [24]. The aim of the project is to identify and design the criteria for a traineeship assignment in Turkish civil aviation institutions. In this regard, the goal was to develop a DSS algorithm and software to be used by traineeship stakeholders. The project defines five work packages: to define traineeship competencies, to identify traineeship assignment criteria, to develop an assignment algorithm, to develop decision support system software and to measure software performance (Figure 2).

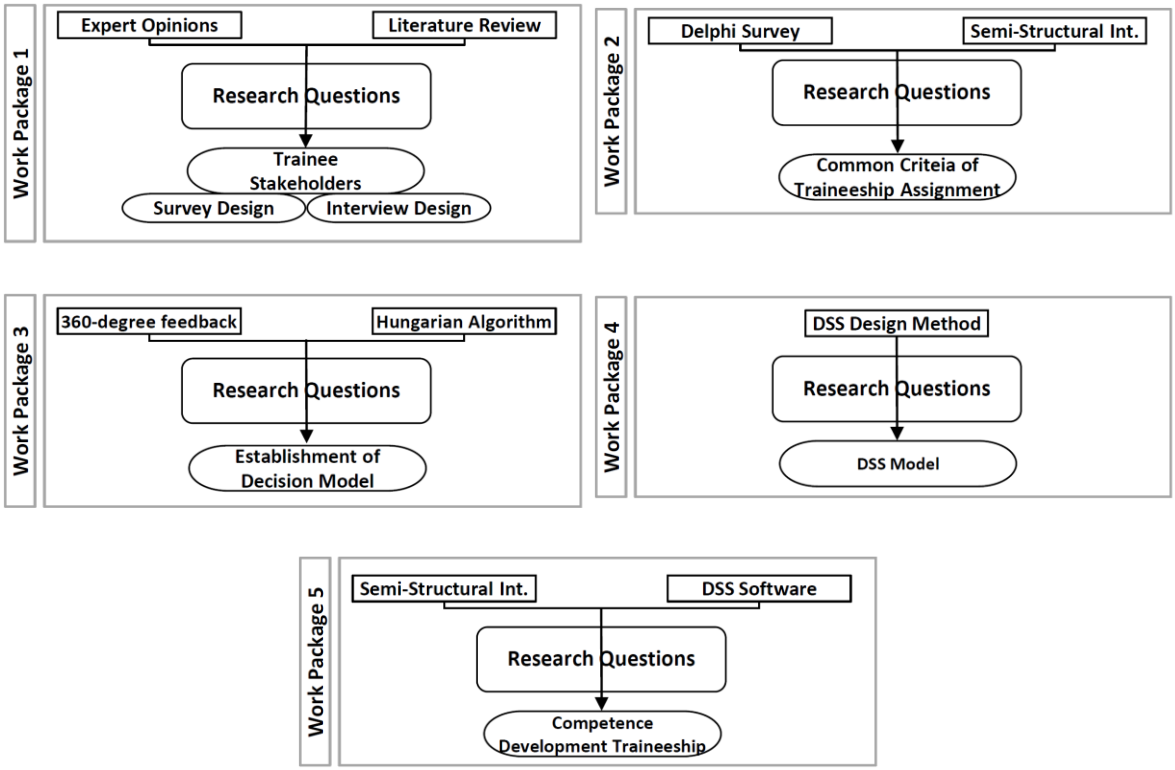

Fig.2 *Project Methodology Flow Chart*

A 5-level scale adapted from the Scientific and Technological Research Council of Turkey (TÜBİTAK) is used to evaluate the case study as shown in Table 1.

***Tab. 1** DSS Project Planning Evaluation Levels*

Description	Level	Score
The project proposal satisfies the relevant criteria in all respects. There is almost no deficiency. It may have negligible errors at an acceptable level.	Very Good	5
The project proposal satisfies the relevant criteria at a good level. However, the proposal has some potential areas of improvement.	Good	4
The project proposal satisfies the relevant criteria at a middle level. The proposal requires improvements.	Middle	3
The project proposal does not satisfy the relevant criteria at an adequate level. The proposal suffers serious deficiencies.	Not Good	2
The project proposal does not satisfy the relevant criteria. The project proposal suffers serious deficiencies/weaknesses.	Inadequate	1

This project has two sections; 'To identify common traineeship assignment competencies (work package 1 and 2)' and 'to design of a decision support system (work package 3, 4 and 5)'. This DSS project concept has a multidisciplinary structure involving aviation, education, computer sciences, and suchlike. Qualitative and quantitative methods are planned to be used on the project to answer the research questions. Plan B is defined to mitigate potential risks during the research and software processes. The period, team and budget are detailed in the planning phase of the project with Microsoft Project Management software. The impact of the project in the long, middle, and short terms is also defined.

