

# CHAPTER 68

## MANAGING PEOPLE

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### 68.1 CRITICAL ISSUES OF MANAGING IN TECHNOLOGY-BASED ENVIRONMENTS

In their quest to remain competitive in our changing business environment, managers must work effectively with people, who are our most valuable asset. They are the heart and soul of a company's core competency, critical to the successful implementation of any strategic plan, operational initiative, or specific project undertaking. The mandate for managers is clear: they must weave together the best practices of both traditional and contemporary schools for teaching and directing their people toward desired results in a rapidly changing world. However, even the best practices do not guarantee success. They must be carefully integrated with the business process, its culture and value system. These challenges are especially present in today's technology-based organizations, which have become highly complex and multifaceted, requiring effective planning, organizing, and integration of complicated, multidisciplinary activities across functional lines in an environment of rapidly changing technology, global markets, regulations, and socioeconomic factors. Because of these dynamics, engineering organizations seldom are structured along traditional functional lines. Rather, they operate as matrices or hybrid project organizations that overlay the functional structure. Their management must share resources and power and establish communication channels that work both vertically and horizontally to integrate the many activities involved in modern engineering operations.

## 68.2 MOTIVATION AND ENGINEERING PERFORMANCE

Understanding people is important in any management situation, and motivation is especially critical in today's technology-based organizations.<sup>1</sup> Leaders who succeed within these often unstructured work environments must confront untried problems to manage their complex tasks. They have to learn how to move across various organizational lines to gain services from personnel not reporting directly to them. They must build multidisciplinary teams into cohesive groups and deal with a variety of networks, such as line departments, staff groups, team members, clients, and senior management, each having different cultures, interests, expectations, and charters. To get results, these engineering managers must relate socially as well as technically and must understand the culture and value system of the organization in which they work. The days of the manager who gets by with only technical expertise or pure administrative skills are gone.

*What works best?* Observations of best-in-class practices show consistently and measurably two important characteristics of high performers: (1) they enjoy work and are excited about the contributions they make to their company and society, and (2) they have esteem needs fulfilled, that is, they feel good about themselves professionally. Specifically, field research studies have identified several professional needs strongly associated with job performance.

### 68.2.1 Sixteen Professional Needs That Affect Engineering Performance

Research studies show that the fulfillment of certain professional needs can drive engineering personnel to higher performance; conversely, the inability to fulfill these needs may become a barrier to individual performance and teamwork.<sup>2-5</sup> The rationale for this important correlation is found in the complex interaction of organizational and behavioral elements. Effective team management involves three primary issues: (1) people skills, (2) organizational structure, and (3) management style. All three issues are influenced by the specific task to be performed and the surrounding environment. That is, the degree of satisfaction of any of the needs is a function of (1) having the right mix of people with appropriate skills and traits, (2) organizing the people and resources according to the tasks to be performed, and (3) adopting the right leadership style. The sixteen professional needs critical to engineering performance are:

1. *Interesting and challenging work*, as intrinsic motivation of the individual, satisfies professional esteem needs and helps to integrate personal goals with the objectives of the organization.
2. *Professionally stimulating work environment* leads to professional involvement, creativity, and interdisciplinary support. It also fosters team building and is conducive to effective communication, conflict resolution, and commitment toward organizational goals. The quality of this work environment is defined through its organizational structure, facilities, and management style.
3. *Professional growth* is measured by promotional opportunities, salary advances, the learning of new skills and techniques, and professional recognition. A particular challenge exists for management in limited-growth or zero-growth businesses to compensate for lack of promotional opportunities by offering more intrinsic professional growth in terms of job satisfaction and skill building.
4. *Overall leadership* involves dealing effectively with individual contributors, managers, and support personnel within a specific functional discipline as well as across organizational lines. It involves technical expertise, information-processing skills, effective communications, and decision-making skills. Taken together, leadership means satisfying the need for clear direction and unified guidance toward established objectives.
5. *Tangible reward* include salary increases, bonuses, and incentives, as well as promotions, recognition, better offices, and educational opportunities. Although extrinsic, these financial rewards are necessary to sustain strong long-term efforts and motivation. Furthermore, they validate the "softer" intrinsic rewards, such as recognition and praise, and reassure people that higher goals are attainable.
6. *Technical expertise* means that personnel need to have all necessary interdisciplinary skills and expertise available within the project team to perform the required tasks. Technical expertise includes understanding the technicalities of the work, the technology and underlying concepts, theories and principles, design methods and techniques, and functioning and interrelationship of the various components that make up the total system.
7. *Assisting in problem solving*: examples include facilitating solutions to technical, administrative, and personal problems. It is a very important need, which, if not satisfied, often leads to frustration, conflict, and poor-quality work.
8. *Clearly defined objectives*. Goals, objectives, and outcomes of an effort must be clearly communicated to all affected personnel. Conflict can develop over ambiguities or missing information.

