ABSTRACT

Project management is no longer limited to the traditional project industries, such as construction and engineering. The abundance of Information and the increasing complexity of projects have increased awareness of the need for tight management and control. As a result, project management software is being used in virtually every important business area: utility, aerospace, defense, financial, government, pharmaceutical, software development, automotive and manufacturing industries. By integrating information relating to activity progress, manpower, materials, cost and time into presentation-quality reports, project management software provides managers with the ability to improve their understanding of project status and to speed decision making—the key to successful project management.

INTRODUCTION

The project management tools in SAS/OR® software represent just one of the many applications that ultimately affect an organization's bottom line: reduced costs, efficiency, quality, and competitive position. Integrated with other critical decision-support components of the SAS® System, the project management tools, along with additional SAS/OR optimization procedures, can have a tremendous impact on the business decisions made throughout an organization. With global competition, a struggling economy, and tighter control over corporate resources, the SAS System provides the information delivery tools needed to make sound business decisions. Integrate SAS/OR software's project management and optimization tools with other SAS System features such as forecasting and financial analysis, total quality improvement tools, interactive multidimensional spreadsheets, and an applications development environment that makes these tools available to any user, and you have an information delivery system that facilitates better decisions and contributes to the overall goals of an organization.

This paper discusses the increasing need for project management as part of the overall corporate decision-support strategy and how SAS/OR software is used for project management and other critical decision-making areas to support that strategy. Since decision-support tools must reach all levels in the enterprise, and details on the operations must be available to managers as well as executives, an example of pulling together information resources and making them available through an easy-to-use Executive Information System (EIS) is also discussed. In addition, the paper presents an overview of the project management shell, PROJMAN, an interactive application for performing project management with SAS/OR software. Implemented with SAS/AF® software and Screen Control Language (SCL), PROJMAN provides a complete interface for each step of the project management process: editing activity and resource data, scheduling with or without resource constraints, and generating presentation-quality reports with current details of the progress and cost of the project.

IMPLEMENTING ENTERPRISEWIDE PROJECT MANAGEMENT

Problems with Improper Project Management Techniques

The reason companies seek the help of software tools and project management experts is to overcome many problems associated with poorly planned or implemented projects. Activity delays due to miscalculated durations, resource shortages, leadership changes, or even new technology cause tremendous losses of time and money. Placing the blame for a project that took twice the estimated time for completion at five or six times the budgeted cost is not only a burden but a political nightmare. The problem often lies in the planning of the project but can also include lack of control over the project once it has begun. The results include loss of material and financial resources, damaged reputations of those involved, and a negative impact on the goals of the organization.

Project Management in the Strategic Enterprise Role

To avoid the problems previously described, an organization must first adopt project management as a strategy that encompasses the objectives and goals of the organization. Global competition and higher quality demands are dictating that project management become imbedded in the decision-support framework of a company. A successful company is one that has in its portfolio a stream of projects that exemplifies the strategy the company has taken to advance into the future. Executives provide the direction and resources for executing the project management strategies that support the corporate goals and then monitor the success of the projects implemented.

Management and Executive Level of Involvement

The role of the executive is critical because every project needs some type of sponsorship from upper-level management. However, the level of executive involvement varies depending on the scope of the project. The executive should be actively involved in both the planning and execution of a project under certain circumstances, for example when it requires substantial resources, shows promise of moving a product ahead of its competition, or shares resources and strategies with another company. When managing the enterprise, executives cannot exclude overseeing the projects which ensure that the objectives of the organization are being met.

Directors or project managers must also take responsibility for their project's contribution to corporate goals. It is important for them to track the success of a project and redirect resources when unexpected changes or delays occur. They need to be able to evaluate the resources and ensure that appropriate, not just available, resources are allocated.

Line workers need an understanding of the importance of their activities and their impact on the final outcome of a project. Some companies credit part of their success to special incentive programs that reward workers for completing tasks on time.

Implementing Project Management with SAS/OR Software

The planning phase is crucial to successful project management. Poor planning is often the cause of delays and project overruns. The SAS System provides the tools for managing, tracking, and reporting projects as well as storing the information for later use. Most project managers are evaluated on their ability to consistently produce a quality product, and the documentation from past projects can have a significant impact on their ability to plan effectively from the start.

