BUSINESS PROCESS REENGINEERING:
A CONSORTIUM APPROACH
WITH END USERS AS THE ARCHITECT
PRODUCES DRAMATIC RESULTS

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ABSTRACT
Business process reengineering teamed with technology produces dramatic results. Legacy software is transformed into systems, architecturally designed by users. Learn how eight Florida community colleges, which are very diverse, combine fiscal and human resources, through a consortium and vendor partnership, to develop mission critical applications.

The Consortium in partnership with Software AG is using a Rapid Application Development (RAD) methodology to concurrently develop integrated Finance, Student Information, Personnel/Payroll, and Facilities systems. Specialized design teams combine the end user architect with Consortium and Software AG system design experts. These baseline applications will be stored in a central repository and maintained by consortium teams.
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FLORIDA COMMUNITY COLLEGE SOFTWARE CONSORTIUM
I. INTRODUCTION

A. EXISTING SITUATION

The 1990s present a variety of critical challenges to all institutions of higher education. Legislated mandates from both the State and Federal governments arrive with increasing frequency. At the same time, funding from both sources to implement these mandates is shrinking. The demographics of the student population is changing dramatically as a decrease in the number of traditional students is offset by an increase in non-traditional learners.

As a result, most community colleges have been forced to find even more cost-effective ways of doing business. In this rapidly changing and increasingly complex environment, we have come to rely on automated systems to support management decision making and to provide improved student services.

Not only are new systems required, but a new way of developing and maintaining systems is required if the Consortium is to meet the pressing challenges of today's higher education environment. Several factors make this so:

-- Current software systems are in place, stable, and functional, but are nearing the end of their life cycles. They are written in languages using design features that are out-of-date and make maintenance complex.

-- Most of these applications either do not fully meet current requirements, or do not exist at all.

-- Although many requirements are common to all the members of the consortium, each member currently develops and maintains its own systems.

-- The time and cost to develop new systems is excessive.

B. CONSORTIUM HISTORY

The 1994 State Legislature appropriated $4.25 million to enable the community colleges and the Division of Community Colleges in the Florida Department of Education to begin compliance with 1987 proviso language requiring the planning and designing of student, personnel, and financial data bases. The appropriation emphasizes and rewards sharing of development activities.

As a response to the Legislature, eight of the twenty-eight Florida community colleges formed the Florida Community College Software Consortium (hereafter known as FCCSC or Consortium) to work collaboratively to develop the four mission critical applications of Financial Management, Student Information, Personnel/Payroll, and Facilities.

The organizational base for the FCCSC is that each of the member colleges has in its software inventory common software products. The FCCSC's common inventory of Software AG (hereafter known as SAG) products allows the member colleges to work in a collaborative atmosphere to meet State mandates.

The decision the FCCSC had to make was whether to purchase a packaged system or develop new systems. Each member college agreed that it wanted systems which would meet State, Federal, and College requirements, but also systems written with tools that could be easily managed, changed and enhanced by the colleges in the future. Existing packages did not meet all of the above requirements. As each college owned SAG products, it was decided the systems should use these tools to develop the new systems.

The participating community colleges are Broward CC, with 26,151 students;
Edison CC, with 9,736 students; Florida CC at Jacksonville, with 21,840 students; Indian River CC, with 12,511 students; Miami-Dade CC, with 47,060 students; Okaloosa-Walton CC, with 6,547 students; Palm Beach CC, with 19,022 students; and Tallahassee CC, with 9,902 students (October 1994 Headcount). Together, the full-time equivalent (FTE) of these eight community colleges represents 47.8% of the FTE of the Florida community college students. The logistics of the project are difficult as the distance between the colleges varies, i.e., Okaloosa-Walton CC to Miami-Dade CC is about 609 miles while Miami-Dade to Broward CC is about 22 miles. The fact that colleges, so very different in size and located geographically far apart, voluntarily choose to work together on such a large project is in and of itself significant.

