Complex business systems: a strategy for success

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ABSTRACT

This paper deals with the development of complex business systems from two perspectives: (1) What role must be played by the project manager and other members of the project team to ensure a cost-effective and timely solution to the right business problems; and (2) What project organization and management techniques can be used to facilitate communications and decision-making among the project team, users, data center personnel, and other project participants.
INTRODUCTION

Complex systems do more than automate existing procedures. Such systems introduce new approaches to decision-making, force changes in job descriptions and in the organization itself, combine many separate (often organizationally distinct) tasks into a single black-box process, and challenge the business’s rules-of-thumb with accessible, manipulatable data. For example, even a very large payroll system generally replicates once manual payroll calculations. However, a human resource management system might identify prospective management trainees by a complex weighting of their education and experience rather than by the personality traits so often used by human selectors.

When complex systems are installed, the organization is bombarded with change. Some changes—new forms, new reports, and a new chart of accounts—can be easily digested after proper training. But other changes must be anticipated—those such as widely different inventory levels produced by economic order quantity/reorder point systems or greatly changed hiring patterns produced by affirmative-action-based applicant tracking systems. Digestion of these types of changes requires corporate actions with a long lead time—e.g., building a new warehouse (or leasing excess space).

Although complex systems are often cost-justified on the basis of cost displacements, e.g., elimination of x payroll clerks, these displacements rarely occur. These systems are more properly viewed as opportunities for improved revenue streams, an enhanced quality of work life, greater productivity by the existing staff, and better decision-making. A primary benefit of an order-entry system that drives production scheduling is that customers more frequently have their requirements met on time. In today’s competitive business climate, complex systems can mean the difference between survival and failure.

Large-scale (translate: complex) business systems projects have not been singled out in our industry for their overwhelming successes. Cost and schedule overruns, organizational disruptions, user alienation—all these and many more problems have plagued our efforts to develop complex management information and decision support systems. When such a project succeeds, and I’ve been fortunate enough to have been associated with several such successes, it’s worth documenting who did what to whom (and when, and how) and why it worked.

This paper deals with complex systems from two perspectives:

- What roles must be played by the project manager and other members of the project team to ensure that the system successfully solves the right business problem in the most cost-effective and timely manner? (The roles of users and operations are discussed by Cox and Jackson.

- What project organization and management techniques can be used to facilitate communications and decision-making among the project team, users, data center personnel, and other project participants?

SYSTEM LIFE CYCLE

Each system progresses through a similar series of major steps, or phases. Once the content of each phase and their interrelationships are understood, the roles of project participants can be defined for each phase and a framework can be created for the effective planning and control of information systems projects.

To simplify integration of our three papers on complex business systems projects, we have adopted as a common terminology the AMS system life cycle (see Figure 1), which is divided into five phases:

1. Concept Definition (Figure 2)—The model of the system that will solve the stated business problems is developed.
2. System Design (Figure 3)—The specifications from which the system will be built are prepared.
3. System Development (Figure 4)—The system design is transformed into programs and procedures, and it is demonstrated that the system meets the design specifications, working successfully in a controlled environment.
4. System Implementation (Figure 5)—The system is brought into operation in the production environment.
5. System Support (Figure 6)—Ongoing support is provided for production operations and system modifications, and enhancements are made over time.

In this approach, a complete picture of the entire system is developed from the very beginning—its business purpose, scope, structure, technical environment, costs, and benefits. As the development proceeds, the picture depicted in the concept definition becomes clearer and more focused as each piece is defined in increasing detail. But each of these detailed views ties in harmoniously with the overall framework envisioned in the concept. Thus, later development tasks are less likely to diverge from the main theme of the system. Further, this approach emphasizes both the business and technical aspects of a system from the outset of the life cycle.

In the concept definition phase the basic framework or model of a system is developed that will meet the user’s business

*The life cycle phases and project management techniques presented in this paper were developed by and are proprietary to American Management System, Inc. (1981), 1777 North Kent Street, Arlington, VA 22209
objectives. The model synthesizes the elements of the new system—its aesthetics, scope, functional capabilities, organizational and budgetary constraints, and technology like an architectural model of a building. The system concept document provides an overview of the total system and shows how its various elements fit into a unified, workable solution to the user's needs.

The goals of the system concept are to evaluate the need for a systems solution to a management or business problem; provide the context in which informed decisions can be made on the numerous policy and procedural issues that must be worked out before the new system can be developed; and provide a road map to guide the activities of subsequent development phases.

In the system design phase the system model developed during concept definition is used to produce specifications for the system. This blueprint includes not just program designs, but all the components of and considerations affecting the new system, such as hardware and software configurations, user and operations procedures, implementation plans, and a detailed work plan for the subsequent phases of the system development effort.