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The SAS System's project management tools provide all of the necessary components of a complete project management system that can reach all levels of users. For the project worker, data entry facilities allow the input of project activities and accomplishments. Anyone in the organization can use the software to monitor progress and status of the entire project. Specifying activities, setting precedences, estimating time and resources, and allowing for holidays are all options when scheduling a project. For reporting project status, calendars, Gantt charts, network diagrams, and customized reports convey information about the project to those concerned with its success. When the project managers need to evaluate changes in the original plan, they can go through any number of what-if scenarios to find the best alternatives. Executives can have access to project status at the touch of a button when they access the reports that have been fed into an executive or corporate information system designed for their use.

An important, and often overlooked, aspect in the implementation of project management is training. Too often, decisions are made without allowing for the appropriate training in both the methodology of project management and the most effective use of the software.

**Reaping the Benefits**

The benefits of a successful project management strategy are easily measured when a quality product is produced on time and within budget, especially if that outcome is unusual. The types of benefits derived from the use of the SAS System vary among industries and with the scope of each project. It is worth considering the benefits cited by others and seeing how they may impact any company's bottom line: full return on investment within months, increased project control, improved product quality, more accurate estimations, investments in projects that yield higher returns, improvements in internal operations, insight into preparing and handling problems that arise during a project, and reduced risk, waste, and costs.

**Integration with Other Decision-Support Tools**

Implementing an enterprise-wide strategy for project management should involve integrating the software tools of an entire information delivery system that supports the strategies of an organization.

The SAS System facilitates the extension of project management into other decision-support areas with its full array of analytical tools. It also provides the data import/export and management capabilities for making the project information available throughout the enterprise and across various hardware platforms: mainframes, minicomputers, workstations, and personal computers.

Within SAS/OR software, linear programming is used in the allocation of resources for a project. Then, the inventory and distribution models are computed for the final product. Decision tree analysis with the DTREE procedure evaluates a decision problem with its associated options, probabilities, and cost tolerances. The optimal decision based on the input is presented in a tree diagram with the expected value of the options. Decision analysis can be useful during the planning stages of projects as well as during periodic management reviews. The DTREE procedure, an experimental procedure with Release 6.06, will likely take a front seat in many project management applications.

SAS/CALC software provides the project manager with a multidimensional spreadsheet that can be integrated with project data for tracking project costs. What-if analysis can be performed with instantaneous results to see how changes in the project will affect its total cost.

**Utilizing Project Management—Beyond the Traditional**

Commonly known project management tasks often lie in the engineering and construction industries. Textbook examples of Gantt charts and network diagrams can illustrate the construction of a new building or the different phases of design and testing of an engineering process. With an increasing demand for tighter control of corporate resources and the availability of new technology, project management software is being used across a broader range of applications, departments, and users.

The following scenarios are typical uses of SAS/OR software in various applications across many industries. Although simplified for the context of this paper, a detailed investigation of each application would show a significant impact in the savings of man-hours that reach months, even years, and of costs that add up to thousands, even millions, of dollars.

- Utility companies often need to shut down different areas of a plant for regularly scheduled maintenance. These shutdowns may require additional resources such as outside contractors. Also, a company must take into account the need to maintain the expected level of service for their customers while performing the maintenance. Subprojects may include the scheduling of active generators to cover the power deficit caused by the maintenance.

- Construction applications such as building a new structure and erecting a water tower are common applications of project management. A network diagram can be expanded to show the starting times, floats, or durations associated with a given task and their relationship to the other activities of the project.

- In the pharmaceutical industry, introducing new products tends to include many long-term and short-term projects. All phases of development, testing, and market introduction need to be carefully planned with the flexibility to accept changes as they occur during the product development process. SAS/OR software allows for multiple projects to be consolidated, providing a complete overview of the process and progress of bringing a new product to market.

- Management Information Services (MIS) departments typically have a seemingly insurmountable backlog of incomplete or unimplemented projects. Delays may be caused by changes in priorities, new technology, or poor allocation of resources in the planning stages. Recently, SAS/OR software has become more widely used in this area to aid in the scheduling of these projects. Properly assigning resources (primarily programmers with different levels of expertise) and scheduling the projects with reasonable

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expectations for delivery have proved to significantly reduce the backlog in many MIS shops.

- **Government** agencies, both local and regional, not only need but sometimes require the use of project management software for their own projects as well as for their suppliers' projects. A local county government used project management to schedule their selection of a new landfill site. Committee members were able to track the progress of the project, which included members attending internal meetings, ranking different proposed sites, informing the public of the project status, and selecting the actual site.