C. WHY FORM THE CONSORTIUM? . . . THE BENEFITS

This diverse group of colleges formed the consortium for the following reasons:

* Meet state data base requirements. When state level data is in integrated data bases, it is absolutely necessary for the colleges to have easily accessible and modifiable integrated data for planning.
* Provide long term solutions. Each college could apply a "band-aid" to meet current state mandates, but this would not help meet additional requirements in the future.
* Develop integrated mission critical applications. Colleges must have integrated data for planning and reporting.
* Gain rewards for sharing development:
  -- Attain project management expertise. It is needed because the Software AG tools and RAD methodology were new for all the member colleges.
  -- Build consensus from consortium business expertise. The knowledge gained from a team is greater than from an individual college.
  -- Increase technical staff expertise. As Software AG tools are new, the technical staff of the colleges gain expertise from working in the Consortium.
  -- Gain cooperative support for future enhancements. The sharing of knowledge and resources will help with future enhancements or modifications.

D. HOW WAS THE CONSORTIUM FORMED?

* College leaders worked with legislators for funding.
* College leaders encouraged other colleges for support and participation.
* College leaders met to formalize the agreement and to develop the plan.
* College leaders agreed to form a vendor partnership to provide management expertise.

II. PROJECT SCOPE

The Florida Community College Software Consortium is seeking to enhance four mission critical systems as a first step in addressing the critical challenges. These Administrative Systems under development between February 1995 and January 1997 include Personnel/Payroll, Student Information, Financial Management, and Facilities.

* Personnel/Payroll includes: Applicant Tracking, Demographics, Job assignments, Benefits, Position Accounting, Payroll, Time Accounting, FTE Accounting, Data Base Transmission, and the General Interface.
* Student Information includes: Admissions, Registration, Records, Curriculum, Fees & Tuition, Degree Audit, Data Base Transmission, and the General Interface.
* Facilities includes: Inventory, Scheduling, Data Base Transmission, and the General Interface.

The software tools used to develop the applications are NATURAL, CONSTRUCT, and PREDICT. The data base of choice is ADABAS. Other data bases may be used provided that the version of NATURAL employed provides an ADABAS view of the data and supports most ADABAS data functionality. The systems being developed are being tested on the MVS, VSE, and AS/400 platforms.

III. PROJECT ADMINISTRATION

Developing four baseline applications is a complex task being carried out over a two-year period. In order to make sure that the desired results are obtained within the time frame and budget specified, a carefully structured business plan was implemented. The following section describes the major steps that were necessary to achieve the results described in this proposal.

1. **Created Executive Committee**
   An Executive Committee was formed with one member from each college, as appointed by the Presidents of the respective colleges.

   The Executive Committee is responsible for:
   * Reviewing business plans.
   * Setting priorities and directions.
   * Developing Consortium project plan.
   * Assigning appropriate personnel to teams.
   * Overall administration and supervision of the Consortium.

   The chair is responsible for coordinating all Executive Committee activities. The fiscal agent is responsible for handling all financial aspects of the Project, including all required reporting. The Executive Committee hired a Project Director who shall assume day-to-day responsibility for refining and implementing the overall systems development plan. The Committee meets regularly to review project progress, provide guidance, and help resolve issues. Committee members represent the interests of their respective colleges in obtaining the goals of the consortium. The Committee approves all expenditures of funds prior to disbursement by the fiscal agent.

2. **Selected a Technical Committee**
   The Executive Committee established a Technical Committee with one representative from each college. The responsibilities of this committee are to provide technical expertise and support for the Executive Committee and to act as direct liaison with the Project Director.

3. **Selected End User Representatives**
   The Executive Committee selected a group of end user representatives to serve as functional analysts for each application. One representative and approved participants was selected from each member institution for each application or component of an application.

   The functional analysts shall provide information about State, Federal, and Consortium requirements for each application. They shall work with Consortium
and Software AG technical experts to design systems which meet all of the above. The functional analysts, who are the users, have the primary responsibility for ensuring that the finished systems meet desired goals. They are the ARCHITECT of the software.

4. **Developed Final Project Plan**
The Executive Committee has developed a high level Project Plan. This plan defines the major components of each application, establishes development priorities, and schedules major project milestones and deliverables. This plan provides organizational guidance for the production of the project.

