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DECISION ANALYSIS IN PROJECT MANAGEMENT PROCESS

In project management, project managers are faced with a huge array of choices. Decision analysis is used in strategic planning, operational management, and other areas of business. Decision analysis helps companies to determine optimal exploration and production strategies under uncertainties in cost, prices, and exploration prospects. Very often we complain about the decisions that were previously made. Yet the fact is that the decisions made were based on the knowledge we had before. By now we have gained more knowledge. Therefore the common problem of making decisions is that decisions are not robust enough, especially when risks associated with supply chain management are underestimated. In this paper we propose a framework that helps to predict future situations collectively and increase the reliability of decision making. This paper describes project management steps and the way they can be supported by Intelligent Decision Support system (IDSS). The main parameters assessed are total cost of the projects, time of the project total fulfilment, number of subcontractors, location factors, and etc. IDSS will enable to collect data, propose possible alternative decisions, and provide risk assessment.

1. INTRODUCTION

Project management is the planning, organizing, guiding and monitoring of organizational resources that are necessary to successfully produce one or more desired outputs or outcomes (often called deliverables). It encompasses management of project risks, issues, and changes, as well as product/deliverable configuration and quality.

A project is [1]:

- A unique venture with a defined beginning and end;
- Carried out by people to meet a specific objective or set of objectives;

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- Defined within the parameters of scope, schedule, cost, and quality.

The most important quality measurements of the project include users' requirements, budget, and schedule, which are indicated as three circles (Fig. 1). Identifying and understanding the users' requirements, building the project schedules, and preparing the project financial plan, are all essential for the project. The most important one among the three is meeting the users' requirements.

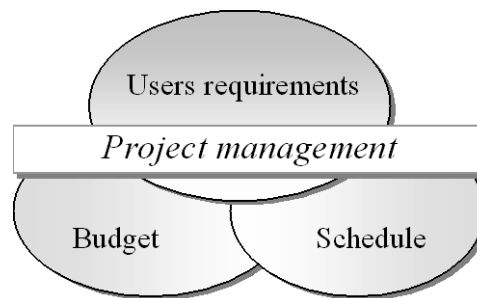


Fig. 1. Elements of project success

Many organizations strive to meet a common business goal of high quality, low cost, and fast to market. The goal is established to ensure the organization meets customer expectations. A formalized project management process supports this goal. The management process establishes [8]:

- Guidelines by which product/process requirements are determined in farther upstream stages to reduce the chances of costly changes in the downstream development stages;
- Progress against schedule and budget that can be tracked and managed in real time;
- Opportunities for improving the project management process - thus reducing the time from concept to product;
- Clearly identified customer expectations early in a project so as to increase the final product quality.

An effective project manager must forecast problems that might arise and prepare tentative solutions to those problems during project planning. Project managers need decision support tools to help them to select the right decision. Decision-making includes analysing the problem to identify viable solutions, and then making a choice from among them. Decision can be made or obtained (from the customer, from the team, or from a functional manager). Once made, decision must be implemented. Decisions also have a time element to them – the “right” decision may not be the “best” decision if it is made too early or too late [4].

Unfortunately existing commercially available tools for project management, such as the Project Management module of enterprise resource planning (ERP) systems, do not support decision making for the project optimisation, project fulfilment tracking, and optimal project portfolio selection,.

There are special commercial packages for project management [12]. These include Microsoft Project (Microsoft Corporation, 48.4% market share), Primavera Project Planner

(Primavera Systems, 13.8%), Microsoft Excel (Microsoft Corporation, 8.5%), Project Workbench (Applied Business Technology, 8.1%), Time Line (Time Line Solutions, 6.1%), SureTrak (Primavera Systems, 5.3%), and others. Microsoft Project is by far the most frequently used computerized project management software tool today. This is consistent with previous surveys of project management tools. It is commented that Microsoft Project is “far from being the perfect project management software package”. Regardless, Microsoft Project remains the most widely used tool. It is primarily used by project managers for: small, medium, and large projects; control and tracking; detailed scheduling; early project planning; communication; high-level planning; Gantt, CPM and PERT; planning, analyzing, tracking, reporting; and total project management.

Existing project management tools do not update resource and cost information from ERP systems. Furthermore, even though ERP systems are able to track the availability of resources and associated costs for projects within one enterprise, they lack the capability of tracking information in collaborative project management where multiple enterprises are involved. It is not possible to collect data from different partners regularly, and it is not convenient to exchange information between a company and its subcontractors.

