
Human Needs, Motivation, and the Results of the NASA Culture Surveys

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An organization is defined by Mondy et al. (p. 198) as two or more people working together in a coordinated manner to achieve group results. When run well, an organization will provide synergism to the activities and efforts of its members. Through division of labor and specialization, the members can contribute their individual skills, expertise and effort toward accomplishing goals that are far beyond the capability of any single individual. Modern research and engineering projects would not be possible without large organizations because both specialization and cooperation are essential in addressing the complex and interdisciplinary problems of the modern world.

Unfortunately, the act of organizing can inhibit or limit individual behavior, working conditions and job satisfaction. Sometimes the limitations are easy to see or discover and are not difficult to understand. That is the case with working hours and office space. In other cases, such as status and rank, they are much more difficult to interpret because they are the result of complex cultural interactions. Wage scales and the apportionment of fringe benefits are examples of limitations that have both a cultural and an economic origin.

The limitations that an organization member encounters in the workplace may come from experience that has been codified and formalized into policies and procedures. Or they may be part of the unwritten corporate culture and folklore. Limitations may sometimes arise when responsibilities are transferred from the corporate entity to its representatives. In all effective organizations, members voluntarily give up some of their individuality and freedom for the common good.

The limitations that an organization imposes on its members can cause dissatisfaction and may

produce unhappy employees who will not participate to the extent of their potential in achieving the organization's goals and mission. This loss of interest is called "demotivation" (Mondy, 300). If the dissatisfaction pervades an organization, the inefficient use of the human resources will lead to poor organizational performance. Thus, a project manager must understand and minimize these demotivators.

But even eliminating all the demotivators, or sources of dissatisfaction, may not result in motivated employees. Motivation, which is defined as the desire to put forth effort in pursuit of organizational objectives (Mondy, 292), is a higher goal than avoiding dissatisfaction. What causes motivation must also be understood because maintaining employee morale and motivation is an important project management duty.

■ Scientific Management

The systematic study of the factors that enhance workplace efficiency is called scientific management. It had its origins in the work of Frederick Taylor at the beginning of this century. He and his followers advocated systematizing efficient work procedures by using the scientific method to analyze management problems and situations.

In a classical application of scientific management, Taylor studied the pig iron operation of Bethlehem Steel Company (Taylor, 41-47). He used what are now known as time-and-motion studies to determine that the average worker output was 12.5 tons per person per day. He then prescribed more efficient work methods and standardized rest periods. The result was that average output rose to 48 tons per person per day. The additional efficiency, combined with a new incen-

tive pay system that he also proposed, increased the worker's daily pay from \$1.15 to \$1.85. Thus, both the organization and its members benefited from Taylor's work.

Taylor's followers embraced his methods and techniques, and for some time it was thought that scientific management was all that was needed to improve the efficiency of any organization, especially those involved in manufacturing. They performed time-and-motion studies to develop efficient work procedures and labor-saving tools, and then directed employees in a rational and scientific way.

Beginning in 1924, Elton Mayo and others performed a series of studies at the Western Electric Company's plant in Hawthorne, on Chicago's west side (Mondy, 68). One study looked at how lighting affects worker productivity. Illumination was first increased to extreme brightness, and then it was reduced in stages to the point where materials could hardly be seen. Workers maintained or even exceeded their original output. Similar results were obtained for wage incentive, supervision styles, length and frequency of rest periods, and length of the work week.

The Hawthorne study led Mayo to speculate that something other than the variables under investigation was having an effect on worker productivity. While observing and interviewing the workers, he noticed that merely by participating in the experiment they felt special. Their morale improved and that caused productivity to go up. The influence that researchers can have on the behavior of the people they study is now known as the Hawthorne effect. It is proof that morale and motivation are at least as important as the physical environment and the tools available to workers.

■ Motivation Theories

Managers may attempt to motivate their workers by using rewards, punishment, and charisma, or

by exercising authority. The method used will depend on their beliefs about the causes of motivation. By widening their knowledge of this subject, managers can use the appropriate motivating technique and will make their workers and the organization more productive and efficient.