5. **Established Electronic Connection**
In order to assure action and complete participation in project development, each consortium member college is electronically connected with a minimum speed of 56KB. Connectivity also results in major savings through reduced travel. Consortium development is being accomplished using the computer facility at Miami-Dade Community College.

6. **Rapid Application Development (RAD)**
The Consortium selected RAD as the development methodology of choice. "RAD (Rapid Application Development) refers to a development lifecycle designed to give much faster development and higher-quality results than those achieved with the traditional lifecycle." James Martin, _Rapid Application Development_.

7. **Created RAD Teams**
Consortium and Software AG system design experts are assigned to work with each group of functional analysts, users. Software AG staff is thoroughly familiar with the techniques of RAD. Each RAD team combines extensive knowledge of the application, provided by the functional analysts, with strong technical expertise of the system design experts. This ensures that the final systems are technically sound, meet user requirements, and can be modified and maintained for the future.

8. **Held Joint Requirement Planning Sessions**
The first task for each RAD team was to participate in a Joint Requirement Planning session. This session was coordinated by a Software AG project manager. The objectives of this session included:

* Defining the scope of the project (defining what was to be accomplished).
* Defining high level system requirements.
* Developing an application "build plan".

All of the above was reviewed and approved by the Technical Committee. During this stage, Software AG conducted FASTRACK training sessions to facilitate the prototype development and to train Consortium technical staff.

**STEPS 9 THRU 13 ARE IN THE FINAL PHASES OF COMPLETION.**

9. **Hold Joint Application Design Sessions (JAD)**
JAD sessions are held for each of the major application areas. The purpose of these sessions is to further refine the requirements begun during the Joint Requirement Planning sessions. During these sessions, functional analysts, working under the guidance of Software AG experts, define the data each application needs to capture. Relationships between data are explored and clarified. The relationships and flow of information among organizational units within each college is defined so that relationships among applications are understood.

The first JAD session for each application area lasts about five days and includes the development of the following:

* Entity Relationship Diagrams, showing what information needs to be collected and how it is related to other information.
10. **Develop Application Prototypes**
JAD sessions produce sufficient data about each application to enable Consortium and Software AG technical staff to quickly develop system prototypes. Software AG technical staff have certain assigned responsibilities for developing applications and management. Application prototypes are built quickly, incorporating only high level requirements as the goal of this first round of prototyping is to ensure that development is progressing correctly. If the development direction needs to be adjusted, it is done at an early stage with little loss of investment.

11. **Evaluate Application Prototypes**
Once each application prototype is completed, it is presented to the functional analysts for review and approval. Other members of the Consortium may also be asked to participate.

These prototypes are reviewed to determine requirements such as the following:
- All required data elements are present.
- The screens are well designed.
- Navigation is appropriate and easy to use.
- All required functions are present.

12. **Hold Additional Joint Application Design Sessions**
The comments from the prototype review are incorporated into subsequent JAD sessions. During these JAD sessions, requirements are further refined and additional details shall be added. Again, these sessions are conducted under the direction of Software AG experts using the knowledge and expertise of the functional analysts. Unlike the first JAD session, these sessions last one to two days.

13. **Revise Application Prototypes Until Complete**
After each round of prototype evaluation and JAD sessions, Consortium and Software AG technical staff enhance the prototype so that it meets the additional requirements as needed. Approximately 6 to 9 rounds, or iterations, are required to develop an application ready for implementation.

14. **Approval of Applications**
As the baseline modules are being completed, in addition to being tested on the development platform, they are being cross-tested at a designated site for each different platform/operating system environment within the consortium to ensure full portability of common baseline code. The Quality Assurance Director is responsible for ensuring the completion of this task. Testing of batch processes (jobs) require that operating system control language procedures (JCL) be converted/developed for each environment. These different control language procedure (JCL) versions then become a part of the baseline applications for the repository and future consortium maintenance. The completed baselines are approved by the Technical Committee to ensure compliance with established technical standards. The approved products are then certified by the Executive Committee chair to the fiscal agent for payment.

