During the last five to seven years, most of the software development languages have improved tremendously. They have become much more powerful, capable of performing many functions, and easier to use. As a result of these excellent improvements, the number of software application systems that are being developed and used has increased noticeably. Organizations from all industries share a common goal of improving work efficiency and accuracy. Most organizations have started to take a close look at their work force, work flow, cost analysis, and many other aspects of work performance. Software application systems are being considered to assist in accomplishing this goal. PRIME system is one of these new software application systems which can be used by management consulting firms as a tool to perform this type of analysis.

PRIME system is an interactive application system developed in the PC environment using the SAS® system version 6.04. The system is developed by HAY Systems, Inc., a management consulting firm. It is used as a tool in the process of analyzing many aspects of work performance in an organization, and in evaluating the various alternative solutions to work performance problems.

HARDWARE: PRIME system was developed using an IBM® / AT-286 Personal Computer with 2 MB of expanded memory above the 640 K conventional memory. However, the recommended ideal hardware to run the system is an IBM / AT-386 personal computer with 4 MB of expanded memory above the 640 K conventional memory. The system takes full advantage of color to capabilities to display data and instructions to users. The system uses an impact printer as the standard device to display output. In addition, a laser printer and/or a plotter are also used to display some of the graphic output.

SOFTWARE: PRIME system is a PC-SAS system which uses the SAS/Base, SAS/FSP, SAS/AF, Screen Control Language (SCL), SAS Macro Language, SAS/OR, and SAS/GRAPH software. The system relies heavily on the Screen Control Language and the use of macro variables in performing many of its critical functions.

This paper will attempt to address the following topics:

1. Background information describing some of the problems faced by many organizations.
2. The first step towards solving organizational problems (the use of a tool such as PRIME system).
3. PRIME system's features and capabilities.
4. Ten steps describing how PRIME system works.
5. PRIME system's applicability and credibility.
6. PRIME system's components.
7. The kinds of data collected by PRIME system.
8. An overview of selected PRIME system modules.

While addressing these eight topics this paper will shed some light on the need for a tool like PRIME system. How PRIME system can be used. The various components of the system. The use of the SAS system to develop PRIME system. And finally what PRIME system can offer.

1. Background Information:

Today, organizations are faced with various conflicting interests, fierce competition, a strong need to utilize the latest available technology, and the necessity of minimizing costs and maximizing profits. Dealing with these various interests exerts pressure on management, and generates another set of internal problems.

Solving internal problems is the key to the success of any organization. Though the nature and significance of these internal problems varies between organizations in different industries, a common list of goals/objectives can be summarized as follows:

* Improve product quality.
* Maintain a challenged work force.
* Avoid overburdened work force.
* Improve work flow.
* Continuous job design and redesign to meet new objectives or strategies.
* Eliminate duplicate work.
* Eliminate work that does not contribute to organizational objectives.
* Maximize work efficiency.
* Constantly develop and review cost efficient organizational strategies.
* Maximize the return on technology investments.

Operating under these conditions, organizations are forced to carefully monitor their work force, work flow, and operational cost. These types of problems are similar to those facing an architect who wants to build an addition to an existing house. The architect has to consider various factors in his design of the addition such as: the strength of the existing foundation, the overall outside view of the house after the new work is completed, the functionality of the new addition, and so forth.

2. The first step towards solving organizational problems:

The problems facing an architect who is trying to design an addition to an existing house resemble those problems faced by any organization that is attempting to reorganize. The similarity is what is needed to deal with these problems. Both organizations and architects need some form of detailed documentation that describes the existing conditions and can be used in the design/reorganization process. The architect needs a full set of blueprints showing the existing structure and foundations in order to ensure that the new addition will be supported properly. An organization needs a set of detailed reports and charts showing the existing work flow, cost figures, an indication of the value of the work being performed, etc. This set of detailed reports and charts will be the vehicle used by the organization during the process of reorganizing.

Developing a set of reports and charts manually is not only time consuming but also very inflexible. These reports will be used in analyzing the existing work structure, and will have to be reproduced several times during the process of evaluating and selecting the proper direction for reorganization. The need for a computerized system to be used by the reorganization team is not only apparent, but also significant to the process of evaluating and analyzing the work structure of any organization.

PRIME system offers a tool to be used by management consulting firms. It facilitates many aspects of the process of analyzing work performance.