9. *Management control* is important for effective team performance. Managers must understand the interaction of organizational and behavior variables in order to exert the direction, leadership, and control required to steer the project effort toward established organizational goals without stifling innovation and creativity.
10. *Job security* is one of the very fundamental needs that must be satisfied before people consider higher-order growth needs.
11. *Senior management support* should be provided in four major areas: (1) financial resources, (2) effective operating charter, (3) cooperation from support departments, and (4) provision of necessary facilities and equipment. It is particularly crucial to larger, more complex undertakings.
12. *Good interpersonal relations* are required especially for effective teamwork; they foster a stimulating work environment with low conflict, high productivity, and involved, motivated personnel.
13. *Proper planning* is absolutely essential for the successful management of multidisciplinary activities. It requires communications and information-processing skills to define the actual resource requirements and administrative support necessary. It also requires the ability to negotiate resources and commitment from key personnel in various support groups across organizational lines.
14. *Clear role definition* helps to minimize role conflict and power struggles among team members and/or supporting organizations. Clear charters, plans, and good management direction are some of the powerful tools used to facilitate clear role definition.
15. *Open communications* satisfy the need for a free flow of information both horizontally and vertically, keeping personnel informed and functioning as a pervasive integrator of the overall project effort.
16. *Minimizing changes*. Although engineering managers have to live with constant change, their team members often see change as an unnecessary condition that impedes their creativity and timely performance. Advanced planning and proper communications can help to minimize changes and lessen their negative impact.

The significance of assessing these motivational forces lies in several areas. First, the above listing provides insight into the broad needs that engineering oriented professionals seem to have. These needs must be satisfied *continuously* before engineering personnel can reach high levels of performance. This is consistent with findings from other studies, which show that in technical environments a significant correlation exists between professional satisfaction and organizational performance.<sup>2,6-9</sup> From the above listing, we now know more specifically on what areas we should focus our attention. In fact, the above listing provides a model for *benchmarking*; that is, it provides managers with a framework for monitoring, defining, and assessing the needs of their people in specific ways. With their awareness of professional needs, managers can direct their personnel and build a work environment that is responsive to these needs. As an example, top-down the work structure and organizational goals might be fixed and not negotiable; however, engineering managers have a great deal of control over the way the work is distributed and assigned. The same degree of operational control exists also in most other need areas. Finally, the above listing of needs provides a topology for measuring organizational effectiveness as a function of the degree at which these needs seem to be satisfied.

Taken together, fulfilling professional needs helps to build people and eventually teams characterized by

- High levels of energy
- High ability to handle conflict and open communications
- High levels of innovation and creativity
- Commitment and ownership
- Willingness to take risks
- Team-oriented behavior
- High tolerance for stress, conflict, and change
- Cooperation and cross-functional linkages

These are precisely the ingredients necessary to work effectively in an environment characterized by technical complexities and rapid changes regarding technology, markets, regulations, and socioeconomic factors. It is also a work environment where traditional methods of authority-based direction, performance measures, and control are virtually ineffective.