In the system development phase the specifications developed in the system design are used to build a system that performs all the specified functions. The complete system is demonstrated to work in a controlled environment. At the completion of this phase, all developed programs, jobstreams, databases, and user and operations procedures are thoroughly tested by the project team. The computer and telecommunications facilities are installed, and the system is ready for implementation in the user's operating environment.

In the system implementation phase the new system is installed for the first time in the user's operating environment. At the completion of this phase, user personnel will have been trained to operate the new system, and the system will have been turned over to the production operations staff.

In the systems support phase the project team may provide supplemental expertise and resources to assist in operating the system and in evaluating and implementing modifications and enhancements. During this phase, ongoing efforts are directed at ensuring that the system meets performance objectives, software problems are repaired, and necessary enhancements are made to adapt the system to changing user requirements.

PROJECT MANAGEMENT PHILOSOPHY

Large and complex projects require strong and steady management for successful completion. Project management is an ongoing process that spans the system life cycle; it is a difficult process that involves the creation and management of a com-
A completely new organization to produce something that has never before been built. This section describes the keys to our management style:

- Effective project management is substantive management, not mere administration. The project manager directs the development of the business and technical solution to the user’s problems. The project manager must have a professional level of knowledge in all areas of system development and should be an expert in some of these areas. The manager’s involvement with the substance of the project is the best assurance of a high-quality product.

- There must be a forum for discussing the numerous design issues that arise on any project and for resolving them so that decisions are clearly understood and carried out. We have found that a weekly team leaders’ meeting, run by the project manager, is an effective mechanism for uncovering and resolving issues. These meetings foster close communication between the teams, reducing interface problems.

- Our approach to status reporting also supports our philosophy of active, substantive leadership. We use simple forms that show task and deliverable status in a graphic manner and measure completion in unambiguous terms of complete or incomplete. If work in one area should fall behind schedule, we take corrective action to facilitate completion of the problem task, to resolve issues holding up progress, and to shift resources to areas not affected by the late deliverable. We find our reports to be more useful for project control than many computerized tools based on detailed PERT charting or critical path management, although the latter are useful in initial planning. The system development process is flexible by nature. Many sequence dependencies that would be assumed in a PERT chart are soft; a task can often be started before its precedents are completed. We take advantage of this flexibility to work around problems.

- Finally, close coordination with the user is essential to our approach. The project manager plays a key role in the user design, reviews deliverables with the user, follows-up on user commitments, and keeps the user aware of the project’s status.

**PROJECT ORGANIZATION AND ROLES**

While project organizations vary greatly in size and in team responsibilities, our large projects tend toward a standard structure as follows:

- **Project Staff**—The business analysts, technical analysts and programmer analysts who make up the project staff
are the backbone of the project. It is the staff's hard work, ability and enthusiasm that ultimately determine the success of the project. On medium and large projects, the staff is organized into teams of 3 to 10 professionals, each with a team leader. Teams are the basic working unit. A large project might have one team devoted to the programming of each major subsystem; a team devoted to testing; another team devoted to user documentation, procedures, and training; and a team working to prepare the production processing environment.

- **Project Manager**—The project manager takes day-to-day responsibility for all aspects of the project. The project manager takes the lead in working with users, in making design and major technical decisions, and in managing the quality and timeliness of project work. In the development and implementation phases, project management is usually a full-time job; in earlier phases, the manager may have other tasks, depending on the size of the team. The project manager is also responsible for planning, status reporting, and other administrative work. On larger projects, a project administrator may be assigned to free the manager from the details.

- **Project Supervision and Review**—At AMS, the project supervisor is a senior line manager, usually a vice president, who has overall project responsibility. The project supervisor reviews deliverables, provides input on substantive issues, takes the lead role in contract negotiations, and works closely with key users on management issues. All projects are formally reviewed on a regular basis by AMS corporate managers. Project reviews enable top management to communicate past experience to the project management, to exchange ideas on new approaches, to provide inputs at key decision points, and to detect and help respond to potential problems.

Based upon my own experiences, selecting a thoroughly competent project manager is one of the two most critical factors in helping to ensure a successful project; top management support and commitment is the other. To be effective, the project manager must have:

1. Substantive, expert knowledge of the project’s business (translate: user) objectives;
2. Considerable delegated authority (or access to users or sponsors with authority) to commit user, data processing and external resources to the project;
3. Enough business experience to assess for the user when, how and in what ways the organization’s current policies and procedures will change as a result of the project;
4. Sufficient technical (translate: computer) expertise to
manage a software development effort and to plan for,
define and monitor changes to the operating environ­
ment;
5. Excellent people management skills, for the project will
involve the active participation of staff ranging from
entry-level clerical personnel to senior management;
6. The ability to move the project forward in the face of
conflicting user requirements, insurmountable technical
“glitches,” contractual headaches, and all the other
problems that will arise; and
7. The maturity to accept responsibility for problems while
accordmg the project team credit for successes.