3. PRIME system's features and capabilities:

In the process of designing and developing PRIME system, several powerful features and capabilities were built in to increase the functionality and applicability of the system. Some of these features are:

- It's portability. Probably the most important feature of PRIME system is its portability. The system was developed in the PC environment using the SAS system version 6.04. Because of the introduction version 6.06 of the SAS system for the mainframe and VAX environments, it will be possible to upload the PRIME system code to either the mainframe or the VAX environment. Minor modifications will obviously be required such as: converting SAS data sets and catalogs, and changing library and file references.

- It's file structure design. The second most important feature of the system is its file structure design. The system uses pointer files to link various other data files together. This efficient design saves disk space and totally eliminates the storage of any duplicate variables. A more closer look at the system file structure will be presented in the discussion of topic 6.

- Its use of the SAS SCL Language. The system relies very heavily on the use of compiled SCL code to perform all of the conditional branching and execution of various SCL submit blocks. The submit blocks contain SAS code which perform all data manipulation and processing. The SAS SCL code is also used extensively behind most of the FSP customized screens. As a result, it was possible to add new capabilities to FSEDIT sessions that were not available in the FSP software, such as: preventing the user from adding a new observation, and requiring data in screen variables even if an observation was not added during the current session. A more detailed discussion of the new capabilities is included in topic 8.

- It's use of the SAS macro language. The SAS macro language is also used to pass information between AF panels, FSP screens, and the user inputs and requirements. Twelve macro variables (WORK1-WORK12) are defined as global macro variables at the beginning of the system, and used repeatedly to transfer information and flags between the various components and modules of the system. The macro variables are cleared by the SCL code or the SAS code before being used. Limiting the use of macro variables to those twelve global variables is adopted as a means of reducing memory requirements.

The use of global macro variables. A global macro variable called COMPANY is used in addition to the twelve global macro variables. This variable contains the name of the project or company that is selected by the user. In addition, the value stored in the COMPANY macro variable is also used as a first level name (Libname) for all SAS data sets which are pertinent to the project or company being analyzed.
The security levels built into the system to assure data integrity. Figure 1 shows the general skeleton of PRIME system. The users have to log on to the system by typing the work "PRIME" then entering their last names and passwords. The system is managed by an assigned system administrator. The system administrator is responsible for giving users access to PRIME system. More importantly, only the system administrator can perform the most critical system functions such as: delete projects (or companies), edit industry data, and edit users passwords. These critical functions can be performed from the systems administrator menu (see figure 1). As a second level of security, the system administrator has a second password to give him or her access to the system administrator menu.

Companies or organizations are grouped by industry. Such as: Engineering, Insurance, Manufacturing, and so on. PRIME system maintains a set of high level functions for various industries. Every high level function has its own set of sub-functions, which is also maintained by PRIME system. Functions and sub-functions can be browsed, edited, and deleted. The industries maintained by PRIME system can be browsed, edited, and deleted as well.

Storing SAS data sets in subdirectories. Every organization studied using PRIME system has its own subdirectory, where SAS data sets are stored. At the beginning of a new organization study, the system is used to define the organization (or company). At that time, PRIME system creates a new subdirectory to store all the SAS data sets pertinent to the company. At the end of the study, only the system administrator can delete the company and all the SAS data sets by simply selecting option 2 from the system administrator menu (see figure 1). This is accomplished by using the SAS command X to issue DOS commands to create subdirectories, delete files, and remove subdirectories: PRIME system does not require maintenance by a SAS programmer. It handles its own files and subdirectories.

PRIME system does not have limitations that will impair its applicability. For instance, there is no limit in the number of companies or projects being analyzed by the system at any time. The PC hard disk space is the only limit. Also, PRIME system does not impose any limitations on the number of high level functions or the number of sub-functions that describe an industry.

PRIME system performs all required housekeeping activities immediately after completing any function, process, or module. These activities primarily include deleting any temporary work SAS data sets and clearing macro variables. These activities reduces the amount of work space required by the SAS system, and accelerates the execution of the system modules.

The consistency of using colors in has facilitated the functionality of the system. For instance, all PRIME system main menus use a blue background. Most of the other second or third level menus use black backgrounds. This consistency in the use of color facilitates the training and use of the system.

The use of SAS AF. PRIME system menus are actually AF program entries. The use of program entries to operate as menus provides more control and enables the system to perform other activities behind the scene. Additionally, the use of AF program entries within PRIME system AF catalog made the F10 key the only key needed to invoke an option or leave a panel. This design is preferable over mixing AF program and menu entries, where users have to use the F10 key in program entries, and the ENTER key in menu entries.