### 68.3 MANAGING WITHOUT FORMAL AUTHORITY

Managers in technology-based work environments must often cross functional lines to get the required support. This is especially true for managers who operate within a matrix structure. Almost invariably,

**Table 68.1 Authority Patterns of Engineering Organizations**

<p>Within technology-based work environments, management of professional people is largely characterized by:</p>	<p>Authority patterns that are defined only in part by formal organization charts and plans</p> <p>Authority that is largely perceived by the members of the organization based on earned credibility, expertise, and perceived priorities</p> <p>Multiple accountability of most personnel, especially in project-oriented environments</p> <p>Power that is shared between resource managers and project/task managers</p> <p>Individual autonomy and participation that is greater than in traditional organizations</p> <p>Weak superior-subordinate relationships in favor of stronger peer relationships</p> <p>Subtle shifts of personnel loyalties from functional to project lines</p> <p>Project performance depending on teamwork, group decision-making, and favoring the strongest organizations</p> <p>Reward and punishment power flowing along both vertical and horizontal lines in a highly dynamic pattern</p> <p>Rewards (and punishment) are influenced by many organizations and individuals</p> <p>Multiproject involvement of support personnel and sharing of resources among many activities</p>
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the manager must build multidisciplinary teams into cohesive work groups and successfully deal with a variety of interfaces, such as functional departments, staff groups, other support groups, clients, and senior management. In the *traditional organization*, position power comes largely in form of legitimate authority, reward, and punishment and is provided by these organizations. In contrast, engineering managers and team leaders have to build most of their power bases on their own. As shown in Table 68.1, they have to earn their authority and influence from other sources, including trust, respect, credibility, the image of a sound decision-maker, and the facilitation of a professionally stimulating work environment.

Position power is a necessary prerequisite for effective engineering project/team leadership. Like many other components of the management system, leadership style has also undergone changes over time. With increasing task complexity, increasing dynamics of the organizational environment, and the evolution of new organizational systems, such as the matrix, core team structures, design/build organizations, and process-oriented team concepts, a more adaptive and skill-oriented management style has evolved. This style complements the organizationally derived power bases—such as authority, reward, and punishment—with bases developed by the individual manager. Examples of these individually derived components of influence are technical and managerial expertise, friendship, work challenge, promotional ability, fund allocations, charisma, personal favors, project goal indemnification, recognition, and visibility. This so-called Style II management evolved particularly with the matrix. Effective engineering management combines both the organizationally derived and individually derived styles of influence.

Various research studies<sup>3-6,10,11</sup> provide an insight into the power spectrum available to engineering managers. These studies show that technical and managerial expertise, work challenge, and influence over salary were the most important influences that project leaders seem to have, while penalty factors, fund allocations, and traditional position-based authority appeared least important in gaining support from support staff and project team members.

#### 68.4 AN INCREASED FOCUS ON TEAM PERFORMANCE

More than any other process, teamwork affects organizational performance.\* Because of its potential for producing an economic advantage, work teams have been studied by many producing a consid-

\*In response to this challenge, many researchers have investigated teamwork and its relationship to the innovation process.<sup>12-18</sup> Often, such research is especially related to technology-oriented developments because these multidisciplinary team efforts rely on interaction among various organizational, managerial, and environmental subsystems. Team members come from different organizations with different needs, backgrounds, interests, and expertise. To be effective, they must be transformed into an integrated work group that is unified toward the project objectives.

**Table 68.2 Variables Characterizing Effective Engineering Team Performance**

Task Variables	People Variables	Leadership Variables	Organizational Variables
Technical success	Good communication	Organizational ability	Collaborative culture
Quality results	High involvement	Direction and leadership	Common goals and objectives
On-time	Capacity to resolve conflict	Facilitating group decision-making	Stable goals, objectives
On-budget	Mutual trust	Motivation	Risk sharing
Innovation, creativity	High team spirit	Conflict resolution	Involved management
Adaptability to change	High commitment	Team unification	Long-range strategy
	Team self-development	Viability and accessibility	Stimulating work environment
	Ability to interface	Top management	
	Need for achievement	Linkage	
	Collaborative spirit		

erable body of knowledge on the characteristics and behavior\* of teams in various work settings.<sup>7,10,12,21-22</sup>

It is interesting to note that, in spite of changing leadership styles and continuously emerging new management practices, this established body of knowledge has formed an important and solid basis for guiding managers in our contemporary, more demanding work environment.<sup>23</sup> It also forms the basis for new management research, theory development, and tools and techniques.