What causes motivation and what diminishes it have been the subjects of much research. Most theories are based on observations of human nature. Table 1 lists some theories widely accepted within the management science community. Keep in mind that human behavior is complex and impossible to generalize. It varies from person to person and depends on the particular situation. No single theory will be valid all the time.

Douglas McGregor's Theory X and Theory Y propose that people either dislike work and responsibility (Theory X) or enjoy self-direction and achievement (Theory Y). Chris Argyris calls Theory Y behavior "mature behavior." He proposes that only immature people are passive and lack initiative. Both authors believe that most people conform to Theory Y assumptions in a healthy work environment.

Argyris sees an unhealthy work environment as characterized by overspecialization that limits self-expression, by a rigid chain of command, or by an overpowering leader. In such an environment workers have little control over their work day. They are expected to be passive and subservient and must have a short time perspective. According to the theory, an unhealthy work environment will cause the worker to cope by escaping (e.g., leaving the firm or seeking promotion or transfer), by fighting (e.g., joining a union or seeking a way of exerting pressure on the organization), or by adapting and developing an attitude of apathy, indifference, or cynicism. Flight, fight or fatigue, Argyris judges the last option to be the worst choice for the worker's mental health.

Theory X and Theory Y do not provide guidelines for all situations. They do not explain situa-

Table 1. Motivation Theories

Theory	Description
Theory X	People dislike work and need to be coerced or bribed to do their jobs.
Theory Y	People enjoy work, will self-direct if allowed, and will strive to succeed in the workplace.
Self-fulfilling theory	People will attempt to fulfill their leader's expectations.
Reinforcement theory	People become motivated or demotivated when faced with situations similar to past experiences.
Needs theories	People become motivated when they attempt to fulfill their unmet needs.
Equity theory	People become demotivated when, in their assessment, other employees are being rewarded beyond their contributions to the organization.
Expectancy theory	People become motivated when there is a high probability of achieving desirable goals.

tions where good leadership can change the performance of a worker or an organization. One explanation for the change in behavior from Theory X to Theory Y is the self-fulfilling theory of human behavior (Cf. J. L. Single). This is the idea that positive or negative expectations will significantly influence worker behavior. Thus, according to the theory, a unique characteristic of superior leaders and managers is their ability to create high performance expectations that the workers fulfill.

Another theory based on innate human behavior is the reinforcement theory. It proposes that people's behavior can be explained in terms of positive or negative past outcomes. Thus, by rewarding desired behavior and punishing what is not wanted, managers can supposedly control the behavior of their workers. Psychologist B.F. Skinner even suggests that by making use of punishment and rewards over a period of years, people can be controlled and shaped while still feeling free. Although this theory is strong justification for managers practicing organizational behavior modification, it has been criticized as being manipulative and autocratic (Mondy, 296). It also assumes that motivation comes from the

environment and is external to the person, overlooking the simple fact that people are rational, thinking entities who control their own actions.

Some theories attempt to explain motivation as the drive to satisfy personal needs. They are called needs theories of motivation. Table 2 compares four of these theories. These theories propose that motivation occurs when a person attempts to satisfy the lowest unsatisfied need. For example, if workers perceive their jobs as dangerous, they will attempt to satisfy the need for safety and thus will be motivated to change their environment to make it safer. They will concentrate their efforts in activities that satisfy their unfulfilled need for a safer environment (the lowest unsatisfied need) before attempting to fulfill any higher need for creativity. Most U.S. workers, according to Abraham Maslow, have satisfied the two lower needs (physiological and safety) to the point where their focus has shifted to the higher needs (belongingness, self-esteem, and self-actualization).

