

Group Decision Support System for Facilities Planning

Janet H. Spoonamore and Bruce C. Goettel

US Army Construction Engineering Research Laboratory, PO Box 9005,
Champaign, IL 61826-9005, USA.

Abstract

Institutions, both public and private, are restructuring due to major global changes: some of which include the unification of Europe, introduction of free enterprise in the Eastern European countries, and the major trade deficits of the United States. Given constrained funding available for building investments in a climate of major change in organizational goals, decision makers need improved planning tools for choosing optimal facility investments, just as for other investment decisions. This paper describes a facilities planning and prioritization system developed at the Army Corps of Engineers Construction Engineering Research Laboratory (CERL) which assists in selection and provides project information on costs and multiple attributes for describing requirements. The system provides multi-level prioritization information for use by decision groups within the organization hierarchy. In addition, proposed enhancements to this system include group decision information handling for realigning projects to the evolving goals of the organization.

1. INTRODUCTION

The facility life-cycle process includes the planning, design, construction and operations and maintenance phases. Facility assets are now being more carefully managed in all organizations. Facilities managers are formulating more complete and rigorous analysis of alternative facilities solutions to meet their organizational needs. Increasingly, managers are using leased space, rather than ownership. Space management, including profit center accountability for space, has resulted in cost savings to the organization. Services and recurring maintenance procedures are being standardized and managed more rigorously. Finally, facility users within the organization are becoming more involved in the decision process, competing to meet their facility needs in a constrained fiscal environment. Typically, within an organization, a capital investment committee representing the functional elements of the organization is established to oversee and recommend facility investments. This decision group includes all laypersons, with the exception of the facility manager.



2. FACILITY GROUP DECISION

The task of the facility decision group is to chart out (and update on a recurring basis) the long range and short range functional needs of the organization and commission the professional facilities manager to prepare alternative proposed facilities investments to meet these needs. The facility decision group, reviewing facilities operations and maintenance costs, commissions inquiries to the facilities manager to quantitatively measure and evaluate these needs. What we are finding is that the facilities management discipline is being challenged to demonstrate to the organization exactly how the physical plant investments are being planned and allocated, how these investments are contributing to organizational goals and needs, and how these plans represent the most cost effective solution possible.

We characterize the facility investment decision process into two methodologies; firstly, analytic methods, and, secondly, group decision methods. The analytical methods are described in the literature. These include predictive models for physical plant renewal, life-cycle costs analysis, lease-purchase analysis, alternative financing and traditional cost engineering. See, for example, Hutson and Biedenweg [1], and Phillips [2]. Our interest in this discourse, however, is to turn our attention to group decision methods, which encompasses a whole range of alternative approaches not available through analytical methods.

3. DECISION GROUP METHODS

Decision groups are defined as heterogeneous, fairly balanced, and competing elements representing issues of a particular decision. A major characteristic of decision groups is a lack of shared, common understanding of the individual issues due to the disparity of the group. Yet, the group is tasked to develop a joint decision within the fiscal constraints, which is a zero sum game.

Two important strategies for effective decision group methods include increasing (without individual risk) communication of information across elements and analysis of information at the group level.

The first strategy is important, because, as evidenced in research, decision group dynamics limit free exchange of information across competing elements in the group. Firstly, exposing one's position or critical information reduces an individual's power within the group. Secondly, open criticism in the group alienates the critic. It has been shown that anonymous transmittal of information increases communication. Increasing communication regarding relative functional needs within the organization, arriving at a common understanding of functional needs, and relating these to organizational goals provides important information to the facility manager in developing facility investment solutions to the decision group.

The second strategy, for group level information analysis, is important to forming a basis for decision results. A major barrier to group information handling (in the group setting) is lack of rapid and convenient ways to meaningfully relate disparate results into a common analysis for group consideration. Even organizing and documenting information developed by the group is difficult to capture accurately and meaningfully. It is in this group analysis mode where innovative ideas can be developed, which could provide great benefits to the organization. First of all, redundant and duplicate functional needs could be detected, clear cost avoidances. Secondly, uniform standards and measures can impose discipline fairly across organizational elements, achieving both cost savings and confidence in the group decisions.

3.1 Comprehensive Facilities Planning

The major tool for the facilities manager to institute more discipline into the facility investment process within the organization is the comprehensive planning methodology. This process includes long range and short range facility investment plans tied to and measured against organizational goals. It involves consideration for complex and disparate issues including environmental, regulatory constraints, economic aspects, and functional issues. Finally, it involves participation and integration with lay participants in the decision process. It is this part of the process that automated group decision tools may be most valuable.