In fact, work teams have long been considered an effective device to enhance organizational effectiveness. Since the discovery of the importance of social phenomena in the classic Hawthorne studies, management theorists and practitioners have tried to enhance group identity and cohesion in the workplace. Indeed, much of the "human relations movement" that occurred in the decades following Hawthorne is based on a group concept. McGregor's Theory Y, for example, spells out the criteria for an effective work group, and Likert called his highest form of management the *participative group*, or System 4.

In today's more complex and technologically sophisticated environment, the group has re-emerged in importance in the form of project teams. The management practices apply principles of interpersonal and group dynamics to create and guide project teams successfully.

## 68.5 CHARACTERISTICS OF HIGH-PERFORMING ENGINEERING TEAMS

The characteristics of a project team and its ultimate performance depend on many factors related to both people and structural issues. Obviously, each organization has its own way to measure and express performance of a project team. However, in spite of the existing cultural and philosophical differences, there seems to be a general agreement among managers on certain factors that are included in the characteristics of a successful project team. A simple framework is suggested in Table 68.2 for organizing the complex array of performance-related variables into four specific categories. (This framework resulted from several field studies. See Refs. 3-5, 24.)

*Task-related variables* are direct measures of task performance, such as the ability to produce quality results on time and within budget, innovative performance, and ability to change.

*People-related variables* affect the inner workings of the team and include good communications, high involvement, capacity to resolve conflict, mutual trust, and commitment to project objectives.

*Leadership variables* are associated with the various leadership positions within the project team. These positions can be created formally, such as the appointment of project managers and task leaders, or emerge dynamically within the work process as a result of individually developed power bases, such as expertise, trust, respect, credibility, friendship, and empathy. Typical leadership characteristics include the ability to organize and direct the task, facilitate group decision-making, motivate, assist in conflict and problem resolutions, and foster a work environment that satisfies the professional and personal needs of the team members.

*Organizational variables* include overall organizational climate, command-control-authority structure, policies, procedures, regulations, and regional cultures, values, and economic conditions. All of these variables are likely to be interrelated in a complex, intricate form.

\*The characteristics of a high-performing technical project team have been studied extensively by Thamhain and Wilemon.<sup>19,20</sup> The studies found a strong association among project success, innovative performance, and certain leadership criteria that include the ability to (1) provide clear directions, (2) unify the team toward a common project goal, (3) foster clear communication channels and interfaces with other work groups, (4) provide stimulating work, (5) provide professional growth potential, (6) facilitate mutual trust and good interpersonal relations, and (7) involve management.

It is interesting to note that managers, when describing the characteristics of an effective, high-performing project team, focus not only on task-related skills for producing technical results on time and on budget, but also on the people and leadership-related qualities, as shown in Table 68.3.

The significance of grouping and categorizing team performances variables is in three areas:

1. It provides a model for determining the factors critical to high team performance in a particular project environment.
2. It provides a framework for diagnosing and stimulating team-building activities.
3. The team performance variable might be useful in benchmarking the team's characteristics against the "norm" of high-performing teams, hence providing the basis for self-assessment and continuous improvement.

Taken together, within an integrated team, members enjoy their group association and derive much of their personal and professional satisfaction from the integration with their team members. Specifically, some of the more important characteristics of such a truly integrated team are

- Satisfaction of individual needs
- Shared interests
- Pride and enjoyment in group activity
- Commitment to team objectives
- High trust, low conflict
- Comfortable with interdependence and change
- High degree of group interaction
- Strong performance norms and result orientation

Creating a climate and culture that produces such team characteristics is conducive to high performance and involves multifaceted challenges that increase with the complexities of the project and its global dimensions.

### **Table 68.3 Self-Directed Teams Defined**

A self-directed work team is a group of people who can manage themselves and their work with a minimum of direct supervision. Yet these teams work within the boundaries of established organizational objectives, business plans, and strategies, as well as overall managerial direction and leadership. Most of the directions come from the work team, rather than from management. Specifically, the characteristics of self-directed teams can be described as follows.

