

Today's Project Management Software: It's Easier Than You Think!

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ABSTRACT

Project management is an application of knowledge, skills, tools and techniques to project activities in order to meet project requirements.

This paper provides an introduction to how one can use the SAS system for the planning, controlling, and monitoring of projects. It demonstrates how a Project Manager can use different SAS Procedures for scheduling project activities, for displaying the computed schedule, for displaying the activity network and also some emphasis on decision analysis. There are several stages in the course of a project when critical decisions are made regarding the future of the project for example, forecasting resource and budget estimates, and forecasting metrics on project delivery. Decision analysis techniques can be used effectively in such situations to help make decisions under uncertainty. These procedures integrate with the SAS system so that one can easily develop a customized Project Management System.

INTRODUCTION

What is a Project..?? – It is a finite endeavour having specific start and completion dates - undertaken to create a unique product or service which brings about beneficial change or added value. A project is a carefully defined set of activities that use resources (money, people, materials, energy, space, provisions, communication, motivation, etc.) to achieve the project goals and objectives.

What is a Project Lifecycle..?? - The generally accepted project lifecycle includes five process groups, which are: initiate, plan, execute, control and close. These process groups are comprised of sub-processes, which may be repeated many times over the course of the project as required. The general flow of the process groups is illustrated in Figure 1.

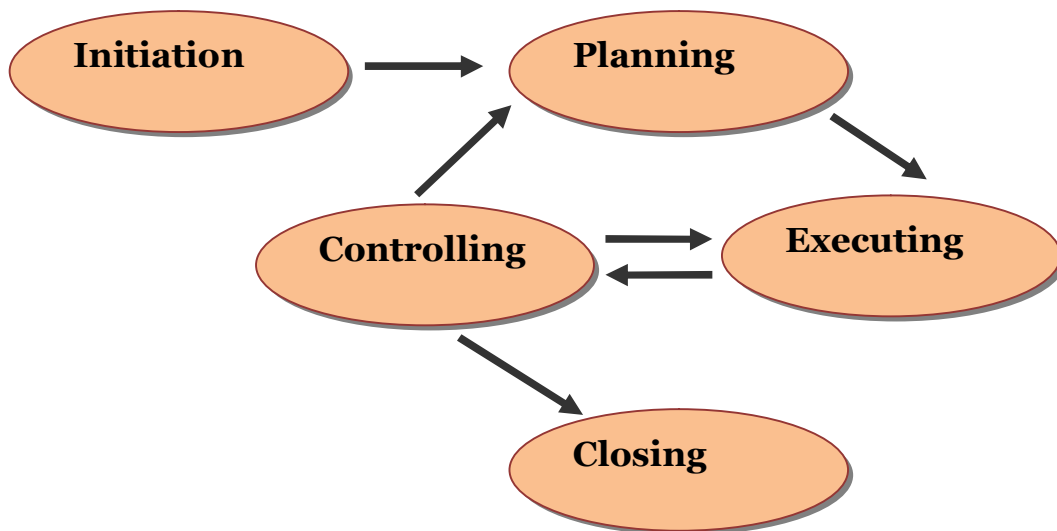


Figure 1: Project Lifecycle

What is Project management..?? – It is the discipline of planning, organizing, and managing resources to bring about the successful completion of specific project goals and objectives. The primary challenge of project management is to achieve all of the project goals and objectives while adhering to classic project constraints which are: - scope, quality, time and budget. The secondary and more ambitious challenge is to optimize the allocation and integration of inputs necessary to meet pre-defined objectives.



The Need for Project Management:

***“If you don't know where you are going, any road will take you there.
If you don't know where you are, a map won't help.”***

Many studies have shown that a significant reason for the failure of business intelligence projects is not failure of the technology, but rather inappropriate project management including lack of integration, lack of communication and lack of clear linkage to business objectives and benefits achievement. Whether you are embarking on a customer relationship management initiative, a balanced scorecard implementation, data mining project, a risk management system or other business intelligence applications, there is a large body of knowledge about what factors contributed the most to the failures of these types of initiatives. We, as an industry, need to leverage this knowledge and learn these lessons so we do not repeat them in our own projects and we need to share these lessons with our peers for the benefit of the profession. Many best practices and methodologies have evolved to help project team deal with these issues. One such methodology is the *Project Management Methodology (PMM)* using the SAS/OR® software.