4. ARMY PRIORITIZATION PROCESS

The MCA (Military Construction, Army) program directs the Department of Defense's allocation of resources for military construction (MILCON) projects. The current MCA programming process contains many occurrences of prioritization and decision making procedures. Each MCA project must work its way up through a seemingly endless series of steps, offices, committees and reviews before the project may be funded.

Part of the process is computerized with the DD1391 processor and the CAPCES (Construction, Appropriations, Programming, Control, and Execution System) databases existing on a McDonald Douglas mainframe computer. The DD 1391 Processor is used to electronically prepare, submit, and review construction projects at each level within the Army. CAPCES provides Army-wide detailed information about MCA projects.

Prioritization of MCA construction projects occurs in five instances as a project moves up the chain. First by the major Army command (MACOM), second by Headquarters, Department of the Army (HQDA), third by a evaluation group (PEG) , fourth by a internal grouping of project types (MDEP), and fifth by a Construction requirements review committee (CRRC). The CRRC uses all the project priorities to come up with a new prioritized list.

When a organization assigns a priority (on a 1 to n basis), it is entered into the CAPCES data base. Each project has a set field in CAPCES for its priority assignment by each group.

Each group/committee has its own methods of accomplishing its prioritization mission. In general, the data is downloaded from CAPCES and put in dBase or Lotus 123 format and is then manipulated to fit a 1 to n scale. In many cases projects are considered "must funds" for statutory, congressional reasons or they are needed to complement a funded project without which the other project would not be complete, i.e. barracks for troops supporting a missile silo.

In essence, each prioritization occurs with the use of a single personal computer and computer generated output. The projects are discussed, proponents have their say, a general agreement is obtained, information is reentered into the computer, and new printouts are obtained.

5. AUTOMATED GROUP DECISION TOOLS

The initial product from the new research into the MCA prioritization process is a priority system called PRI. PRI is a single user PC based program which was developed in Clipper, a dBase compiler from Nantucket Corporation. The data bases generated by this program are also accessible by dBase or the equivalent. PRI contains an interface with CAPCES for the downloading of project information from the mainframe.

PRI is structured so as to avoid the limitations of the current MCA process. PRI allows evaluation of projects based on priorities generated by five committees or groups, the CRRC, PEGs, MACOMs, CINC, and MDEPs. Also, still in development, is an additional section which will feature a Uniform criteria section from which a project may be independently evaluated based on six types of economic criteria.

Once all projects and their criteria are scored, the criteria may be given a weight. Since, at any given time, an individual criteria may be determined to be of greater or lesser importance than another, this weighing factor becomes a way to adjust priorities at another level.

The total priority is then calculated with the weighing factor included. Any combination or all of the weighted criteria may be selected to make up the total priority score. Reports may then be generated which will show the listing of projects in order of priority.

This system is meant to be used in a group prioritization meeting. An earlier prototype of this method was tested during an actual prioritization meeting in 1988, using a PC display of program information projected on a screen for all members to see. An additional, reporting/display capability allowed the moving

of projects up or down the prioritized list and creating a final prioritized list. Although this group prioritization and analysis tool is expected to be useful, we still conclude, though, that improved communication is necessary for a greatly improved prioritization process. The prioritization process must be enhanced to facilitate interaction between in-group participants. One solution is to enhance communication via the use of groupware.

5.1 Groupware

Groupware is a generic term for specialized computer aids that are designed for the use of collaborative work groups. Groupware can support face-to-face meetings or electronic meetings. Groupware can facilitate exchange, presentation, management of information, as well as support group-authorship, screen sharing, and teleconferences. See, for example, Johansen [3] or Stefik, et al [4].

The main aim of groupware is to help people work together. It must facilitate communication between people. One feature most groupware must possess is a physical connection between machines, usually a local area network (LAN). On a LAN, some introductory groupware products include E-mail, group filing systems, and calendars. Figure 1 illustrates a Group Decision room connected via a LAN running groupware software.

These products are typically available as standalone products, but groupware characteristically takes them a step further. For example when scheduling a meeting, a groupware calendar system would show potential scheduling conflicts among group members, then select a time, then select a place. The system would next put this meeting on everyone's calendar, send a E-mail message telling everyone about the meeting, and finally remind people shortly before the meeting would take place.

What could groupware do to support the work of prioritization groups? What groupware methods exist that would be useful in the prioritization process. We will look at several scenarios of how groupware could facilitate the prioritization process. Overlap occurs in many of these approaches, but each has unique options.

5.2 Multi-User Prioritization System

The current prioritization system of a consensus of opinions which are used to create a prioritized list. This may or may not ensure that the optimum MCA projects are selected with group dynamics having the potential to be inconsistent. A multi-user prioritization could resolve some obstacles. How would this work?