#### *Characteristics:*

Members are encouraged (empowered) to take ownership in the work and self-control

Leadership evolves within the team based on expertise, trust, and respect

Members are highly committed to established team objectives

Has ability to organize task teams and define project plans within given objectives

Self-reliant, less dependent upon policies, procedures, and formal control systems

Interested in work, high involvement, energy, need for achievement, and pride in accomplishments

Rewards are significantly derived from recognition, accomplishments, and work challenge

Capacity for self-development of team members

Good intrateam communications and cross-functional linkages

Shared goals and values

Self-control, accountability, and ownership

Strong ability to seek out, share, and process information; group decision-making

Ability to share risks, mutual trust, and support

High level of team member involvement toward continuous improvement of work processes regarding quality and resource effectiveness of winning the day rather than looking for what is best for the team. There is also the possibility that lower-status individuals are being ignored, thus eliminating a potentially valuable resource

## 68.6 BARRIERS TO HIGH TEAM PERFORMANCE

As functioning groups, project teams are subject to all of the phenomena known as *group dynamics*. As a highly visible and focused work group, the project team often takes on a special significance and is accorded high status with commensurate expectations of performance. Although these groups bring significant energy and perspective to a task, the possibilities of malfunctions are great. A myth is that the assembly of talented and committed individuals automatically results in synergy and renders such a team impervious to many of the barriers commonly found in a project team environment. These barriers, while natural and predictable, take on additional facets in technology-oriented project situations that are exposed to the various challenges shown in Table 68.1. Understanding these barriers, their potential causes, and influencing factors is an important prerequisite for managing them effectively and hence facilitating a work environment where team members can focus their energy on desired results. The most common barriers to effective team performance are discussed below in the context of technology-oriented work environments.

### 68.6.1 Different Points of View

The purpose of a project team is to harness divergent skills and talents to accomplish project objectives. Having drawn upon various departments or perhaps even different organizations, there is the strong likelihood that team members will naturally see the world from their own unique point of view. There is a tendency to stereotype and devalue “other” views. Such tendencies are heightened when the project team includes people from different countries with different “work cultures,” norms, values, needs, and interests. Further, these barriers are often particularly strong in highly technical project situations where members speak their own codes and languages. In addition, there may be historical conflict among organizational units. In such a case, representatives from these units will more than likely carry their prejudices into the team and potentially subvert attempts to create common objectives. Often these judgments are not readily known until the team actually begins its work and conflicts start developing.

### 68.6.2 Role Conflict

Project and matrix organizations are not only the product of ambiguity; they create ambiguity as well. Team members are actually in multiple roles and often report to different leaders, possibly creating conflicting loyalties. As “boundary role persons,” they often do not know which constituency to satisfy. The “home” group or department has a set of expectations that might be at variance with the project team organization’s. For example, a department may be run in a very mechanistic, hierarchical fashion while the project team may be more democratic and participatory. Team members might also experience time conflicts due to multiple task assignments that overlay and compete with traditional job responsibilities. The pull from these conflicting forces can either be exhilarating or a source of considerable tension for individual team members.

### 68.6.3 Power Struggles

While role conflict often occurs in a horizontal dimension (i.e., across units within the same division or across geographic and culture regions), conflict can also occur vertically as different authority levels are represented on the team. Individuals who occupy powerful positions elsewhere can try to recreate—or be expected to exercise—that influence in the group. Often such attempts to impose ideas or to exert leadership over the group are met with resistance, especially from others in similar positions. There can be subtle attempts to undermine potentially productive ideas, with the implicit goal of winning the day rather than looking for what is best for the team. There is also the possibility that lower-status individuals are being ignored, thus eliminating a potentially valuable resource.\* While some struggle for power is inevitable in a diverse group, it must be managed to minimize potentially destructive consequences.

\*An example of such power struggles occurred in a quality of work life *project team* in an engineering organization.<sup>25</sup> The team was set up as a collaborative employee-management group designed to devise ways to improve the quality of work life in one division of a utility company. The membership of this representative group was changed halfway through the project to include more top managers. When the managers came aboard, they continued in the role of “manager” rather than “team member.” Subsequently, the weekly meetings became more like typical staff meetings than creative problem-solving sessions. Although there was considerable resistance, the differences were pushed under the table, as the staff people did not wish to confront their supervisors. There was also considerable posturing among the top managers in an effort to demonstrate their influence, although none would directly attempt to take the leadership position.

