A Successful Methodology for Designing and Implementing Virtual Work Teams

R. B. Stuewe, M. G. Barnes, and D.K. Hughes,
Los Alamos National Laboratory, Los Alamos, New Mexico, 87545

A system has been implemented at Los Alamos National Laboratory to rapidly staff and run one project teams. These project teams are created and subsequently perform their project functions using information technology as the communication medium. A simplified model of group interactions was used to guide the design and implementation of the system. The model uses three primary axes of group interactions to express the functional requirements that must be supported by a virtual work team application. The evolution of the approach and its relationship to traditional project management are described. A number of design characteristics were found to be critical to the success of the implementation and are presented. The technology and supporting processes and the business results stemming from implementation of the system are described in a limited manner.

Overview

An application system has been designed to handle creation and management of up to 1000 project teams per year. These teams are composed of an average of 15 individuals selected from a pool of 200 professionals. This pool is drawn from more than 30 functional work units physically scattered across 43 square miles. The average project requires 75 total person-hours to complete. Using the application system, team members are selected and perform a hazard analysis on proposed science projects at Los Alamos National Laboratory.

Project teams most closely resemble a matrix project organization, although their lifetimes as organizations are very brief. Traditional project leadership functions are distributed between project teams and another permanent self-managed team that maintains the overall application system and supporting processes.

The absence of formal project leaders and the fact that project teams are staffed, tasked and execute their assignments using information technology, without face-to-face contact, makes this implementation of interest. Despite the fact work is accomplished in the virtual arena provided by the information technology, the commitment to the common task and performance orientation causes these groupings of individuals to behave much as traditional teams do, hence the use of the nomenclature "virtual work team."[2]

Theory and Approach

Projects can be organized as part of a functional organization, as a pure organizational form, using a matrix approach, or some combination of any or all of these organizational forms.[4,5] With respect to the quantity and type of projects involved in this effort, these forms would be expected to exhibit certain weaknesses. The functional form is traditionally weak in customer focus making it an unlikely selection to satisfy the large number of customers served by the overall process in this implementation.[5] Further, with required technical expertise scattered across 30 or more functional work units, this approach was not found to be a good fit. The pure project organizational approach demonstrates a weakness in terms of inefficiency in staff utilization.[5] This would be exacerbated by the sheer numbers of projects and teams in this instance. The overhead involved for team members to meet as a unit even once per project would be at least fifty-percent of the average project’s total labor costs. This left a matrix approach as the likely base form, assuming that it was possible to overcome the expected difficulties in maintaining roles and responsibilities and in balancing individual team member work loads.[4,5]

The physical logistics involved in communicating across 43 square miles suggested that technology was required to meet the projects schedule requirements. The natural thought progression was toward virtual teaming if it could be executed in the rapid repetitive fashion required and if the potential team members could be motivated to perform their work using such an approach.

Understanding the motivating forces that induce people to successfully work as a virtual team required examining how groups work together. Models have been presented to describe how groups function and interact, examining the states and transitions that occur as a group performs work.[2,3] These are often described in terms of modes and functions.[3] To apply them and assist in designing the desired virtual project team application, it was necessary to distill and simplify the models. This resulted in a model that uses three axes to describe the functional space that work groups can be expected to occupy. The axes are Identity, Task and Time.

The most basic Identity Axis elements are organization (corporate) mission maintenance, work team structure maintenance, and team member support and maintenance. Task Axis elements include task initiation, problem solving, conflict resolution, and task execution. Time Axis elements are time ordering of work, matching bundles of resources with available time slots, and synchronization of the group as a unit.
DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, make any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.
DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.
The Identity Axis can be thought of as describing the degree of maintenance required for the relationship between the team and the overall organizational structure and mission. It has a role and responsibility element that extends from the individual, through the team, up to the corporate entity as a whole. This axis is a further expression of the recognition that individuals need to understand the structure in which they are operating and the relationship of their contributions to the whole in order to be maximally effective.

The Task Axis expresses the degree of complexity required to successfully initiate and execute the work group’s assignments. It includes elements such as task initiation, problem solving, conflict resolution and the specifics of task execution. Although time does not figure into these elements in this model, they include many of the common constituents and mechanics of project and team management.

The Time Axis expresses the chronological relationships and the time management systems that are necessary to maintain the team’s identity and to successfully execute the assignments. It includes elements such as sub-task sequencing, matching available time and resource bundles, and the synchronization of the team members as a unit when required.

This “three axis” model, when overlaid on a matrix project management model, covers most of the areas required to design a virtual work team application system. Two exceptions are leadership and overall system management. A variety of approaches could be used for these exceptions. The decision in this instance was to design the project teams to be self-directed to the extent possible. Additionally, overall system and process management was assigned to a permanent self-directed team that will not be discussed in great detail in this paper.