This paper is designed keeping in mind the interests of both information technology professionals and business representatives. It is useful for Project Managers, Business Analysts, Developers, and Business Subject Matter Experts. This is to make them aware that SAS® Software is founded on industry best practice and is very useful in providing the link between business vision, technology and SAS deliverables.

While all SAS PMM Procedures have various applications and are very beneficial when managing a highly iterative project, the primary focus of this paper will be to explain briefly the “general purpose” and the “data flow” for each of these procedures and how SAS could be a potential ‘best fit’ solution to the project management industry.

SAS/OR software has four procedures that can be used for planning, controlling, and monitoring projects: the CPM and PM procedures for scheduling project activities subject to precedence, time, and resource constraints; the GANTT procedure for displaying the computed schedule; and the NETDRAW procedure for displaying the activity network. These procedures integrate with the SAS System so that one can easily develop a customized project management system. The PROJMAN application, a user-friendly graphical user interface included as part of SAS/OR software, is one such system. In addition to these four procedures and the Projman application, SAS/OR software also contains a procedure for decision analysis, the DTREE procedure.

SCHEDULING PROJECTS

The ***CPM procedure*** does the project scheduling and forms the core of the project management functionality. It is used for planning, controlling, and monitoring a project. A typical project consists of several activities that may have precedence and time constraints. Some of these activities may already be in progress; some of them may follow different work schedules. All of the activities may compete for scarce resources. PROC CPM enables you to schedule activities subject to all of these constraints.

PROC CPM:

- Uses activity precedence, time, and resource constraints, and holiday and calendar information to determine a feasible schedule for the project
- Enable you to define calendars and specify holidays for the different activities so that you can schedule around holidays and vacation periods
- Enable you to compute an updated schedule
- Enable you to compare the new schedule with a baseline (or target) schedule
- Helps you determine resource-constrained schedules for projects with scarce resources
- Provides variety of options to control the scheduling process
- Uses critical path method (CPM) to determine shortest completion time for the project.
- All project information is contained in SAS data sets. The input data sets used by PROC CPM are as follows:
 - The *Activity* data set contains all activity-related information such as activity name, precedence information, calendar used by the activity, progress information, baseline (or target schedule) information, resource requirements, time constraints, and any other information that you want to identify with each activity.
 - The *Resource* data set specifies resource types, resource availabilities, resource priorities, and alternate resources.
 - The *Workday* data set and the Calendar data set together enable you to specify any type of work pattern during a week and within each day of the week.
 - The *Holiday* data set enables you to associate standard holidays and vacation periods with each calendar.
- The output data sets are as follows:
 - The *Schedule* data set contains the early, late, baseline, resource-constrained, and actual schedules and any other activity-related information that is calculated.
 - The *Resource Schedule* data set contains the schedules for each resource used by an activity.
 - The *Usage* data set contains the resource usage for each of the resources used in the project.

Figure 2 illustrates all the input and output data sets that are possible with PROC CPM. In the same figure, `_ORCPM_` is the SAS macro variable defined by PROC CPM that contains a character string indicating whether or not the procedure terminated successfully. This information is useful when the procedure is one of the steps in a larger program.

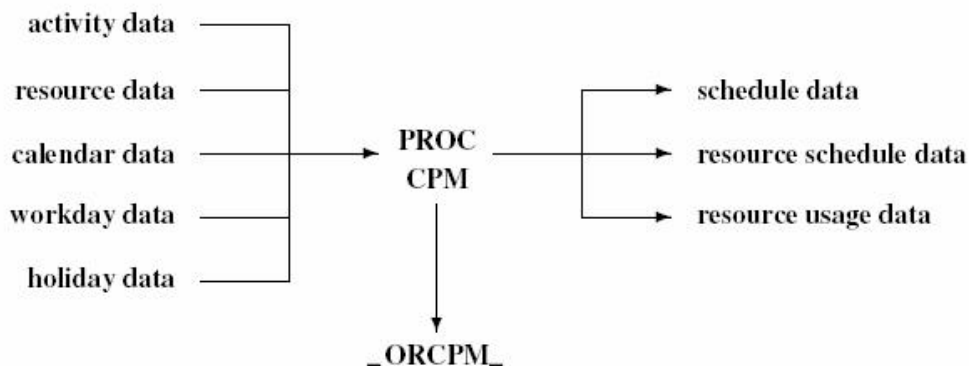


Figure 2: Input and Output Data Flow in PROC CPM

The three output data sets produced by PROC CPM contain all the information about the schedule and the resource usage; these data sets can be used as input to either PROC GANTT or PROC NETDRAW or to any of the several reporting, charting, or plotting procedures in the SAS System.