Allowing user to select a new or existing project. All main menus display the name of the selected project or company to continuously remind the user of the project name.

A few of the features and capabilities of PRIME system in terms of conducting a work performance analysis are:

- The system is capable of performing many types of organizational and functional analyses. As discussed before, every industry has a set of high level functions and a set of sub-functions for every high level function. At a lower level, every organization performs many activities that should contribute to the achievement of these sets of functions and sub-functions. For instance, most engineering firms share a set of high level functions such as: Design, Review, and Implementation. Additionally, every function is detailed by a set of sub-functions. This type of information is stored in PRIME system under the Engineering industry. When there is a requirement to perform a work performance analysis for an engineering firm, or for one division of a large engineering firm, the Engineering industry will be used to describe the project. All the work performed in the engineering firm is viewed as activities. The activity data is easily entered into PRIME system in a very organized fashion.

Before activity data is entered, PRIME system will prompt the user for two identifying Data elements:

1. Name of the employee performing the activity. The name is selected via an FSEDIT screen that displays all employees working in the engineering firm.
1. A high level function and sub-function which are contributed to by the performance of the activity.

The following is some of PRIME system's reporting capabilities:

- PRIME system produces many reports and charts. Some reports track all of the activities supporting every possible combination of function and sub-function. Other reports show the various functions and sub-functions for every industry maintained by the system.

- Every activity that takes place will logically have some input and some output. Inputs usually include requests for the activity output, or requirements to perform the activity. Output includes the outcome of performing the activity. PRIME system collects this type of information for every activity, and produces various reports showing work flow. These reports show input, activity, and output information.

- A significant feature of PRIME system is its ability to collect cost information, compute and generate various cost reports which are crucial to performing any cost analysis. These reports track the cost for every activity, and all activities contributing to every function and sub-function. All the cost reports break down the activities by their value to the overall organization. Activity values can be critical, essential, nonessential, or optional. Additionally, cost reports can also be produced to show total cost of performing work in every organizational entity, such as divisions, departments, groups, and units.

- PRIME system is also capable of performing cognitive requirements analysis for jobs in the organizations. Cognitive requirements reports are also available and used extensively in any reorganizing process. In addition, PRIME system can measure, compare, and report the competency level for employees and jobs. This type of analysis is needed to reassign employees to different positions were they will not be overburdened or underchallenged.

4. Ten steps describing how PRIME system works:

   The following ten steps briefly describe the process of using PRIME system in performing work performance analysis.

Step 1: Define high level functions and sub-functions:

   In this step, the management consultants meet with the organizational high level management to define and review a list of high level functions and sub-functions that describes the organization objectives. The project is added to PRIME system as a new company. General information about the company is entered into the system, as well as linking the company with the proper industry which contains the revised sets of functions and sub-functions.

Step 2: Define organizational structure:

   PRIME system is capable of analyzing four levels of any organizational structure. For instance, the system views the structure of any organization as a group of divisions. Every division consists of various departments. Every department consists of a number of groups. And finally, every group consists of a number of units. In this step, the organization tree is defined and entered into the system.

Step 3: Create an employee data set:

   Employee data are collected and entered into the system. The data collected include the location or organizational entity (Division, Department, Group, Unit) where each employee works.

Step 4: Interview a group of employees:

   A group of employees are selected to describe the work or activities performed in their organizational entities. It is important to cover the work performed under all high level functions. A series of interviews are conducted to collect data describing the activities, inputs, and outputs.

Step 5: Data entry and reports generation process:

   The data collected are then entered into PRIME system. A set of initial reports are then produced and analyzed.

Step 6: Detailed analysis to Identify problem areas:

   A more detailed analysis of the initial reports is performed. The purpose of this analysis is to identify problem areas. Consultants will be looking for problems such as: duplicate work being performed in various divisions, extremely high cost activities, and non-value added activities.

Step 7: Detailed review of reports by the organization:

   The produced reports are then presented to the organization to be reviewed, along with the potential problems identified by the consultants.

Step 8: Identify alternative solutions:

   During several meetings, consultants assist the organization in analyzing the reports, identifying problems, and determining alternative solutions.
Step 9: Analyze alternative solutions:

PRIME system is then used by consultants to analyze alternative solutions. These solutions vary between merging divisions, reassigning employees to different positions, merging or eliminating activities, and many others. All possible scenarios can be analyzed through the extensive editing capabilities offered by PRIME system. Reports will be produced repeatedly during this process.