OTHER ROLES

Successful projects are those which satisfy the properly nur­
tured business expectations of their sponsors (translate: users)
and can be reliably operated by their inheritors (translate: data center personnel). In order to help ensure success, the
project team must therefore include user and data center
perspectives. The papers by Cox and Jackson address the
roles of users and data center personnel throughout the sys­
tem life cycle.

KEEPING IT ALL MOVING FORWARD

While there are no sure-fire management techniques that will
compensate for a “just average” project team, even a really
excellent team must operate in an orderly, well-documented manner. Effective project management requires a standard­
ized approach to the basic management functions of or­
ganizing, planning, and controlling the project. This section
describes approaches and techniques developed by AMS for
carrying out each of these basic functions.

Organizing the project team is not a one-time effort. The
project organization must be adapted to the changing avail­
bility of specific personnel, including user and data center
personnel. Real people have skills and experience levels that
never exactly match a theoretical organization; therefore, the
actual project organization will be molded around the re­
sources that are assigned. In addition, each phase of the sys­
tem life cycle requires a different mix of skills, and, on long
projects, there is usually some planned and some unforeseen
turnover. Maintaining a viable project organization in the face
of all these changes is a major task for the project manager.
Planning also occurs continuously throughout the system
life cycle. Our planning approach includes three tasks:
1. Near the conclusion of each phase, develop a plan for
the next phase which includes the tasks, milestones, and
budget. At the same time, develop or adjust the high level plan, which contains the approximate costs and schedule for the remainder of the project;
2. At the start of each phase, or at the start of each task area in larger projects, develop a detailed plan of task assignments and intermediate milestones for internal progress monitoring. Typically, these more detailed plans are done by the team leaders, helping to ensure their commitment to meet goals to which they and the project manager have agreed.
3. Revise plans and forecasts as work proceeds. It is essential to maintain an up-to-date plan and realistic forecasts of actual completion dates at all times. Changes in the system features, the project staff, or their assignments must be reflected in the plan. The forecast for the completion of milestones and for the project as a whole must be revised to reflect both changes in the plan and actual team performance. Team leaders usually update their task level forecasts on a weekly basis.

The manager's day-to-day involvement with the team's work is the fundamental means of controlling quality and progress. Nevertheless, a set of orderly processes is necessary for coordination and control. The project manager performs the following control tasks:

- Monitor and report project status. We use a standard set of project management reports which we have found to be highly effective in monitoring overall project status. A Project Task Plan shows the status of individual tasks. A Deliverables Schedule shows deliverables by week and pinpoints any that are late. A Milestone Chart provides a high-level visual display of the schedule, of any late deliverables, and of upcoming deliverables that may be late because of a late start or slow progress. Finally, a Planned/Actual/Projected Staff Utilization Report tracks actual hours against plan by task area. We use this report to maintain a current forecast in each area.
- Conduct team leader meetings. Every week, a team leader meeting is held to report on progress or problems, review deliverables, assign action items, and resolve issues. The meetings always have a published agenda and minutes. On small projects, a team meeting is generally substituted.
- Conduct client/user status meetings. We review the project status with the key client/user on a regularly scheduled basis. These meetings serve the purpose of informing the user of the status of deliverables and resolving any management issues. Meetings are attended by the user manager or managers, the project manager, frequently the project supervisor, and team leaders or members as appropriate. These meetings normally have an agenda, handouts, including status reports, and minutes.

**SYSTEM IMPLEMENTATION**

![System Implementation Diagram](image)

Figure 5—System implementation

From the collection of the Computer History Museum (www.computerhistory.org)
• Conduct walkthroughs. Deliverables for all phases are reviewed, or walked through, internally and with the user. Internal walkthroughs are held as needed, and are typically attended by the team member's immediate manager, one or two other team members, and the project manager. These walkthroughs prevent any piece of work from proceeding too far without review. User walkthroughs are the key to ensuring that the system meets the user's business needs. Comprehensive user walkthroughs are major task areas in the concept and design phases. They are usually attended by the project manager, the team leader, the team member primarily responsible for the deliverable being reviewed, and the users whose responsibilities are related to the deliverable.

• Conduct project reviews. As mentioned above, project reviews are held regularly to ensure the input of top-level AMS managers into the quality, substance, and progress of the project.

CONCLUSION

There is no magic formula for ensuring a successful outcome for a complex business systems project. However, I believe that the probability of success can be substantially enhanced by doing the following:

1. Rigorously defining the responsibilities of all participants during each phase of the project in terms of specific, tangible deliverables;
2. Reducing miscommunication and/or documentation deluge through well-structured, formally recorded weekly team leader meetings;
3. Managing the expectations of users and developers alike by explicit resolution of design issues and constraints; and
4. Selecting a capable project manager with strong, substantive knowledge of the project's business objectives.

REFERENCES