PROC PM is an interactive procedure also used for scheduling projects. The syntax and the scheduling features of PROC PM are virtually the same as those of PROC CPM. As far as the flow of data is concerned, the PM procedure supports an additional data set that can be used to save and restore preferences (*Preference* data) that control the project view.

DISPLAYING COMPUTED SCHEDULE/GANTT CHART

The **GANTT procedure** produces a Gantt chart that is a graphical scheduling tool for displaying the computed schedule. It is a bar chart that plots the tasks of a project versus time. The horizontal axis represents time, and the vertical axis represents the sequence of observations/activities in the data set. This procedure offers several options and statements for tailoring the chart to your needs.

PROC GANTT:

- Displays the early, late and actual schedules in a single bar and identify critical, supercritical, and slack activities
- Enables you to visually monitor a project in progress
- Enables you to graphically view the effects of scheduling a project subject to resource limitations, project deadlines and other important dates
- Enables you to display weekends, holidays, and multiple calendars, and you can depict milestones, reference lines, and a time-now line on the chart
- Enables you to annotate text and graphics on the Gantt chart and provides you with a wide variety of options to control and customize the graphical appearance of the chart
- Enable you to associate HTML pages with activity bars and create Web-enabled Gantt charts
- Gives you the option of displaying the Gantt chart in one of three modes: line-printer, full-screen, or graphics mode
- Provides a functionality wherein both the time and the activity axis can be plotted across more than one page
- Provides extensive labelling of the time axis, enabling you to determine easily the exact time of events plotted on the chart
- Project information is communicated into PROC GANTT using SAS data sets. The input data sets used by PROC GANTT are as follows:
 - The *Schedule*, *Workday*, *Calendar* and *Holiday* data sets can be the same as was produced by PROC CPM, or it can be created separately by a DATA step.
 - The *Label* data set contains the label information of the project that enables you to draw labelled Gantt charts independently of the SAS/GRAPH Annotate facility.
- The GANTT procedure produces one output data set.
 - The *Imagemap* data set contains the outline coordinates for the schedule bars used in the Gantt chart that can be used to generate HTML MAP tags
- `_ORGANTT` is the SAS macro variable defined by PROC GANTT that contains a character string indicating whether or not the procedure terminated successfully.