According to Frederick Herzberg's needs theory of motivation, human needs can be grouped into hygiene needs and motivators. Hygiene needs do

Table 2. Comparison of Needs Theories of Motivation

Frederick Herzberg's	Abraham Maslow's	Clayton Alderfer's	David McClelland's
Hygiene(demotivators) <ul style="list-style-type: none"> • Pay • Status • Working conditions • Fringe benefits • Policies and regulations • Interpersonal relations 	Physiological <ul style="list-style-type: none"> • Air, water, food, etc. Safety and security <ul style="list-style-type: none"> • Danger and job security Belongingness and love <ul style="list-style-type: none"> • Group acceptance 	Existence <ul style="list-style-type: none"> • Air, water, food, and safety Relatedness <ul style="list-style-type: none"> • Interpersonal relations 	Need for affiliation <ul style="list-style-type: none"> • Friendship and social activities
Motivators <ul style="list-style-type: none"> • Meaningful and challenging work • Recognition for accomplishments • Feeling of achievement • Increased responsibility • Opportunity for growth and advancement 	Self-esteem <ul style="list-style-type: none"> • Achievement recognition, and status Self-actualization <ul style="list-style-type: none"> • Use of creative talents 	Growth <ul style="list-style-type: none"> • Promotions, salary, and autonomy 	Need for achievement <ul style="list-style-type: none"> • Challenge and goal oriented Need for power <ul style="list-style-type: none"> • Influence and domination

not motivate, but they can create dissatisfaction and can thus be strong demotivators. Managers must be constantly alert to ensure that these are not hurting the organization. On the other hand, motivators can encourage the superior performance that will result in organizational synergism. The leader or manager is also responsible for using these motivators to benefit the organization.

In McClelland's needs theory of motivation, everyone has three needs: achievement, affiliation and power. But for each person, one of these needs is relatively stronger than the others. Entrepreneurs and salespeople, for example, have a high need for achievement, whereas the best managers have more moderate achievement needs (Cf. M. J. Stahl). A strong need for achievement may actually impede effective delegation of tasks. Also, needs may be cultural, as in Japanese workers having a stronger need for affiliation than U.S. workers.

The relevance of McClelland's theory is that, depending on a person's needs, incentives may be effective or ineffective. For example, a strong need for achievement may require more auto-

my, but a preference for affiliation would dictate team involvement. Hence, if a brilliant researcher with high achievement needs is required to participate in committee work, he or she may not see such a request as beneficial or desirable even if the committee's function is important to the organization. Similarly, a strong team player may feel out of place in a position of team leadership with responsibility for difficult personnel actions such as firing and performance evaluation. In both cases persons with different needs may eagerly pursue those responsibilities.

Nevertheless, in addition to theories based on human needs, other explanations for motivation have been proposed. The equity theory, credited to J. Stacy Adams, states that people base their performance on the correctness of their perceived situations. They do this by comparing their performance and rewards with those of others.

Thus, a worker may decide to stop working "hard" because someone else may get similar or greater rewards with less effort. This inequity may or may not be real, but it is the person's perception that motivates or demotivates. Hence, it is important for an organization to have fair and

open reward and promotion systems. It is also important to communicate to all employees the specific reasons for promotions and rewards.

Another theory of motivation known as expectancy theory was developed by Victor Vroom and modified by Barry Staw. It has dominated research in this field since the early 1970s. The theory states that people are motivated by the probability of achieving desirable goals. To explain motivation, expectancy theorists use the formula:

$$\text{Motivation} = E \times V \times I$$

where E denotes expectancy, the probability that effort will lead to performance; V denotes valence, the desirability of the predicted outcome; and I denotes instrumentality, the perception that rewards are tied to performance.

The expectancy theory gives managers useful guidelines for improving the motivation of their workers. First, training may be used to increase expectancy. Second, any of the needs theories listed in Table 2 will provide guidelines for increasing valence. For example, people with high security needs will value pension plans and job security guarantees, whereas those with self-actualization needs may require challenging assignments or a creative environment. Finally, to maintain instrumentality at a high level, the reward system must be fair and open, with good communication between management and workers.

Today's high-technology professionals have been characterized as highly educated, autonomy seeking, and career motivated rather than company dedicated (Cf. Glinow). Their allegiances are suspect, and they are quick to change employers in search of technical challenge or more autonomy in their work (Bailyn and Raelin). They expect to be rewarded for their work and expertise, and they abide by ethics dictated by their professional groups and not by their employers. In short, their

ties to their professional peers are stronger than those to their employers.