Using Intelligent Decision Support Systems (IDSS) within ERP systems, which directly solves the problem of no decision support, is also a suitable way to take advantages of sharing information and facilitate collaboration. In our previous work [7] we showed how an IDSS helps a decision maker to perform the analysis of the projects and enables to select the most interesting one for the enterprise. In this paper we emphasize the project management details. It will be shown how the IDSS is able to support project management activities and what gains the user will receive.

2. MAIN FUNCTIONS OF INTELLIGENT DECISION SUPPORT SYSTEMS

Decision support systems combine individuals’ and computers’ capabilities to improve the quality of decisions [5]. They can be adopted in manufacturing ranging from the design of floor plans to the optimization of resource allocation and performance. Our proposed IDSS helps to improve project management, plan time and budget with proven methodologies.

Decision systems help to:

- Minimize risk,
- Improve project performance,
- Manage and deliver projects consistently,
- Reduce delivery times,
- Decrease project costs, while improving quality,
- Utilize limited human resources and capital more capital effectively, and
- Improve communications between business units.

The IDSS will support different ERP systems of enterprises that are connected as one network, which will bring benefits to all participating enterprises. It extends the previously

reported capabilities of optimisations in decision support, security features, and adjustability to particular requirements of collaborative enterprises [8]. The potential users of the IDSS are small and medium size enterprises (SME-s), which are interested in the optimisation of commonly used management processes.

ERP and IDSS have independently evolved and prospered in the marketplace [7]. The ERP system is responsible for the management of information flows in the collaborative network of enterprises and enabling secure data transfers. The IDSS integrated with the ERP system can enhance the effective usage of information available in the database of the ERP system. It also helps to archive and manage external information to make more reliable decisions. It is an intelligent system that can be trained towards the user's needs and preferences based on historical data.

The IDSS system also tracks the project implementation, i.e. to see the project development in real time as well as to predict problems, in addition to tracking resource and financial expenses, This helps to find the reason for project delays and to respond quickly to the frequent changes in the market.

3. PROJECT DECISION ANALYSIS PROCESS

The most important component of decision analysis is to evaluate alternatives. The evaluation of potential alternatives is needed for each stage of a project. The assessment of uncertainties is part of the alternative evaluation in the risk management process. New computerized project management tools utilizing quantitative analysis help project managers to make informed decisions. Recent research [9] showed that well-established decision analysis process integrated into the overall project management significantly improves organizational performance.

The decision analysis process for project selection with alternative evaluation provides project managers more information to make sound decisions. The features and functions for project selection process include [2]:

- Identification and analysis of projects or project alternatives,
- Identification of the activities, resources, and constraints of the strategic projects,
- Depiction of the projects in a symbolic form for modelling, (influence diagram),
- Identification of the model inputs and outputs from the analysis,
- Explanation of how the model will optimise the inputs,
- Explanation of how the outputs are generated by the model.

Any decision analysis process is based on three main rules, which can be called 3C principle [3]:

1. Consistency: It is important to standardize the decision analysis process for similar kinds of problems and opportunities to enable consistent decision making over time.

2. Comprehensiveness: Decision analysis processes should include a comprehensive assessment and analysis of the business situation. Missing or incomplete information may lead to incorrect decisions.

3. Continuity: The value of decision analysis will significantly diminish if it is done only in discrete situations during the course of a project, because decision analysis is a continuous process of making and refining decisions.

The 3C approach highlights what must be done and when. It also helps to identify the resources (manpower, equipment, facilities, etc.) required for each effort.

4. PROJECT LIFE CYCLE

Organizations performing projects will usually divide each project into several project phases to provide better management control and appropriate links to the ongoing operations of the performing organization. Collectively, the project phases are known as the project life cycle.

Project life cycles generally define *what* technical work should be done in each phase, *who* should be involved in each phase.