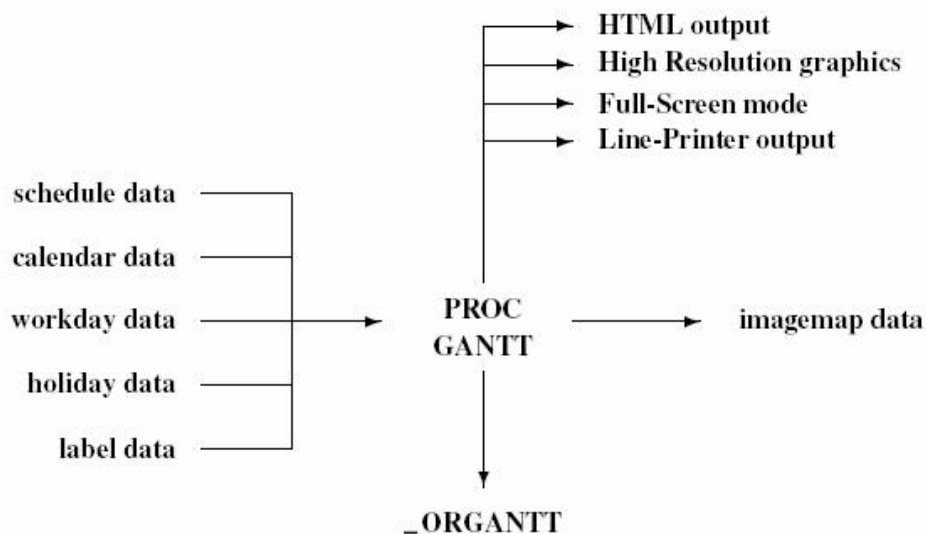


Figure 3.1: Input and Output Data Flow in PROC GANTT

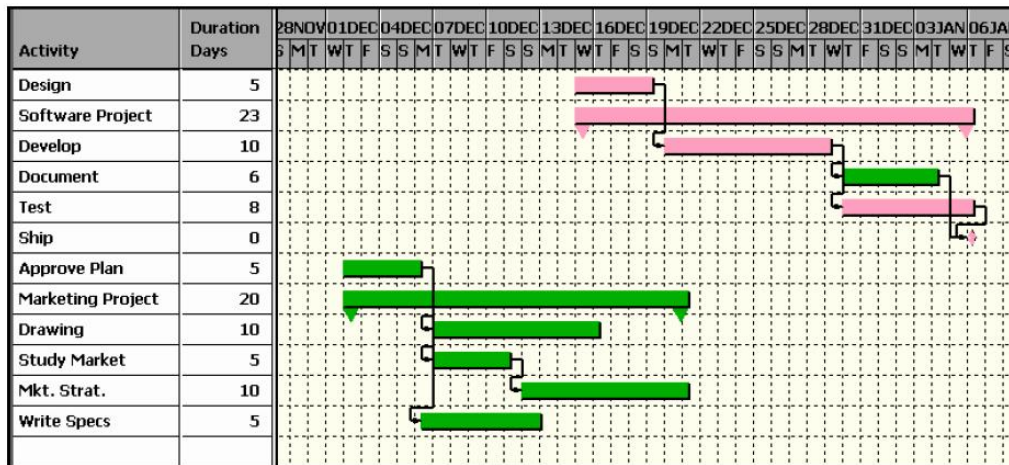


Figure 3.2: Example of a Gantt chart

ACTIVITY NETWORK

The **NETDRAW procedure** draws a network diagram of the activities in a project. Boxes (or nodes) are used to represent the activities, and lines (or arcs) are used to show the precedence relationships among the activities. The only information required by the procedure for drawing such a diagram is the name of each activity in the project (or node in the network) and a list of all its immediate successor activities (or nodes connected to it by arcs).

PROC NETDRAW:

- Useful in drawing any network (organizational chart or a software flow diagram), the network does not have to represent a project.
- Can draw the diagram in line-printer mode as well as in high resolution graphics mode
- If invoked in full-screen mode, enables you to scroll around the network to view different parts of it; in this mode, you can also modify the layout of the network by moving the nodes of the network
- Enables you to align the nodes according to any numeric variable in the network data set, not just the start and finish times
- Also draws tree diagrams. This feature can be used to draw work breakdown structures or other organizational diagrams.
- The input data sets used by PROC NETDRAW are as follows:
 - The *Network* input data set contains the precedence information, namely, the activity-successor information for all the nodes in the network which can be obtained from any one of the preceding three possible types of data sets: Activity data set that is used as input to the CPM procedure or a Schedule data set that is produced by the CPM procedure, or it can even be a Layout data set produced by the NETDRAW procedure.
- The output data sets produced by PROC NETDRAW are as follows:
 - The *Layout* output data set produced by PROC NETDRAW contains all the information about the layout of the network i.e. it contains the positions of the nodes and the arcs connecting them.
- `_ORNETDR` is the SAS macro variable defined by PROC NETDRAW which contains a character string indicating if the procedure terminated successfully.