Some Implementation Specifics

The implemented application system consists of a customer interface system, a relational database application, the corporate email system, and a web-based product development and project management system. The relational database application was designed from future project team member specifications that described how to collect “correct” information and subsequently determine “who” the appropriate team members should be. The application then uses email to notify team members that a project task has been created for them. Collected information is presented to team members via their web browser where they analyze the information and then “build” their sub-product using tools available on their desktops. Performance against delivery dates is visible to both team members and to the customers through the corporate web. The implementation relies heavily on corporate desktop computer and network standards.

As indicated before, the implementation also uses a permanent self-directed work team to ensure system operation and improvement. This small team includes specialists in data collection, process quality management, customer relationship management, information technology and hazard analysis. The team provides initial customer interface for all projects. It is responsible for overall process measurement and improvement. This team handles process marketing, feedback, recognition and some conflict resolution mechanisms for project team members.

Critical Design Characteristics

In designing and implementing the system a number of characteristics were critical to the eventual success. The construction of the pieces of the system related to the identity axis were found to be of the overall highest importance. The elements of the application design that clearly identify the roles of individuals and their linkage to the final product were critical in providing the motivation for team members to work in the new manner. This is consistent with theories that suggest that successful teams and organizations address certain “needs” of their individuals such as the need to join with others in a common task, to have latitude in individual decisions, to have clearly recognizable contributions, to have opportunities to learn information beyond one’s immediate contribution, the need for feedback, and finally the need to see how and why all contributions fit into a logical whole.[2,5,6,7] These needs were found to be present in these “virtual” teams just as would be expected for more traditional team forms.

In designing this specific implementation of the identity axis, it was necessary to provide mechanisms to decide who will be on a team and what the individual and team roles are to be. This was found to be best accomplished if potential team members defined “when” they should be part of a team by describing the detailed project criteria that determine their participation. These steps must necessarily be repeated for new individuals as they join the pool of potential team members. Visual “products” with a clear relationship to the customer were a key to establishing the identity linkages and the “logical whole” of the projects.

The critical design characteristics of the task axis implementations were obtained from anticipation of the work process, both in terms of tools and in terms of human performance. At task initiation, it was critical that tasks were well-defined and understood by team members. This avoided mistakes and the delays caused by miscommunications that normal teams often prevent or work through using face-to-face meetings. For problem solving, the design anticipated problems that could be caused by insufficient or incorrect information and attempted to prevent them. To accomplish this, it was critical to have each potential team member define in advance what information they required in order to fulfill their role. It was also critical to ensure that such information was collected and available at the time of task initiation. The key to designing for conflict resolution was to anticipate common conflicts associated with the project tasks and then try to avoid them by design. This includes typical project conflicts such as schedules, priorities, and staffing.[4,5] In designing task execution, it
was essential to actually create the "product" in the virtual workplace and to minimize external processing. This required anticipation of the tools required by each team member.

The complexity of designing the implementations of the time axis was greatly reduced by first analyzing the needs of the identity and task axes. The subsequent reduction in complexity was primarily a consequence of team members understanding their role, and having quality input information, sufficient latitude, and understandable target dates and deadlines. No special time controls, such as workflow or aggressive ticklers, were found to be necessary to ensure on-time project performance. It was critical, however, to provide a method for team members to call for "help" or a method to redirect tasks when their workload was becoming excessive. This allowed team members to be responsible for balancing their various projects without diminishing their contributions, thus addressing the stated weakness in the matrix approach to project management. Finally, synchronization required that progress toward all deadlines be visible to all team members and that team members be notified of new projects at essentially the same time. Overall, it was found to be valuable to think of time management separately from task execution in order to take maximum advantage of the asynchronous and parallel capabilities of the virtual workplace.

Results And Conclusions

Designing a virtual project team system from a simplified model of how groups function has proven to be a workable approach. One result of this approach was increased design time focusing on incorporation of functions that support the identity of the team members.

The use of the "three-axis" model in designing a virtual work team approach for the described project management problem has produced highly favorable business results. These results include a factor of 4-6 reduction in unit cost and a factor of 10 reduction in cycle time over a previous more traditional process. Customer focus also has improved significantly as evidenced by customer satisfaction measurements.

The design methodology led to careful analysis of the process and significant up-front involvement of potential virtual team members to ensure that roles and responsibilities were built into the system. Success also required that quality information be collected and encapsulated in the virtual team's workspace. Desktop infrastructure standards and an internal intranet seem to improve the probability of success at an affordable cost. It appears that this methodology and project approach should be extensible to other knowledge-based product development processes.

References