Step 10: Select the best solution:

During a series of meetings, the organization with the consultants' assistance will be able to select the best solution. More reports may have to be produced during this step.

5. PRIME system's credibility:

PRIME system is currently being used in a two million dollar project to conduct work performance analysis for several bureaus at the State Department. In addition, work has already begun in a project for American Express to conduct work performance analysis where PRIME system will be the main tool. The system is also being used in performing various competency analyses for the U.S. Air Force. Enhancements are constantly being added to the system because of these applications. Various major enhancements are planned for future implementations.

6. PRIME system's components:

The system code resides in a DOS subdirectory called PRIME. Under this subdirectory, the following files and subdirectories reside:

- A DOS batch file, PRIME.BAT, is used to invoke the SAS system and start PRIME.
- A SAS config file is used by PRIME system to specify the following: The name of the autoexec file used by PRIME. Global configuration options. And the name of a news file used by PRIME.
- A SAS autoexec file. This file contains SAS statements which set global options, define global macro variables, and call the PRIME system logon screen.
- DATALIB subdirectory. Under this subdirectory, the following system data sets are stored:
  - CMPNYDIR.SSD
  - USERS.SSD
  - INDSTKEY.SSD
  - FUNCTION.SSD
  - MAJORACT.SSD
- AFLIB subdirectory. Two SAS/AF catalogs and one SAS/FSP catalog reside in this subdirectory. A total of 121 AF program entries, and 52 FSP customized screens, are stored in these three catalogs:
  - PRIMEAF.SCT
  - MCBER.SCT
  - FSPSCRNS.SCT
- CODE subdirectory. Various SAS programs are stored under this subdirectory. These programs are included by PRIME system to perform various functions; primarily to produce reports.

7. The kinds of data collected by PRIME system:

The system collects various types of data. For example, the data collected about the employees working for the organization being studied include:

- Employee ID number (Social Security Number).
- Full name of employee.
- Position title and description.
- Bureau of labor statistics code describing the position.
- Age and sex of employees.
- Salaries and overhead multiplier for every employee.
- Educational background.

Other types of data collected by PRIME system include:

- Function and sub-function data.
- Activity data.
- Input and output data.
- Value of every activity to the overall organization.
- Organizational structure. Names of divisions, departments, groups, and units.
- Number of technical and support people in every division, department, group, and unit.
8. An overview of selected PRIME system modules:

In this topic, two PRIME system modules will be briefly discussed to show some of the PRIME system capabilities, as well as the SAS system applicabilities.

Edit activity descriptions (rearrange) module:

This module is an option in the activity management menu. As explained before, PRIME system maintains several kinds of data for every activity. The activity data, input data, output data, and the activity description data. The activity description data consists of:

- Employee ID who is performing the work.
- The name of function and sub-function to which the activity work is contributing to.
- The name of the activity.

As explained previously, most solutions for organizational problems include some form of reorganization. The process of reorganizing usually involves reassigning employees to other organizational entities, changing the job responsibilities for some employees, or consolidating jobs. Accomplishing all these possible scenarios is achievable as follows:

- The user can assign an existing activity to a different employee who works either in the same organizational entity, or at a different organizational entity.
- The user can also change the name (description of work) of any existing activity.
- And finally, the user can reassign employees to different organizational entities by simply editing the personnel file through PRIME system.

Adding a new activity:

After the user has entered the activity description, the system will be ready to store the activity data. A customized FSEDIT screen is used to collect the data. Since the user is allowed to enter activity data for only one activity that matches the provided description, SAS/SCL code is used behind the FSEDIT screen to prevent the user from adding a second observation. This feature is not available in FSEDIT, and is accomplished by using the SAS/SCL WORD function to return the command entered by the user at the command line. If the user entered the ADD command, a message is displayed and all the erroron flags for all screen variables are set to prevent the user from adding an observation. The SCL code is as follows:

```bash
user_cmd = upcase(word(1));
if user_cmd = 'ADD' then
do;
_msg_ =
"" YOU CAN NOT ADD ""
erroron = _all_
.call sound (600, 450)
end;
```

This paper has attempted to demonstrate to SAS users an example of a PC/SAS application system. PRIME system is a successful application that utilizes the powerful features of the SAS system.

REFERENCES:

   * SAS is a registered trademark of SAS Institute, Inc.
   * IBM is a registered trademark of International Business Machine.

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