These professionals are motivated by different needs than those of their organizational counterparts, including managers and other support personnel (see Table 3). Numerous surveys have found that technical professionals get the most satisfaction from challenging work, autonomy, and variety of work assignments but that managers are challenged primarily by the opportunity for promotion (Cf. Resnick). Managers, by training and personality traits, prefer predictability and control in their areas of responsibility, but technologists thrive in a challenging and changing technical environment.

Table 3. Motivators: Rewards Most Valued By High Technology Professionals

Reward	Motivator
Professional	Opportunity to work with top-flight professionals Freedom to make own decisions Intellectually stimulating work environment Forward-looking organizational goals Ability to affect national goals and policy
Job content	Productive atmosphere Flexible work hours Long-term project stability Opportunity to address important human needs Patriotic projects Projects of altruistic nature
Career	Work for a leading-edge company Diverse opportunities for personal growth and advancement Opportunity for self-expression Opportunity to play a role in the company's future Opportunity to participate in technological breakthroughs
Social status or prestige	Desirable location Open-door management Recreational facilities
Financial	Twice-yearly salary reviews Compensation for unused leave Cash bonuses

■ Motivators and Demotivators for Scientists and Engineers

The rewards listed in Table 3 address motivators as defined by Herzberg. Demotivators or hygiene factors related to security and affiliation needs have been identified by Resnick-West and Von Glinow and are listed in Table 4. Demotivators arise because the needs of the organization sometimes conflict with the needs of the professional. If a proper balance between these two diverging sets of needs is not found, both the organization and the professionals will suffer.

Table 4. Demotivators: Culture Clashes Between Professionals and Organizations

Category	Organization	Professional
Experts clash	Hierarchical control ("The boss is right")	Expert control ("Let experts decide")
Standards clash	Company policies/rules	Professional standards
Ethics clash	Company secrecy	Dissemination of information
Commitment clash	Company loyalty	Loyalty to profession
Autonomy clash	Organizational decision-making	Desire for autonomy

Donald C. Pelz conducted research to determine what made researchers productive. He concluded that some degree of creative tension between sources of stability and security and sources of disruption was needed to raise researchers' productivity. Table 5 summarizes the eight creative tensions that he identified. These tensions allow researchers to question and gauge the usefulness of their work in the real world. Data supporting the influence of these tensions on researcher productivity confirms this.

Pelz's research shows that scientists and engineers increase their technical contributions when each performs more than one task simultaneously

and has more than one area of specialization. With multiple specialties, the enhanced performance is directly proportional to the number of specialties. With multiple tasks the enhanced performance continues until the researcher has four simultaneous functions or projects. Additional tasks may result in over commitment and inefficiencies that will be detrimental to performance. Similar results plot the performance of scientists and engineers as a function of the decision-making sources including supervisor, project managers, peers, and upper management. Effectiveness correlates strongly to the number of decision-making sources the researcher has to consider.

This appears to contradict the theory that researchers will perform best when isolated from distractions. Apparently, the cross-fertilization of ideas and interpersonal relationships that are possible when a researcher is involved in a limited number of projects with more than one source of direction, before making a decision, has a positive and desirable influence on his or her output. This synergism should be the goal of any research organization.

Additional research by Pelz illustrates the nature of goal-setting synergism. Performance is higher for scientists when the goals are set by the scientist in conjunction with their supervisors than when they are set by the supervisor alone or by scientists alone. For engineers, effectiveness is maintained even when working alone or only with peers. This result may reflect the more product-oriented work performed by engineers. Two lessons appear evident from such research. First, when the goal is clear, motivated workers will achieve it with or without the help of management. Second, when the goal is not clear, the best results are achieved when both the manager and the worker jointly define the task. More research shows that although too little autonomy is not conducive to high productivity, complete independence is not the optimum either. Again, this reinforces the theory that interaction is a neces-