### 68.6.4 Group Think

This phenomenon of groups was identified by Janis<sup>26</sup> as a detriment to the decision-making process. It refers to the tendency for a highly cohesive group to develop a sense of detachment and elitism. It can particularly afflict groups that work on special projects. In an effort to maintain cohesion, the group creates shared illusions of invulnerability and unanimity. There is a reluctance to examine different points of view, as these are seen as dangerous to the group's existence. As a result, group members may censor their opinions as the group rationalizes the inherent quality and morality of its decisions. Because many project teams typically are labelled as special and often work under time pressure, they are particularly prone to the dangers of *group think*.

### 68.7 BUILDING SELF-DIRECTED TEAMS

As the work environment is changing toward higher levels of effectiveness, speed and quality, we are also encountering higher technical complexities, interdependencies across functional lines and geographic boundaries, and a critical need for innovative performance. With the changing environment, self-directed work teams are gradually replacing the more traditional, hierarchically structured project team. These emerging team processes are seen as significant tools for orchestrating the multifunctional activities that come into play during the execution of modern technology-based developments. As summarized in Table 68.3, these processes rely strongly on group interaction, resource- and power-sharing group decision-making, accountability, self-direction, and control. They also rely to a considerable extent on member-generated performance norms and evaluations, rather than hierarchical guidelines, policies, and procedures. While leveraging human resources via self-directed teams can improve project performance, with better resource utilization, speed and higher levels of innovation, it often requires radical changes from traditional management philosophy regarding organizational structure, motivation, leadership, and control. Leading such self-directed teams also requires a great deal of team management skills and overall guidance by senior management.

The key to continuous team development and effective team leadership is keeping the team focused. Field studies on multidisciplinary work groups show consistently and measurably that to be effective, managers and project leaders must not only recognize the potential drivers and barriers of high team performance, but also must know when in the life cycle of the project they are most likely to occur.<sup>24,27,28</sup> They also observe early warning signs of problems. A keen sensitivity to these warning signs and their diagnostics can help in dealing with developing problems in their early stages. Table 68.4 summarizes the most common warning signs of potential team performance problems. The list can also be used as metrics for benchmarking team strength, health, and potential for further development. Team leaders can focus on preventive actions and foster a work environment that is conducive to team building as an ongoing process. A crucial component of such a process is the sense of ownership and commitment of the team members. Team members must become stakeholders in the project, buying into the goals and objectives of the project, and willing to focus their efforts on the desired results.

Specific management insight has been gained from studies by Gemmill,<sup>27</sup> Thamhain,<sup>3-5</sup> and Wilmon<sup>11,29</sup> into work group dynamics of project teams. These studies clearly show significant correlations and interdependencies among work-environment factors and team performance. They indicate that high team performance involves four primary factors: managerial leadership, job content, personal goals and objectives, and work environment and organizational support. The actual correlation of 60 influence factors to the project team characteristics and performance provided some interesting insight into the strength and effect of these factors. One of the important findings was that only 12 of the 60 influence factors that were examined were found to be statistically significant. Other factors seem to be much less important to high team performance. Listed below are the 12 factors, classified as drivers, associated most strongly project team performance:

1. Professionally interesting and stimulating work
2. Recognition of accomplishment
3. Clear project objectives and directions
4. Sufficient resources
5. Experienced management personnel
6. Proper technical direction and leadership
7. Mutual trust, respect, low conflict
8. Qualified project team personnel
9. Involved, supportive upper management
10. Professional growth potential
11. Job security
12. Stable goals and priorities