Each group member has access to the multi-user prioritization system residing on a local area network (LAN). They will be able to score projects based on uniform criteria. The criteria can be weighted depending on Army priorities for the current MCA cycle. Each member grades the project based on this criteria. The totals for the projects are rolled up to form one priority list. The list can be

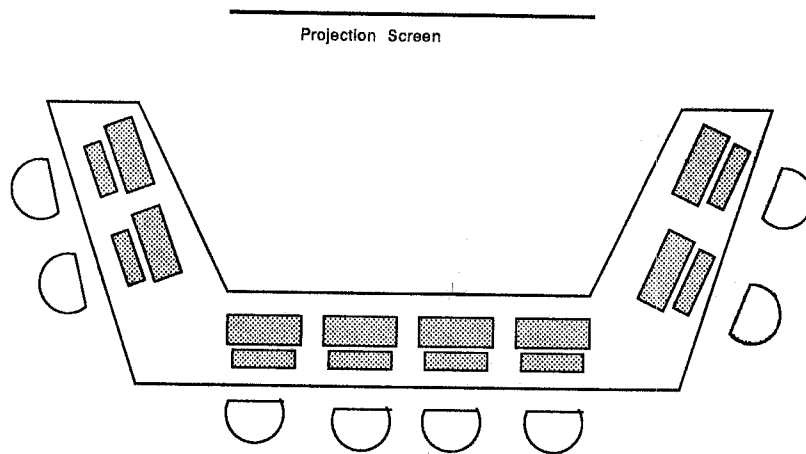


FIGURE 1. Group Decision Room

viewed electronically. Once the list is viewed, another pass at prioritizing can be made, perhaps reviewing only those projects on the funding borderline. Or perhaps the weighing factor can be changed. With a prioritizing system games can be played to satisfy different scenarios. For example, what happens if training projects are weighted higher, if more weight is given to energy conservation projects, etc. Eventually a prioritized list is developed, and the list is electronically sent up the chain to the next level.

5.3 Group Decision Support Systems

The use of Group Decision Support Systems (GDSS), is a process by which the group attempts to electronically reach a consensus regarding a decision. It relies on anonymous judgments by group members and a series of rounds until a decision is reached.

Each group member is electronically asked a series of questions regarding their expertise and partialities. Then the GDSS asks the group members to prioritize the projects. The GDSS does some aggregation of the members views and gives the group members a first round prioritized list. The group goes through a series of these rounds until a final group decision is attained. This process can help groups come to a consensus and also provide a method to remove some of the members bias and prejudices from the final product through the anonymous opinions.

5.4 Face-to-Face Meeting Facilitation Services

This method involves the use of a facilitator and electronic equipment to help expedite the group meeting process.

A facilitator is hired to run the meeting. Equipment is set up to provide a means to display and reproduce the results. This equipment would include a PC,

large display screen, and a laser printer. The facilitator sits in the middle of the room, using the PC and display to formulate a group decision and display the results. The facilitator is directly involved in the process and asks questions of the members to help do the prioritization. The group sees the results of the decisions displayed immediately on the large display screen. Hard copy output is also made available to group members to take with them.

5.5. Computer Support for Face-to-Face Meetings

This groupware technique is similar to the previous method except instead of a facilitator, each member has their own computer. Each member is able to edit or add information on a common display.

Each group member has a PC in front of them which are then linked and tied to a large screen common display. The software running on their PC's allow each member to interact with the same data and display. A member can control the display screen and move, edit, add information to it. Someone can move a project higher on the list or push it down further. Since the main concern with prioritization groups is the projects falling on the borderline between funded and non-funded, it will be easy for members to see and play "what if" games when a project is moved along the list.

6 CONCLUSIONS

Recognizing that planning and programming limited fiscal resources for facilities investments requires fuller knowledge of the organizational goals related to benefits of these investments leads research into, not only analytical deterministic methods, but more importantly, to involve more participants in the investment decisions. Automated group decision tools provide efficient, effective methods to enable and facilitate decision groups in making investment decisions.

7. REFERENCES

- 1 Hutson, Robert E. and Biedenweg, Frederick M., "Before the Roof Caves In: A Predictive Model for Physical Plant Renewal", Capital Renewal and Deferred Maintenance, APPA , Waldorf MD 1990.
- 2 Phillips, Cushing, " Facilities Renewal: The Formula Approach", Capital Renewal and Deferred Maintenance, APPA , Waldorf MD 1990.
- 3 Johansen, Robert, "Groupware: Computer Support for Business Teams," Free Press, 1988.
- 4 Stefik, et al. "Beyond the Chalkboard: Computer Support for Collaboration and Problem Solving in Meetings," *Communications of the ACM*, 30:1, 1987 pp. 32-47.