15. **Install Applications In Central Repository**
Once each application has been completed, it will be installed in a central repository. The repository will be the location where all the baseline applications are stored and maintained. From this central location, subsequent versions of program modules shall be distributed to Consortium members. The repository site has not been finalized. It may be at one of the Consortium colleges, or as an alternative, it could be located at Software AG's corporate headquarters, located in Reston, VA.
16. **Distribute Applications**
The next step in the process is to distribute applications to the member colleges. Each college shall get the same set of programs for each application.

17. **Customize Applications**
Once each college has installed the baseline applications, a functional analyst shall provide an application walk-through for interested staff. No customization shall be needed to meet State and Federal mandates. However, customization may be needed to meet specific college requirements. For example, this could include interfacing the new systems to subsystems, equipment (i.e., POS Terminals), and/or other applications existing at the institution.

18. **Train End Users**
High quality end user training is absolutely essential to achieving system goals and objectives. Training design shall begin during the latter JAD sessions.

19. **Maintain Applications**
Maintenance of an application is a critical, though often overlooked, aspect of system planning. By developing baseline applications that meet shared requirements, the FCCSC shall create an information processing environment which minimizes the effort required for maintenance. As State, Federal, or Consortium requirements change, the baseline applications and associated documentation will be modified at the central repository. Consortium colleges may assign resources to maintenance teams to make the required modifications. These modifications with documentation will then be distributed to all Consortium members. Thus, teams will be able to keep all Consortium members in compliance with mandates.

IV. **THE PROJECT ORGANIZATION**

A. **CONSORTIUM AND VENDOR PARTNERSHIP**

The project has been set up as a partnership between FCCSC and Software AG. Each staff member allocated by FCCSC is regarded as an equal member of the project team and schedules tasks accordingly. SAG has undertaken the management role, supplying a project director, a QA director, data base manager, three project managers, technical project leaders and information specialists.

It is for this reason that SAG will apply strict project management at all times and will need the total commitment from the FCCSC management team. The management of the day-to-day activities on the project is the responsibility of the Project Managers and they in turn are managed and directed by the Project Director. FCCSC staff are assigned tasks by the Project Managers and are expected to complete the assigned tasks competently. Non-task-related management issues, such as performance, attendance, leave and other problems are performed by the Technical Committee members, with input from the project managers.

B. **ORGANIZATION AND FUNCTION**

Some of the following were described earlier in III Project Administration # 1-3, but again will be highlighted here.

**Executive Committee**

The Executive Committee has the overall authority for the project. They are responsible for reviewing business plans, and setting priorities and directions. They have the final approval for the allocation of resources, funds and personnel; the progress of the
overall project; and changes that must be made to the project plan.

Technical Committee
The Technical Committee provides support for the Executive Committee by handling month-to-month authority, performing technical oversight, assuring adequate resources on the projects. They also act as the direct liaison with the Project Director.

Project Director
The Project Director has the day-to-day responsibility for refining and implementing the overall plan, managing the project, maintaining the project budget, and reporting progress to the Executive and Technical Committees.

Quality Assurance Director
The Quality Assurance Director reports to the Project Director and is responsible for coordination across all applications and the portability of baselines across all platforms. As baseline systems are customized for Consortium members, the QA Director will ensure the applications remain maintainable.

Data Base Administrator
The Data Base Administrator reports to the Project Director and is responsible for designing data base and file structures which support efficient processing for each application while also observing restrictions and limitations of versions of NATURAL which support most, but not all, ADABAS data functionality to ensure cross platform compatibility.

Project Manager
The development of each application shall be directed by a Project manager. The Project Manager reports to the Project Director and is fully responsible for overseeing the day-to-day operation of the development of an application, i.e., the student system.

Information Specialist
The role of the Information Specialist is to provide programming support, provide technical expertise, and to provide systems support. Each application shall have access to a lead information specialist from Software AG. This person reports to the Project Manager for the system and ensures the appropriate use of Software AG tools.