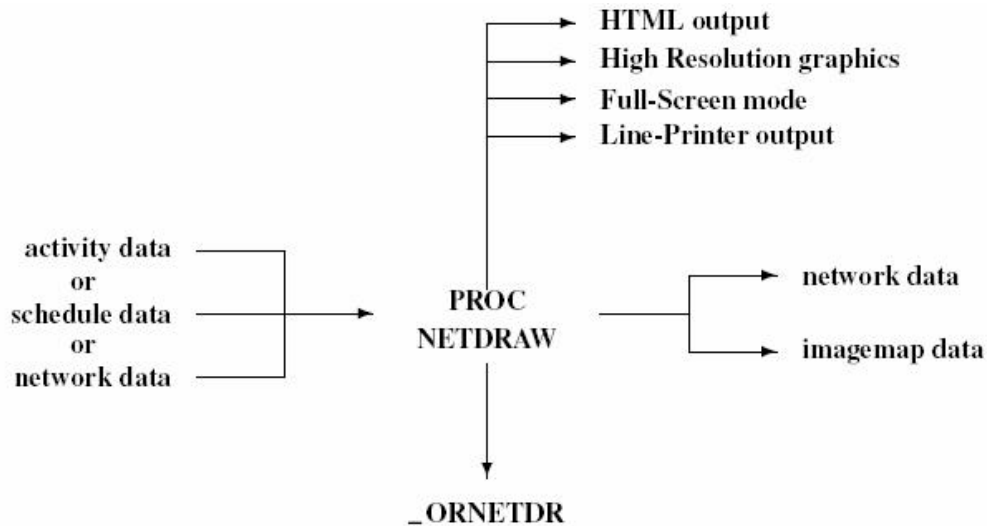


Figure 4.1: Input and Output Data Flow in PROC NETDRAW

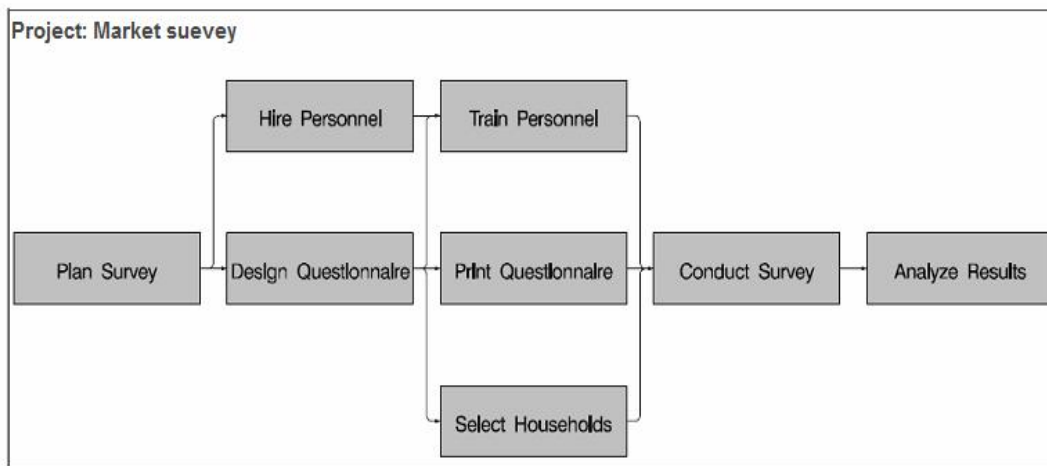


Figure 4.2: Example of a Network Diagram

DECISION ANALYSIS

Decision Analysis helps make crucial decisions at different stages of a project. In fact, the most crucial decision might be to decide at the beginning whether to embark on the project or not.

PROC DTREE:

- Interprets a decision problem represented in SAS data sets, finds the optimal decisions, and plots on a line printer or a graphics device the decision tree showing the optimal decisions.
- A decision tree contains two types of nodes: decision nodes and chance nodes.
 - A decision node represents a stage in the problem where a decision is to be made that could lead you along different paths through the tree.
 - A chance node represents a stage in the problem where some uncertain factors result in one of several possible outcomes, once again leading you to different branches of the tree, with associated probabilities.

- The structure of a decision model is given by the following input datasets:
 - The *Stage* data set specifies the name, type, and attributes of all outcomes for each stage in your model. This is the only data set that is required to produce a diagrammatic representation of your decision problem.
 - The *Probability* data set specifies the conditional probabilities for every event in your model.
 - The *Payoff* data set specifies the value of each possible scenario (sequence of outcomes).
- The DTREE procedure produces one output data set.
 - The *Imagemap* data set contains the outline coordinates for the nodes in the decision tree that can be used to generate HTML MAP tags.
- PROC DTREE uses the Output Delivery System (ODS), a SAS subsystem that provides capabilities for displaying and controlling the output from SAS procedures.