- **Manufacturing** sites are constantly evaluating their production resources. Growth of the company often means expanding their facilities to meet an increasing demand for current or new products. The costs associated with a project of this scope are an important factor to consider when reviewing the project's progress. SAS/OR software allows managers to visualize the activities as well as the costs in a single Gantt chart.

- **Retail** organizations use a mixture of SAS/OR software decision-support tools. Linear programming is frequently used in price determination and in yield-management systems. A rental car agency can optimally meet the demand at its rental sites with its supply of fleet cars of different classes. Cruise lines and airlines can determine the best mix of full-rate and discount-rate tickets to maximize revenue. Along with solving their distribution, inventory, and transportation problems with SAS/OR software, consumer goods producers implement project management for scheduling a product's move from the production site to the distributors and finally to the retail outlets.

Many project management applications are not industry-specific. Almost any organization needs to conduct market research, monitor new product development, or maintain and update their computer operations. These are only a few of many examples where project management techniques are currently being used and should be used to improve the operations of the enterprise.

**THE PROJMAN MENU SYSTEM**

While the SAS System provides the educated programmer or operations research expert with a programming environment to fully exploit the tools of SAS/OR software, a menu-driven approach to managing projects for non-technical users is available. This menu-driven system, known as PROJMAN, is an application for entering project data, updating project status, scheduling projects using the critical path method (CPM), and obtaining various reports.

Some of the reports that can be generated from PROJMAN include:
- full-screen, line printer, and graphics Gantt charts and network diagrams;
- tabular reports of variance and resource usage, calendars of starting and finishing dates; pie charts, bar charts, and plots of resource costs and usage; and schedule and variance reports. Utilities are available for copying, deleting, and combining projects.

PROJMAN is documented in The PROJMAN Menu System, published by the Applications Division of the Operations Research Department of SAS Institute. PROJMAN is a part of SAS/OR software and is designed to be used in an interactive environment. It is primarily a prototype application that incorporates most of the commonly used tools for project management but is also designed to be modified to meet each site's particular needs.

**INTEGRATED DECISION-SUPPORT TOOLS—EIS**

Decision makers need access to information quickly and in a concise manner. Executive Information Systems are rapidly becoming the standard medium for delivering information to managers and executives. With project management implemented as a corporate strategy, status reports need to be included in the top manager's EIS, along with quality, financial, operations, marketing, and sales reports. SAS software is an exceptional vehicle for providing the information that top management demands. Its applications development environment is designed to build customized user interfaces that tap into the full power of the SAS System's decision-support software.

A simple EIS incorporating project management may contain a number of menus, report selections, drill-down analyses, and graphics. The system would enable the executive to explore what is occurring throughout all departments of the organization. Although the system may be running on a personal computer, it would most likely be tied into the corporate mainframe or minicomputer and the host database management system. This scenario is ideal for SAS software because it runs the same across multiple platforms and can operate in a cooperative or distributed processing environment.

To evaluate the success of the company's projects, the executive would have the ability to review projects in their planning or execution phase. The system would be data-driven and provide links to a spreadsheet, so the executive could perform his or her own what-if analysis. For projects under way, reports on quality, variance, resource utilization, costs, and activities in progress would all be accessible at the touch of a button. The access is made possible by the project managers who are already monitoring and updating the projects. The output they generate can be easily placed in a file for use in the EIS.

The extensibility of the system would depend on the level of the user and their need for information. A vice president of Operations may only want to scan the project's progress, while a division manager may need drill-down capability to find the person responsible for a delay in the project. Each menuing system can be customized to meet the needs of the user. Although the term EIS usually refers to executive management, the SAS System is designed to provide information delivery to everyone in the organization.

**CONCLUSION**

Project management techniques have been studied and used for more than forty years; yet recently the scope of the applications seems to have reached a new magnitude. Increasing global competition and new software technology are a few of the reasons that more industries are looking at project management to increase their productivity, reduce their costs, and improve their market position.

The SAS System and SAS/OR software in particular provide the necessary tools to support the decisions involved in managing projects at any level of an organization—from the mathematician running linear programming models to the project manager inputting project activities into a data entry system to the senior vice president investigating whether the company's projects are in line with its corporate strategies. The SAS information delivery system can make an impressionable impact on the success of organizations that realize its strengths and potential.
REFERENCES


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