Users, the ARCHITECT
Users are no longer only consultants; they are functional analysts, the architect! The User Representatives are functional experts, from the colleges, who are thoroughly familiar with the requirements for an application. It is the User Representative's primary responsibility to ensure that the final applications meet all State, Federal, and Consortium common requirements. They provide systems specifications, create consensus on issue resolution, review development, test products, provide user documentation, and train secondary staff.
Development Teams

Development Teams are comprised of Consortium and Software AG technical staff as appropriate. Their tasks are to implement the results of the JAD sessions. They work with the User Representatives to create and enhance application prototypes.

C. RESOURCE SUMMARY

The following summary of resources shows the level of commitment of top management from the member colleges. Yes, new funding, which served as an incentive to begin the project, was provided by the State. This new money, mostly used to fund costs for the SAG partnership, covers only a portion of the costs. The college dollars and personnel are being allocated from current resources by shifting priorities.

<table>
<thead>
<tr>
<th>PERSONNEL</th>
<th>NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>-- Colleges Technical Staff</td>
<td>27</td>
</tr>
<tr>
<td>-- Colleges User representatives</td>
<td>120+</td>
</tr>
<tr>
<td>-- Software AG staff</td>
<td>19</td>
</tr>
</tbody>
</table>

FINANCIAL (estimated cost to complete)

| -- Colleges       | $11.3 million |
| -- State          | $2.7 million  |

V. CRITICAL SUCCESS FACTORS

The Florida Community College Consortium and Software AG partnership is committed to meeting the State integrated data base requirements, within the resources and directions provided, using the following:

* Cost-effective application development.
* Fully functional applications delivered in less time than with traditional approaches.
* Protection of the Consortium investment should members need to change technical platforms.
* Reduced maintenance costs.
* Applications which can easily be modified to meet ever-changing regulations.
* Effective training for consortium technical staff.

The project will be successful when the following criteria is met:

* Completion of the applications under development within budget and on time.
* Systems to satisfy the user requirements within the scope of the baseline.
* Cross-platform compatibility for all systems (MVS, VSE, AS/400).
* Properly trained users.
* Detailed documentation.

VI. RESULTS AND DIRECTIONS

A. RESULTS OF THE ENGINEERING PROCESS

* Users are the architect of their Information Systems.

-- Users become the owners of their systems and data and
become their own systems experts.
* Fully integrated applications are delivered in dramatically less time.
* Application development is more cost-effective.
* Investments in applications are protected across multiple platforms (MVS, VSE, AS/400).
* Application maintenance costs are reduced.
* Technical expertise is provided by vendors.
* Technical staff are expert at application development.

B. ACCOMPLISHMENTS DECEMBER 1994 TO PRESENT

* Plan defined, accepted, and funded.
* Contracts signed.
* Staff organized and in place--SAG and FCCSC.
* Eight colleges inter-communicating.
* Miami-Dade Community College development site operational and used for all development.
* High-level specifications defined for all systems.
* Detail specifications were developed for the Personnel/Payroll, Student Information (Admissions, Registration, Curriculum, Fees and Tuition), Financial Management, and Facilities.
* Construction for the Personnel/Payroll, Student Information (Admissions, Registration, Curriculum, Fees and Tuition) and Financial Management is on schedule for completion December 1995.
* College Implementation/Steering Committees beginning to meet.

C. UPCOMING CHALLENGES

* Holding to the development plan's scope, time and budget.
* Implementation of the applications under development.
* The future after this baseline development is complete.
  -- To continue funding.
  -- To continue commitment of staff resources (business and technical) to the FCCSC by its member colleges.
  -- To continue commitment to the RAD process.
  -- To finalize plans for the Consortium organization, for future enhancements and maintenance.
  -- To develop the financial aid component.
  -- To integrate the library database component.

D. CONCLUSION

This project is already a success in that eight very diverse community colleges are working and sharing together. It will continue to be successful because, along with the enthusiasm of the colleges and the need and desire for the products, this project has three criteria required for success. They are:

--- The project must be organized and managed so successes occur along the way, not just at the end. RAD is our methodology.
--- The project must have support and direct involvement of the users. Our users are the ARCHITECT.
--- The project must have top management support. Look at the commitment of the college resources by top management. They are committed!

Our dynamics and momentum are strong! Every member college believes in our success!

November 2, 1995