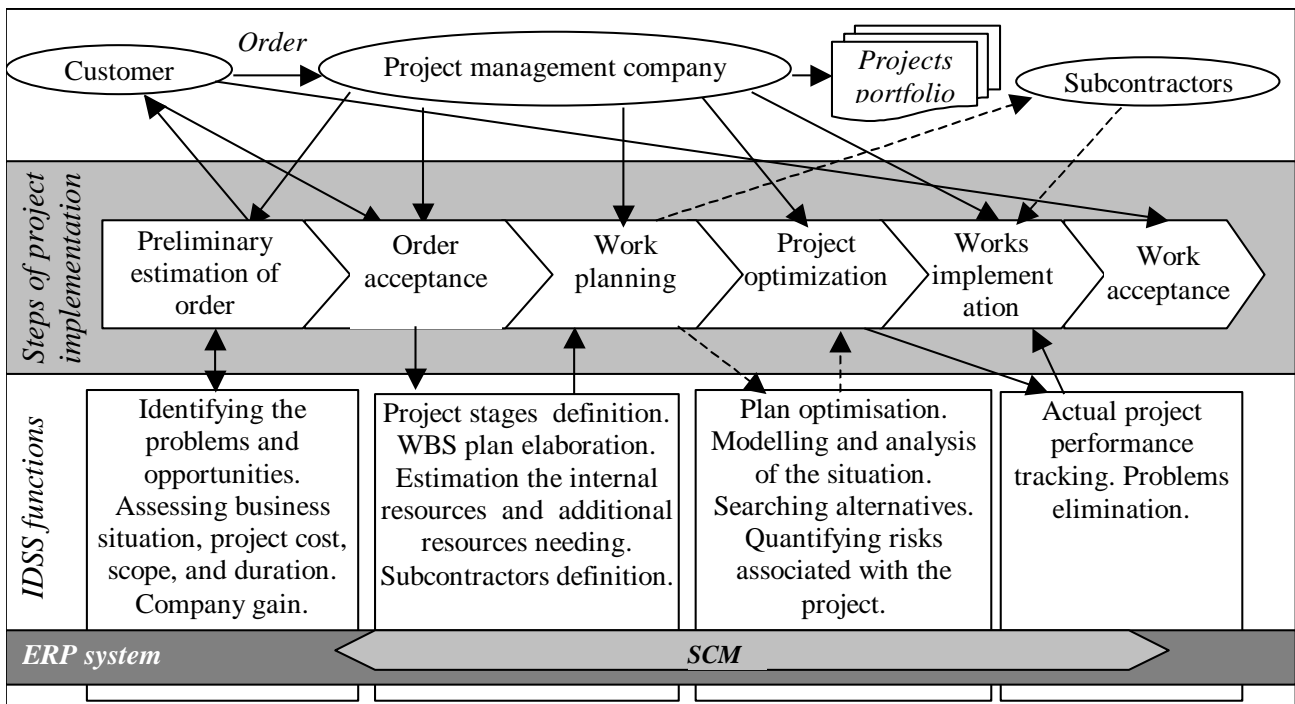


Fig. 2. Project lifecycle

In practice, the specific contents of each phase and breakdown of the phases may be dictated by the prevailing situation and organizational requirements. The phases are not necessarily implemented in a strict order. Events that occur during the scheduling phase, for example, may necessitate revising the project plan. In that case, re-planning may involve several of the elements included in the initial planning phase. ERP has focused primarily on

processing of transaction data resulting in the creation of the extensive, organizational databases of an organization that may consist of individual business units across the globe. The extensive databases created by the ERP system provide the platform for decision support.

Fig. 2 shows the main phases of a project management process.

Preliminary estimation of order (or project definition)

It is the most important phase of a project. It entails defining the objectivities, scope, and deliverables of the project; selecting the most appropriate approach; developing high-level estimates of time and cost; defining the project-management process; and identifying and addressing potential problems and risks.

Project objectives: Good objectives state what goal will be achieved and what results are sought, instead of how to achieve. They are specific, unambiguous, and measurable, containing a time frame for the intended achievements.

Scope: The statement of scope sets the boundaries of the project, in that it defines the confines, the reach, and the extent of the areas to be covered. The project scope states what will and will not be included as part of the project. The scope provides a common understanding of the project for all stakeholders by defining the project's overall boundaries. Scope can be defined in terms of impacted organizations, processes, systems, data, functionality and the like. Collected project requirements usually are used to test the scope statement.

The IDSS system enables the collection of the required data and supports the project analysis process. It also helps to estimate the project's profitability for an enterprise. If the enterprise has enough internal and external resources, the IDSS system will provide a composition of quotations to the potential subcontractors and help to identify possible problems based on the previous knowledge. At this stage the IDSS system will support the process of quotation composition. It helps to estimate the resource requirement for every stage based on historical data. Moreover it allows to search for similar tasks previously performed, and it helps to estimate the project cost based on the acquired information.

Order acceptance

The next step is to prioritise the needs. From the prioritised list, a set of goals can be easily measured. In this way it will be easy to know when a goal has been achieved. If a clear set of goals are established, they should be recorded in the project plan. It can also be useful to include the subcontractors' needs and expectations.