Table 5. Eight Creative Tensions

SECURITY	CHALLENGE
Tension 1- Multiple Tasks	
(None listed in the literature)	Effective scientists and engineers in both research and development laboratories did not limit their activities either to pure science or to application but spent some time on several kinds of R&D activities, ranging from basic research to technical services.
Tension 2 - Interaction	
Effective scientists were intellectually independent their or self-reliant; they pursued their own ideas and valued freedom.	But they did not avoid other people; they and their colleagues interacted vigorously.
Tension 3 - Multiple Skills	
(a) In the first decade of work, young scientists and engineers did well if they spent a few years on one main project.	But young non-Ph.D.s also achieved if they had several skills, and young Ph.D.s did better when they avoided narrow specialization.
(b) Among mature scientists, high performers had greater self-confidence and an interest in probing deeply.	At the same time, effective older scientists wanted to pioneer in broad new areas.
Tension 4 - Autonomy	
(a) In the loosest departments having minimum coordination, the most autonomous individuals with maximum security and minimum challenge were ineffective.	More effective were those persons who experienced stimulation from a variety of external or internal sources.
(b) In departments having moderate coordination it seems likely that individual autonomy permitted a search for the best solution to important problems faced by the organization.
Tension 5 - Influence and Goal Setting	
Both Ph.D.s and engineers contributed most when they strongly influenced key decision-makers but also when persons in several other positions had a voice in selecting their goals.
Tension 6 - Interaction	
High performers named colleagues with whom they shared similar sources of stimulation (personal support) but they differed from colleagues in technical style and strategy.
Tension 7 - Teams	
R&D teams were of greatest use to their organizations at that "group age" when interest in narrow specialization had increased to a medium level but interest in broad pioneering had not yet disappeared.
Tension 8 - Interaction	
In older groups that retained vitality the members preferred each other as collaborators yet their technical strategies differed and they remained intellectually combative.

sary ingredient in achieving high productivity in a research environment.

These results seem to agree with Rensis Likert's research in service organizations. He concluded that high performers felt that they had a great deal of influence in setting their own goals but that the higher echelons had much influence also. He noticed that there was more total influence on high performers than on low performers. This observation conflicts with some older theories of organizational behavior that assume a fixed quantity of influence to be shared between management and workers. These older theories propose that if workers have more influence, management has less. Likert and Pelz propose that more total influence is possible and desirable.

The clear message in these observations is that in research organizations, higher performance requires interaction between members of the organization. Additional research repeats the message and shows clearly that daily interactions are better than less frequent interactions. This conclusion also applies to projects, especially in the early stages of concept definition. Finally, the research shows that the best interactions are consensus and influence as opposed to autocratic management, where the manager alone determines the goals of the workers.

Interaction between organization members can be encouraged by promoting participation in committees and project teams. The practice of concurrent engineering, for example, requires teams that include representatives from research, marketing, engineering, production, and others, according to Carter and Baker. The fast and unconstrained interaction by these specialists in a small work group allows quick identification of key issues and agreement on the best solutions. The result is reduced development time for new products (Cf. Sprague et al.).

Further research shows that work groups tend to become less effective with the passage of time.

Their performance decreases because interaction decreases. As group members get to know each other, interactions become predictable, reducing the need for consultation and idea exchange. Old groups may run out of new ideas. Management should be on the lookout for teams and committees that need overhauling.

These results are consistent with the research by Vollmer et al. Their work is summarized in Figures 1 and 2 for an aerospace industry research laboratory and for a government defense research laboratory, respectively. The vertical axis in the chart, general job satisfaction, contains the hygiene factors; the horizontal axis, professional productivity, contains the motivation factors. The charts are constructed so that issues can be evaluated for their effect on satisfaction (hygiene) and productivity (motivation). For example, in both cases, productivity and satisfaction are associated with freedom to influence the choice of research assignment. Adequate salary is not a factor in productivity but may be a factor in job satisfaction. An inadequate salary will cause dissatisfaction, but salary in excess of that which causes satisfaction will not produce more satisfaction. Clearly, salary is a hygiene factor.

■ Motivation of NASA Employees

To study the validity of the motivation theories discussed previously, the results of two culture surveys of NASA employees were analyzed. The responses in the surveys were compared with the theories to determine which theories best explain the results. The first survey was performed in December 1986 and the second in the spring of 1989. In the interim, Agency management implemented new procedures to change the NASA culture in a positive way.