A scale is derived from the steps discussed in the literature review regarding the planning of the DSS project. According to this scale, dimension 1 measures the PMI steps, dimension 2 measures the sub-planning steps, dimension 3 measures the fundamental principles of the information system design, and dimension 4 measures the information system research steps. The case study is evaluated with the Project Planning Evaluation Levels Scale (Table 1). Then for each dimension, the average score is calculated as shown in Table 2.

Tab. 2 *The Score of DSS Project Planning Phase*

Dimensions			Score
1	PMI Planning Steps	Collecting needs	3
		Scope determination	4
		Work breakdown structure	5
		Activity definition	5
		Activity listing	5
		Activity resource definition	3
		Activity resource listing	4
		Activity resource estimation	2
		Work program development	5
		Cost estimation	3
		Average	**3.9**
2	PMI Sub Planning Steps	Communications planning	1
		Procurement planning	2
		Risk planning	4
		Quality planning	2
		Human resources planning	2
		Project management plan	3
		Average	**2.3**
3	IS Design Fundamental Principles	Design as an artifact	3
		Define information system problem	5
		Evaluation method	4
		Participatory research	5
		Rigor	4
		Design of research processes	5
		Communication	3
		Average	**4.1**
4	IS Research Steps	Develop - build	5
		Method of proof	5
		Bases	4
		Methodology	5
		People	4
		Organization	4
		Technology	3
		Average	**4.3**

The average score of the 'PMI Planning Steps' is calculated as 3.9. According to this score, the project plan is satisfactory at the middle level. As a result, the project plan needs improvement. Moreover, the average score of the PMI Sub Planning is 2.3. According to the scoring of this dimension, the project plan fails to satisfy the sub-planning criteria at an adequate level. The DSS project plan has serious deficiencies in regard to the terms of the PMI Sub Planning Steps. The score of 4.1 is calculated as the average score of the 'Information System Design Fundamental Principles', and similarly 4.3 is calculated in terms of the 'Information System Research Steps'. The calculated levels for these dimensions show that the project plan satisfies the relevant criteria at a good level. Nevertheless, certain potential improvement is required for these dimensions.

A score of 3.65 is calculated as the general average according to this 4-dimensional scale. According to this score, the project plan satisfies the scale criteria at a middle level. A general average indicates that the project plan requires improvement. Communication

planning, activity resource estimation, procurement planning, quality planning and human resources planning should be developed to satisfy the scale criteria.

5 CONCLUSIONS

DSS design must observe current technological infrastructure, communication architecture, and developmental capability. Moreover, information systems and DSSs must be designed to serve as business strategies in corporations.

In this study, a scale is derived as a result of a literature review for the planning phase of the DSS. Then a derived scale is approved by the case study technique. According to this scale, DSS projects require the implementation of PMI planning and PMI sub-planning steps. In addition to these planning steps, the problems of DSS projects must be defined and analyzed by taking into consideration the requirements of different corporations. Information system research and design steps must consider the fundamental principles and Capability Maturity Model Integration (CMMI). The scale items can be used for quantitative evaluation at the DSS project planning phase. However, the evaluation of a number of items, such as 'design as an artifact' and 'rigor', is quite difficult for quantitative approaches. For an objective evaluation, these items have to be divided into sub-items or removed from the scale, otherwise, it is impossible to measure the planning's rigor. The 'design of research processes' is also included in the PMI planning steps. Therefore, it should be removed from the scale. However steps of the scale cannot be applied to the heuristic approach with simulation technique and benchmarking. Because this approach to problem solving is a practical method not guaranteed to be optimal or perfect.

For future research, the DSS planning phase scale can be improved with CMMI standards. Moreover, derived scale can be applied with a statistical analysis for the validation. The results of the scale can be generalized by more and different types of projects or a group of cases. In this context proposed scale would be able to help the project manager to evaluate and compare DSS project planning phase.

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