**Table 68.4 Early Warning Signs of Team Performance Problems**


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Observations and/or team member perceptions	Project perceived as unimportant Unclear task/project goals and objectives Excessive conflict among team members Unclear mission and business objectives Unclear requirements Perceived technical uncertainty and risks Low motivation, apathy, low team spirit Little team involvement during project planning Low degree of mutual trust and respect Disinterested, uninvolved management Lack of leadership credibility Poor communications among team members and/or support groups Problems attracting and holding team members Unclear roles, role conflict, power struggle Indecisions No agreement on project plans Surprises, contingencies, subtle problems Lack of performance feedback Professional skill obsolescence Perception of inadequate rewards and incentives Poor recognition, visibility of accomplishments Work not interesting, no challenge Perceived problems Fear of failure, potential for penalties Fear of evaluation Mistrust, collusion, protectionism Excessive documentation Excessive requests for directions Complaints about insufficient resources Strong resistance to change
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It is interesting to note that these factors not only correlated favorably with the direct measures of high project team performance, such as technical success and on-time/on-budget performance, but also were positively associated with other desired team characteristics, such as commitment, effective communications, creativity, quality, change orientation, and needs for achievement. These measures are especially important in multicultural, multinational environments where management control is weak through traditional chain-of-command channels but relies more on the norms and desires established by the team and its individual members. What we find consistently is that successful project leaders pay attention to the human side. They seem to be effective in fostering a work environment conducive to innovative creative work, where people find the assignments challenging, leading to recognition and professional growth. Such a professionally stimulating environment also seems to lower communication barriers and conflict and enhanced the desire of personnel to succeed. Further, this seems to increase organizational awareness as well as the ability to respond to changing project requirements.

In addition, effective teams have good leadership. Team managers understand the task, the people, the organization, and all the factors crucial to success. They are action-oriented, provide the needed resources, properly direct the implementation of the project plan, and help in the identification and resolution of problems in their early stages.

Management and team leaders can help a great deal in keeping the project team focused. They must communicate and update organizational objectives and relate them to the project and its specific activities in various functional areas and geographic regions. Management can help in developing priorities by communicating project parameters and objectives related to organizational needs. While operationally the project might have to be fine-tuned to changing environments and evolving solutions, the top-down mission and project objectives should remain stable. Project team members need

this stability to plan and organize their work toward unified results. This focus is also necessary for establishing benchmarks and integrating innovative activities across all disciplines. Moreover, clear goal-focus stimulates interest in the project and unifies the team. Ultimately it helps to refuel the commitment to established project objectives in such critical areas as technical performance, timing, and budgets.

## **68.8 RECOMMENDATIONS**

A number of recommendations should help managers in dealing with people effectively. Special focus is on technology-based situations that involve the integration of multidisciplinary task teams.

### **68.8.1 Clear Assignment**

At the outset of any new assignment, project leaders should discuss with their team members the overall task, its scope, and objectives. Involvement of the people during the early phases of the assignment, such as bid proposals, project and product planning, can produce great benefits toward plan acceptance, realism, buy-in, personnel matching, and unification of the task team. A thorough understanding of the task requirements comes usually with intense personal involvement, which can be stimulated through participation in project planning, requirements analysis, interface definition, or a producibility study. In addition, any committee-type activity, presentation, or data gathering will help to involve especially new team members and facilitate integration. It also will enable people to better understand their specific tasks and roles in the overall team effort. Senior management can help develop a “priority image” and communicate the basic project parameter and management guidelines.

### **68.8.2 Clear Goals and Objectives**

Management must communicate and update the organizational goals and project objectives. The relationship and contribution of individual work to overall business plans and their goals, as well as of individual project objectives and their importance to the organizational mission must be clear to all personnel.

### **68.8.3 Effective Planning**

Effective planning early in the life cycle of a project or specific mission will have a favorable impact on the work environment and team effectiveness. Because engineering managers and the project leaders have to integrate various tasks across many functional lines, proper planning requires the participation of the entire project team, including support departments, subcontractors, and management. Phased project planning (PPP), stage-gate concepts (SGC), and modern project-management techniques provide the conceptual framework and tools for effective cross-functional planning and organizing the work toward effective execution.

### **68.8.4 Image Building**

Building a favorable image for an ongoing project, in terms of high priority, interesting work, importance to the organization, high visibility, and potential for professional rewards, is crucial for attracting and holding high-quality people. Senior management can help develop a “priority image” and communicate the key parameters and management guidelines for specific projects. Moreover, establishing and communicating clear and stable top-down objectives helps in building an image of high visibility, importance, priority, and interesting work. Such a pervasive process fosters a climate of active participation at all levels, helps attract and hold quality people, unifies the team, and minimizes dysfunctional conflict.