Project approach: The project approach defines the general course of actions that will be taken to accomplish the project objectivities. It may be defined in terms of the methodology to be used, the timing and phases of the project, or the types of technology and human resources to be applied. The approach section of the project definition explains, in general, how the project will be carried out.

Resource and infrastructure requirements: Resource and infrastructure requirements for professional service projects typically fall into any of the three categories: human resources, facilities and equipment, and information technology.

Human resource requirements, which often are the major costs of a project, should be defined in terms of the roles, responsibilities, and skills in order to be successful for

a project. The roles and responsibilities then are translated into a depiction or description of the planned organization structure for the project.

At this stage the negotiations about cost, duration and scope are performed. The aim is to find the solution that satisfies the needs of partners. After an agreement is achieved it is important to prioritise the list of the needs. In case some changes are expected, it should be decided in project management team.

The IDSS system supports the search of resource availability, the search of the similar projects for the calculation of duration and technological solutions from historical data, and the information exchange with potential subcontractors. The IDSS system will support the negotiation process by providing information directly from subcontractors and import of customer requirements. It ensures that the project is profitable and can be fulfilled by the agreed due date.

Work planning

The purpose of project planning is to confirm the project scope and objectives; develop the project organization, schedule and budget; secure the necessary resources; and create clear expectations about the project organization, timing, budget and resources.

Project planning provides the basis for the initiation, implementation, and termination of a project. It sets guidelines for specific project objectives, project structure, tasks, milestones, personnel, cost, equipment, performance, and problem resolutions. An analysis of what is needed and what is available should be conducted in the planning phase of industrial development projects [6].

The availability of technical expertise within and outside the organization should be reviewed. If subcontracting is needed, the nature of the contract should undergo a thorough IDSS analysis. The question of whether the project is needed at all should be addressed. The "make," "buy," "lease," "subcontract," or "do nothing" alternatives should be given unbiased review opportunities. In the initial stage of project planning, internal and external factors should be determined and priority weights should be given.

Project planning usually is the most time consuming activity. The planning process starts with an assessment of the constraints affecting the project. The progress milestones and deliverables are then defined and a schedule drawn up. Project managers revise their assumptions about the project as more information becomes available.

Here we plan the duration and cost of main stages. We estimate what jobs we are able to perform ourselves and what should be subcontracted. We also determine the contractors' competence or ability to participate in the project bid. For the selection of subcontractors the Analytical Hierarchy Process (AHP) methodology [9] is used. AHP has potentials in decision making for project management [10]. The result is a general working plan which describes when and what operation should be started and the total cost of operations.

The basic functionality of IDSS is to generate solutions of selected problems automatically. However, the user can create or change solutions. The IDSS is capable to evaluate solutions based on feasibility and efficiency. Using an IDSS system is often a process of generating, manipulating, and evaluating solutions.

Project Optimisation

At this stage the IDSS system uses different analytical decision making features for the project activities optimisation, as illustrated in Fig. 3. The time and cost of project will be optimised. System will help to assess what should be done by enterprises and what should be subcontracted.

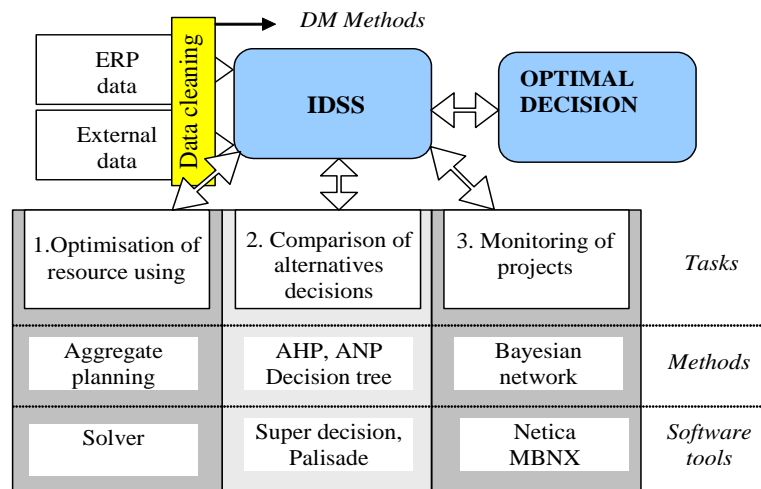


Fig. 3. Analytical features available in IDSS system

IDSS system will help to select appropriate tools, which depends on the type of decisions to be made. System will select the suitable method for solving of specified tasks like: comparing alternatives on strategic level, monitoring of established projects and processes in real time, operation level management decisions support, reliable decision making. In such way IDSS will be able to perform project management in optimal way and to ensure that the decisions are based on the same logical platform [8].

