

TVA WorkForcePlanner (WFP): A Case Study of the Iterative Development Methodology

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ABSTRACT

The purpose of this paper is to illustrate the effectiveness of the iterative development methodology using an actual enterprise-wide application. The importance of a partnership between client and developer when creating an application such as this will also be discussed.

The Tennessee Valley Authority (TVA) had an immediate need for a workforce planning system which would allow users to enter and analyze human resource forecasts. TVA, working in conjunction with SAS Consulting Services Inc. (SCS), used the iterative development methodology to create and implement version 1.0 of the WorkForcePlanner (WFP) system within six weeks. The iterative development approach allowed TVA/SCS to continue to create additional WFP modules at the same time the initial version was being used to enter forecast data. Since March 1993, subsequent system iterations have introduced new enhancements and modules to the application.

INTRODUCTION

TVA is a federal utility which serves seven southeastern states in the Tennessee Valley region. The utility employs a staff of 18,000-plus at corporate offices, nuclear, fossil, and hydro plants around the Valley. In 1993, after several years of downsizing, TVA implemented a formal workforce planning initiative.

As TVA developed a workforce planning process, it became apparent that a decision support system would be necessary. Workforce demographics information, such as average age of employees, numbers of employees in various occupations, numbers of potential retirees, and diversity statistics would be needed to make decisions about the TVA workforce. While workforce demographics information existed in various TVA information systems, it was not readily ac-

cessible. The original concept of the WFP application was to put workforce demographics information at the manager's fingertips.

After careful consideration of existing data and hardware, TVA chose to develop WFP for the mainframe environment for the following reasons:

- Most existing TVA workstations had mainframe access, not all were personal computers
- TVA wide area network was not yet completed
- TVA workforce demographics information resided on the mainframe in various information systems
- Many users would be accessing the system from remote locations and a mainframe application would be much easier to trouble shoot

TVA chose to develop WFP in SAS for the following reasons:

- Rapid prototyping capability
- Ability to access information in many file types
- Ability to develop a user-friendly, PC-like application
- Portability, making it easy to move the application from a mainframe environment to a distributed environment

TVA developed the original WFP prototype using SAS/AF[®] software and SAS/SCL[®] software. This prototype consisted of a main menu, a selection box which allowed the user to pick a particular TVA organization, and a set of screens that displayed information such

as the number of employees in the organization, average age of employees, number of employees by occupation, potential retirees, and numbers of veterans, women and minorities. A file containing the data for the application was extracted in batch each night from the TVA Human Resource Information System and Retirement System data bases.

The original WFP prototype was beta tested by managers for ease of use and type of information displayed. Appropriate changes were made before WFP was released and this application was well received by users.

As the workforce planning initiative evolved, the capability to enter, roll-up, and analyze the human resource forecasts in a standard format became a necessity. Managers also needed the capability to print reports from the WFP application. After determining there were no in-house resources available to enhance WFP, TVA chose SCS to develop the WFP planning and reporting modules for the following reasons:

- Rapid development (6 weeks)
- Flexibility to implement portions of the modules in conjunction with the workforce planning cycle, while additional development continued
- Consultants who could work as partners with TVA staff

THE ITERATIVE APPROACH

The traditional approach to application development has been for the client to give the developer a series of specifications and instructions that describe system requirements. Next, the developer conducts the necessary analysis on the project, generates the screens and programs, and delivers the system. In between, there is generally very little communication between the parties, especially in regard to how the finished product will look. Changes are not easily made due to strict adherence to the original client specifications.

The alternative to this process is the iterative development methodology or rapid prototyping. This places a version of the application in the client's hands as soon as possible, and delivers the application in usable modules to encourage client feedback while development on other modules continues. This paper will demonstrate how this approach to system development was successful in an actual application.

SCS regularly uses the iterative approach to application development. Using this approach allows SCS to deliver a prototype of an application within weeks after the initial specifications are defined. The client then has an idea of how the application will look early in the development process and any necessary changes can be identified before much work is completed.

While the client is reviewing the prototype, development on additional modules can continue as well as enhancements on the initial prototype. The client can provide feedback on the prototype and desired changes can be incorporated into the subsequent version of the application. When the second iteration of the system is delivered, it contains revised and functional copies of the initial screens and programs, as well as new modules to be reviewed.

RELATIONSHIP BETWEEN TVA AND SCS

The iterative approach to application development also emphasizes the relationship between client and developer. Communication between the two becomes part of the development process, including client feedback on new prototypes, notification of new or unforeseen needs of the clients, and discussion of design ideas as development progresses. This type of relationship between TVA and SCS has helped tremendously during the development of the WFP application. It has facilitated changes to specifications, priority lists, implementation, and problem solving throughout the development process.

