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An organizational decision support system for effective R&D project selection

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Abstract

Research and development (R&D) project selection is an important task for organizations with R&D project management. It is a complicated multi-stage decision-making process, which involves groups of decision makers. Current research on R&D project selection mainly focuses on mathematical decision models and their applications, but ignores the organizational aspect of the decision-making process. This paper proposes an organizational decision support system (ODSS) for R&D project selection. Object-oriented method is used to design the architecture of the ODSS. An organizational decision support system has also been developed and used to facilitate the selection of project proposals in the National Natural Science Foundation of China (NSFC). The proposed system supports the R&D project selection process at the organizational level. It provides useful information for decision-making tasks in the R&D project selection process.
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1. Introduction

Research and development (R&D) project selection is an organizational decision-making task commonly found in organizations like government funding agencies, universities, research institutes, and technology-intensive companies. It is a complicated and challenging task to organizations with the following reasons: (1) it is very difficult to predict the future success and impacts of the candidate projects; (2) it is a multi-stage multi-person decision making process involving a group of decision makers (e.g. external reviewers and panel experts). Thus, it can be very hard to manage the decision-making process, especially when the decision makers have heterogeneous decision-making strategies [5,7,22].

In the past four decades, a number of decision models and methods (e.g. *Mathematical Programming and Optimization, Decision Analysis, Economic Models, and Interactive Method*) have been developed to help organizations make better decisions in R&D project selection [7,16]. However, current research findings [14,22] indicate that many of the elaborated decision models and methods are not being used, and they have limited impacts on decision makings for real-world project selection. In order to improve the

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usability of decision models and methods in real application, decision support systems (DSSs) have been proposed and developed, which integrate decision models and methods with computer-based supports together [5,10,13,14,24]. Although some of the proposed DSSs are useful, they use decision models and methods for specific tasks and fail to support the whole decision-making processes at the organization level. Since the R&D project selection process typically involves multiple decision makers in different organizational units, an organizational decision support system (ODSS) is more appropriate for R&D project selection tasks.

ODSS is an integrated decision support tool with focus on the organization-wide issues rather than individual, group, or departmental issues [4,6,18]. It supports organizational decision activities by integrating model base with database and user interfaces over the communication networks. ODSS is different from the traditional DSS in aspects such as goal, scope, users, technology components, and implementation methodologies [11,12].

ODSS combines computer and communication technologies to coordinate decision-making activities across functional areas and hierarchical layers [20,28]. ODSS architectures have been proposed to support distributed decision-making tasks with access controls over the organization [8,17,25]. ODSSs have been applied in the telecommunication organizations [11], the military [3], the governments [23], and other organizations [2,19,21]; however, few research can be found in ODSS for R&D project selection. This paper attempts to present the development of an ODSS for the selection of R&D projects at the National Natural Science Foundation of China (NSFC).

Section 2 of this paper describes the research background. Section 3 proposes an ODSS architecture for R&D project selection. Section 4 reports the application of the proposed ODSS in NSFC. A summary of the contribution and lessons learned can be found in the last section.

2. Research background

NSFC (http://www.nsfc.gov.cn) is the largest government funding agency in China with a primary aim to promote basic and applied research. Supported by the Chinese government, NSFC's annual budget has been dramatically increased from RMB 80 million in 1986 to over RMB 1,290 million in 2000. Up to 1999, it has provided funding support for more than 51,500 projects.

There are seven scientific departments, four bureaus, one general office and three associated units in NSFC. The scientific departments are responsible for the selection and management of the projects, while the bureaus, general office and associated units are mainly responsible for policy making, administration and other related affairs.

One of the major tasks of NSFC is to select and fund R&D projects with great potential of scientific

Table 1
Major decision tasks in R&D project selection process

No.	Decision task	Decision makers	Responsibilities
1	Proposal submission	1. Division as well as department managers of NSFC 2. Applicants 3. Research office coordinators of the applicant institutes	1. Validate the content of proposals 2. Ensure the applicants and the proposal meet the application requirements
2	Selection of external reviewers	1. Division managers	1. Assign external reviewers to proposals 2. Transfer proposals to appropriate divisions
3	Peer review	1. Division managers 2. External reviewers	1. Evaluate proposals by external reviewers 2. Validate the content of review results 3. Coordinate the evaluation process by division managers
4	Aggregation of review results	1. Division managers	1. Aggregate the external review results 2. Recommend proposals for panel evaluation
5	Panel evaluation	1. Department and division managers 2. Panel experts	1. Make decisions for margin proposals 2. Suggest a list of funded projects
6	Final decision	1. Top managers 2. Department managers	1. Confirm the final recommendation list 2. Treat exceptional cases