### **68.8.5 Process Definition and Team Structure**

The proper setup and communication of the operational transfer process, such as concurrent engineering, stage-gate process, CAD/CAE/CAM, and design-build, is important for establishing the cross-functional linkages necessary for innovative engineering performance. Management must also define the basic team structure for each project early in its life cycle. The project plan, task matrix, project charter, and operating procedure are the principal management tools for defining organizational structure and business process.

### **68.8.6 Interesting Work**

Whenever possible, managers should try to accommodate the professional interests and desires of their personnel. Interesting and challenging work is a perception that can be enhanced by the visibility of the work, management attention and support, priority image and the overlap of personnel values and perceived benefits with organizational objectives. Making work more interesting leads to increased involvement, better communication, lower conflict, higher commitment, stronger work effort, and higher levels of creativity.

### 68.8.7 Senior Management Support

It is critically important that senior management provide the proper environment for an engineering team to function effectively. At the onset of a new development, the responsible manager needs to negotiate the needed resources with the sponsor organization, and obtain commitment from management that these resources will be available. An effective working relationship among resource managers, project leaders, and senior management critically affects the perceived credibility, visibility, and priority of the engineering team and their work.

### 68.8.8 Clear Communication

Poor communication is a major barrier to teamwork and effective engineering performance. Management can facilitate the free flow of information, both horizontally and vertically, by work space design, regular meetings, reviews and information sessions. In addition, modern technology, such as voice mail, e-mail, electronic bulletin boards and conferencing, can greatly enhance communications, especially in complex organizational settings.

### 68.8.9 Commitment

Managers should ensure team-member commitment to their project plans, specific objectives, and results. If such commitments appear weak, managers should determine the reason for such lack of commitment of a team member and attempt to modify possible negative views. Because insecurity is often a major reason for low commitment, managers should try to determine why insecurity exists, then work to reduce the team members' fears and anxieties. Conflict with other team members and lack of interest in the project may be other reasons for such lack of commitment.

### 68.8.10 Leadership

Leadership positions should be carefully defined and staffed for all projects and support functions. Especially critical is the credibility of project leaders among team members, with senior management and with the program sponsor, for the leader's ability to manage multidisciplinary activities effectively across functional lines.

### 68.8.11 Reward System

Personnel evaluation and reward systems should be designed to reflect the desired power equilibrium and authority/responsibility-sharing of an organization. A QFD-philosophy helps to focus efforts toward desired results on company internal and external customers to foster a work environment that is strong on self-direction and self-control.

### 68.8.12 Problem Avoidance

Engineering managers should focus their efforts on problem avoidance. That is, managers and team leaders, through experience, should recognize potential problems and conflicts at their onset and deal with them before they become big and their resolutions consume a large amount of time and effort.

### 68.8.13 Personal Drive and Leadership

Managers can influence the work environment by their own actions. Concern for the team members, the ability to integrate personal needs of their staff with the goals of the organization, and the ability to create personal enthusiasm for a particular project can foster a climate of high motivation, work involvement, open communication, and ultimately high engineering performance.

## 68.9 A FINAL MESSAGE

Sophisticated people skills are crucial to effective role performance in technology-based organizations. Managers have to cross organizational, national, and cultural boundaries and work with people over whom they have little or no formal control. Alliances and collaborative ventures have forced these managers to focus more on cross-boundary relationships, negotiations, delegation, and commitment than on establishing formal command- and control-systems. To be effective in such a team environment, the manager must understand the interaction of organizational and behavioral variables. This understanding will facilitate a climate of active participation, minimal dysfunctional conflict, and effective communication. It will also foster an ambience conducive to chance, commitment, and self-direction. No single set of broad guidelines exists that guarantees instant managerial success. However, by understanding the variables and the interrelationships that drive people toward high performance in a technology-oriented environment, managers can examine and fine-tune leadership styles, actions, and resource allocations toward continuing organizational improvement.

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