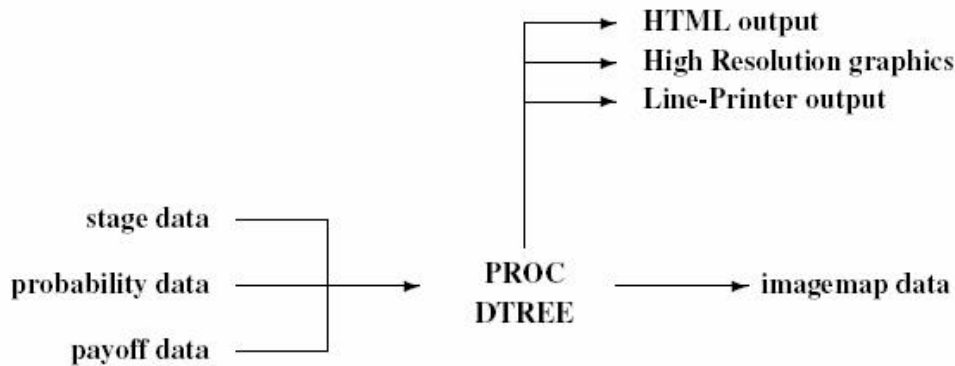


Figure 5: Input and Output Data Flow in PROC DTREE

COMMUNICATION BETWEEN PROCEDURES- PROCESS GROUPS

The data sets described in the previous sections store project information and can be used to communicate project data between the procedures in the SAS System. Figure 6 shows a typical sequence of steps in a project management system built around these procedures. Of course, this is only one possible scenario of the use of these procedures.

Further, the data flow shown in Figure 6 may represent only the first iteration in a continuous scheme for monitoring the progress of a project. As the project progresses, you may update the data sets, invoke different PROCs as required, produce updated Gantt charts and network diagrams, and thus continue monitoring the project. Thus, SAS/OR software provides four different procedures designed for performing many of the traditional project management tasks. These procedures can be combined in a variety of ways to build a customized comprehensive project management system.

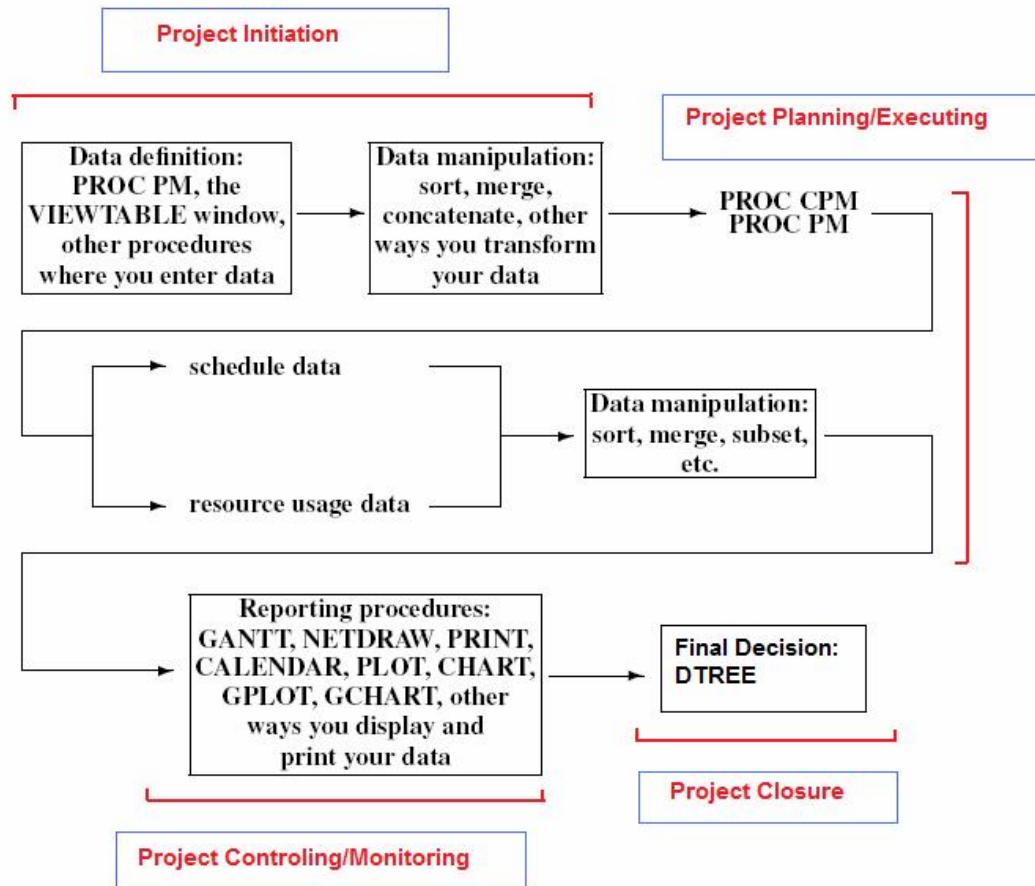


Figure 6: Using the SAS System for Project Management

PROJMAN APPLICATION

The best part of SAS/OR software is that it provides an in-built, user-friendly graphical user interface for performing various project management activities with the SAS System. Such a front-end tool provided by SAS is known as the *Projman* application.