Work Implementation

At this stage the reporting of the job performed will be transmitted from subcontractors and the actual situation of the project will be received. This information can be provided in different ways. The subcontractor's ERP system can export the required data every day after the new information was received. In this case the system will be able to find all the invoices related with a particular project. This enables to track the total cost of the project that takes into account all the investment made. The other possibility is that the subcontractor can fill in the performed operations in the web form. The result will be the actual picture of the project realisation that can be transmitted to our customer. We will see in real time if the probability of the project fulfilment in time is decreased, or whether financial expenses of a particular step are higher than in the signed contract. In this case the decision maker will be able to respond and to find an optimal solution for the situation.

Work Acceptance

A customer can accept the work after all the operations are fulfilled. The IDSS system will enable to perform the projects in the borders of the agreed cost due to the improved

information flow and the real time project tracking possibility. The specific idea of such a system is a function of archiving data, collecting experiences, i.e. best-practice of particular projects in order to extract needed information anytime [11]. Fig. 4 shows an example of a finished project, as compared with the planned version of it.

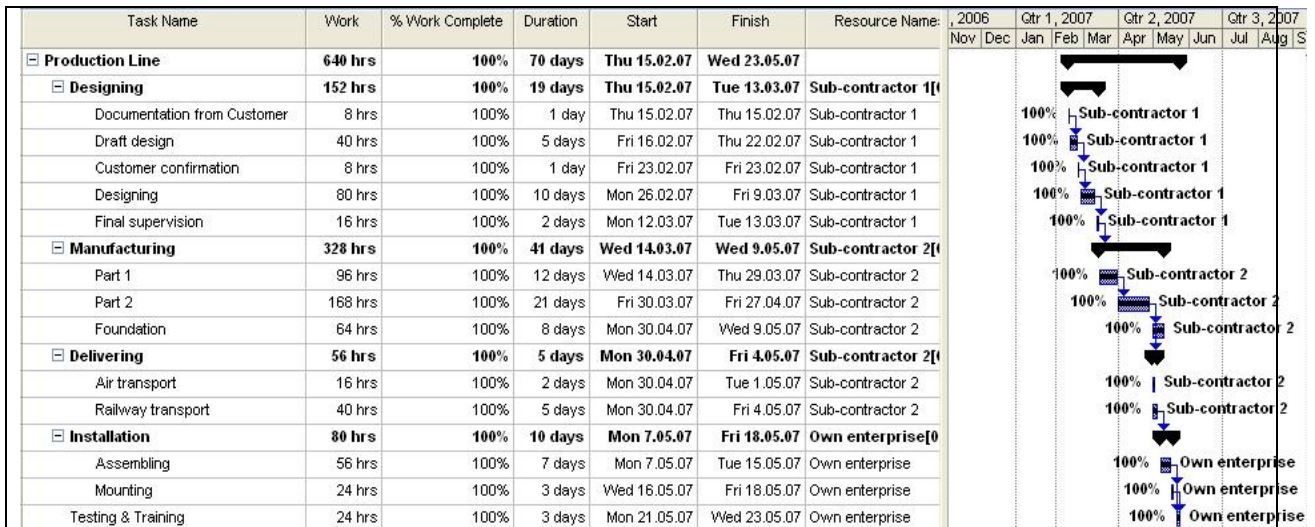


Fig. 4. Finished project and relation with planned version of project

5. CONCLUSIONS

Intelligent decision support system is a framework that helps project managers solve a variety of decision-making problems. There are no exact recipes for how decision analysis should be structured. Yet the process can be tailored for different companies, types of projects, and the types of decisions that must be made.

The outcome of the research is a decision support tool, which captures key data on projects and then provides an interrogation regime that enables users to compare and contrast the characteristics and decisions on projects that lead to success or failure.

This paper is dedicated to the description of project management process using decision-support interface with ERP system. As we noticed above, the combination of software allows project managers to handle his or her project correctly and actively, enhance the effective usage of information available in the database of an ERP system, increase stability of the project fulfilment, and useful information and history of decision could be achieved.

Such contribution entails a new vision in reliable project management, which could be achieved by implementation of complementary decision support systems. It is presented at what stages and how the IDSS system will be able to support the decision making process for project management activities. This tool enables us to track the project in real time and ensure that the project will be successfully implemented from both time and cost points

of view. It is proposed that the IDSS system will be the main tool for information exchange, optimisation of project management activities and performing of established project tracking. This tool can be widely used in project management within companies in the near future.

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