The partnership between TVA and SCS was most evident at a series of continuous improvement meetings in April 1994, where SCS consultants were introduced not as outside consultants, but as an extension of the workforce planning staff. These meetings, along with a similar one held in July 1993, helped SCS in two ways. First, they received first-hand feedback from users of the application they developed, including a number of suggestions for enhancements. A number of these suggestions from the 1993 meeting were implemented between July 1993 and March 1994. Second, SCS was able to see how the application and the entered data are used, how the entire workforce planning process flows, and how the WFP application fits into that process. This understanding has been helpful in developing the later modules of the WFP system.

EVOLUTION OF THE WFP APPLICATION

The iterative methodology meshed well with TVA's needs. TVA had a deadline for entering the 5-year

human resource forecasts and needed the screens within six weeks of the beginning of development. The original SCS prototype included the screens and programs necessary for TVA to view and edit the 5-year forecasts, the estimated number of available personnel for each of those five years, and the jobs and departments where they would have gaps or surpluses in personnel for those years. These were developed using Base SAS® software, SAS/AF® software and SAS/FSP® software.

The initial prototype also included two different screens to view/edit forecast data using two methods of data entry/modification. This allowed TVA to see both screens and choose the one they were more comfortable with. Once this feedback was relayed to SCS, they were able to continue development on only the module chosen by TVA. TVA began using these screens immediately to enter the human resource forecasts.

The next system module needed by TVA was reporting. This module would generate reports showing the forecasts and the resulting personnel gaps and surpluses. There were also some changes to the prototype screens and programs. The enhancements and the new printing module were delivered for TVA's review within six to eight weeks after the first version was implemented. At this writing, seven iterations of the WFP application have been delivered since March 1993, with additional modules to be developed during 1994. In addition, the prototype of a new module in the application for displaying and reporting TVA diversity information was delivered in June 1994.

Along with the major releases of the application delivered since March 1993, there have been numerous quick changes made when a member of TVA's workforce planning staff would request a minor but immediate change to a module. In many cases, the open communication between client and developer allowed these requests to be fulfilled quickly, often during the phone call to make the request.

CONTINUOUS IMPROVEMENT OF THE WFP APPLICATION

The TVA workforce planning staff facilitates WFP continuous improvement meetings around the Valley each year. All WFP users are invited to attend these meetings to contribute ideas for WFP enhancements. SCS consultants are involved, as mentioned earlier in this paper. At the conclusion of these meetings, all ideas are compiled and sent to attendees for input on priorities.

After WFP priorities are set, TVA and SCS work to-

gether to finalize the enhancement schedule. The WFP enhancements are scheduled for completion before the next annual workforce planning cycle. The prioritized enhancement list and schedule is then sent to those who participated in the continuous improvement meetings. This acknowledges user input and produces a system which meets the users' changing needs.

LESSONS LEARNED

The iterative process and a good client/developer relationship allow much 'on the fly' development to occur. However, there are some issues to consider when this type of environment exists. Some examples are:

- It is important to ensure that the client and developer are working with the same version and maintenance release of the SAS software. If system problems occur for the client but not the developer, the software releases or versions may not be identical.
- Make sure all of the proper file accesses have been addressed on any platform (RACF® on the mainframe, network file access on PC or UNIX®). If not, file updates may not be saved.
- Making quick changes sometimes involves commenting existing statements. Be sure not to comment any statements that are vital to the program. In SAS, remember that PL/1-style comments can exist within a commented line beginning with an asterisk (*). If the slash (/) at the beginning of this style of comment is accidentally replaced with an asterisk, the first necessary statement will become part of that comment and not be executed.
- If the developer has had the client turn on the SAS/SCL Debugger to find and correct a problem in a program, be sure to have the client turn the Debugger off before compiling the program for the last time. Otherwise, the user may find a screen that is quite different from what was expected.

CONCLUSION

TVA and SCS together have been able to adapt the WFP application to meet the changing needs of the workforce planning process as it has evolved. This is largely due to the flexibility inherent in the iterative methodology and the unique partnership formed between client and developer. This partnership has been instrumental in the development and success of this application.

REFERENCES

Staff of SAS Consulting Services Inc., Rockville, MD (1994), "A Development Environment for Applications Based on SAS Software." Proceedings of the Nineteenth Annual SAS Users Group International Conference, 19.

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