Projman is accessed by invoking the 'Projman' command in the SAS windowing environment or by selecting Solutions->Analysis->Project Management from the primary SAS menu.

Projman:

- Already have in-built macros and programs to take care of various project management activities like scheduling, resourcing, budgeting etc. - hence less hassles of writing your own codes.
- Helps you define multiple projects in one system
- Provides a project dictionary- a convenient way to manage and store all the data sets associated with each project.
- Also provides a variety of project reports. These reports include Gantt charts, network diagrams, calendars, and tabular listings as well as resource usage and cost reports. You can modify these reports to add your own personalized reports to the application.

ADDITIONAL FEATURES

- Every company has its own set of requirements for how project data should be handled and for how costs should be accounted. The CPM, GANTT, NETDRAW, PM and DTREE procedures, together with the other reporting, summarizing, charting, and plotting procedures, are the basic building blocks that can be combined in several different ways to provide a rich environment for developing customized project management systems.
- Further, the application building tools in the SAS System can be used to cement the pieces together in a menu-driven application. You can create easy-to-use applications enabling the user to enter information continually and to obtain progress reports periodically.
- In addition to the above, you can convert Microsoft Project data to a form that is readable by the PM procedure by using the two SAS macros: MDBTOPM and MP2KTOPM. MDBTOPM converts Microsoft Project 98 data, and MP2KTOPM converts Microsoft Project 2000 data. These two macros are wrapped into the macro MSPTOSAS. The macros generate the necessary SAS data sets, determine the values of the relevant options, and invoke an instance of the PM procedure with the converted project data.
- SAS provides macros for the EVM (Earned Value Management) analysis which is one of the core analysis performed by the project management to compare the amount of work that has been completed within a project to date - to - the work that was planned, in order to measure project performance and to estimate future costs and project completion.

CONCLUSION

Why SAS for Project Management..??

By using the SAS system for managing your projects, you can add a great degree of control to projects that are seemingly full of change. Those projects will succeed that have good project management and good project management comes from good technology!

The key concept that we have discussed in this paper is that of thinking of the 5 process groups of initiating, planning, executing, controlling, and closing as repeating themselves within each iteration, version, or phase of your project. This allows you to leverage the significant experience and lessons embodied in the project management best practices while adapting to the needs of your projects.

By introducing the Project Management module, SAS is able to rapidly deliver the most intricate of complex business solutions. In this way PMM not only manages the correct delivery of the project, but also ensures that it is the correct project that is delivered.

The SAS PMM:

- Aligns your strategic vision with SAS technology
- Provides more accurate estimates of time and costs
- Supports effective resource allocation and deployment
- Ensures expectations are met on time and to budget
- Forecast future costs & revenues
- Manages and controls risk
- Limits and manages scope changes
- Provides formal communications and reporting channels
- Addresses change management, quality and acceptance issues
- Delivers business solutions more quickly and effectively
- Help you react early to issues
- Interrogate project performance and progress
- Seamless integration with industry standard project management software i.e. MS Project

The PMM comprises 500+ pages of documentation, 50+ supporting templates and various illustrations to describe- different ways in which the project management procedures can be used to define, manage, and monitor projects. It brings together the elements of Keane's methodology, PMBOK (Project Management Institute Body of Knowledge), the experiences of SAS consultants worldwide and the specialist expertise of individual SAS offices.

“The really nice thing about not planning is that failure comes as a complete surprise and is not preceded by long periods of worry and depression!”

REFERENCES

SAS online documentation (<http://support.sas.com/onlinedoc/913/docMainpage.jsp>).
SUGI Paper 30 (<http://www2.sas.com/proceedings/sugi30/109-30.pdf>)

ACKNOWLEDGEMENT

Internet search engines for finding information on project management.
Thanks to all my colleagues who provided valuable input for this presentation.
I would like to thank my Manager, Alison McDonald for reviewing the paper and Jeremy Gurney for helping me out with the creation of a customized front-end tool.

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