The results from the surveys are included in Figures 3 to 11. Figure 3 describes the rating system for the questions. A maximum of 5 was possible for each question. A rating of 1 means that the statement is not perceived as true by the per-

PROFESSIONAL PRODUCTIVITY		
G E N E R A L J O B	IS ASSOCIATED WITH	IS NOT ASSOCIATED WITH
	<ul style="list-style-type: none"> • Freedom of choice in research assignments • Consultation with management on research decisions • Opportunity for promotion in own research field 	<ul style="list-style-type: none"> • Opportunity to do interdisciplinary research • Opportunity to do research with members of own discipline • Opportunity to do basic research • Adequate salary • Adequate technical assistance • Opportunity for promotion into management positions • Freedom in day-to-day research activities
	None	<ul style="list-style-type: none"> • Opportunity to do applied research • Opportunity to keep up-to-date on scientific developments • Adequate funds to support individual research interests • Adequate laboratory equipment • Opportunity to persuade sponsor to support research • Recognition by name in connection with research • Opportunity to attend professional meetings • Opportunity to publish research findings
Figure 1. Incentive in Relation to Professional Productivity and General Job Satisfaction for Applied Researchers		
S A T I S F A C T I O N	IS ASSOCIATED WITH	IS NOT ASSOCIATED WITH
	<ul style="list-style-type: none"> • Freedom of choice in research assignments • Opportunity to do basic research 	<ul style="list-style-type: none"> • Opportunity to do applied research • Recognition by name in connection with research • Opportunity to attend professional meetings • Opportunity for promotion into management positions • Freedom in day-to-day activities
	None	<ul style="list-style-type: none"> • Opportunity to do interdisciplinary research • Opportunity to do research with members of own discipline • Consultation with management on research decisions • Opportunity to keep up-to-date on scientific developments • Adequate technical assistance and laboratory equipment • Adequate funds to support individual research interests • Adequate salary • Opportunity to publish research findings • Opportunity for promotion in own research field
Figure 2. Incentive in Relation to Professional Productivity and General Job Satisfaction for Staff Scientists		

son answering the question. A rating of 5 means that the statement is perceived as completely true. The aggregate responses in the figures represent such a large number of responses that small variations are significant and meaningful. For example, a response of 4.3 is more true than 4.2.

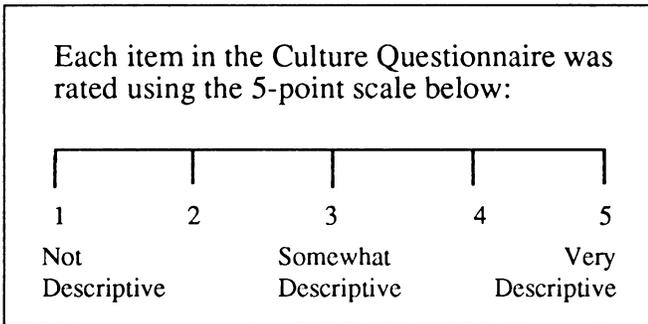


Figure 3. Culture Surveys Rating System

Figures 4 to 6 present the ratings for questions about work satisfaction, work unit climate, and NASA culture. Figure 4 shows that NASA employees are very proud to work for the Agency. The rating is 4.4 out of a possible 5.0. But the responses are not as high for the Center, the work unit and the job. Although the ratings are significantly higher than “somewhat descriptive,” there is a steady decline from NASA to the Center, to the work unit, to the job.

This situation represents an opportunity and a challenge to Agency management. The goal should be to raise the level of employee satisfaction with the job, the work unit, and the Center to the level of satisfaction and pride resulting from association with NASA. This is possible because employees are favorably disposed to work for the Agency. The solution is to make unit managers aware of the situation and to give them the skills to fulfill their workers’ expectations. If the issue of satisfaction is addressed at the work unit level, a successful outcome will be felt in increased satisfaction with the job, the Center and NASA.

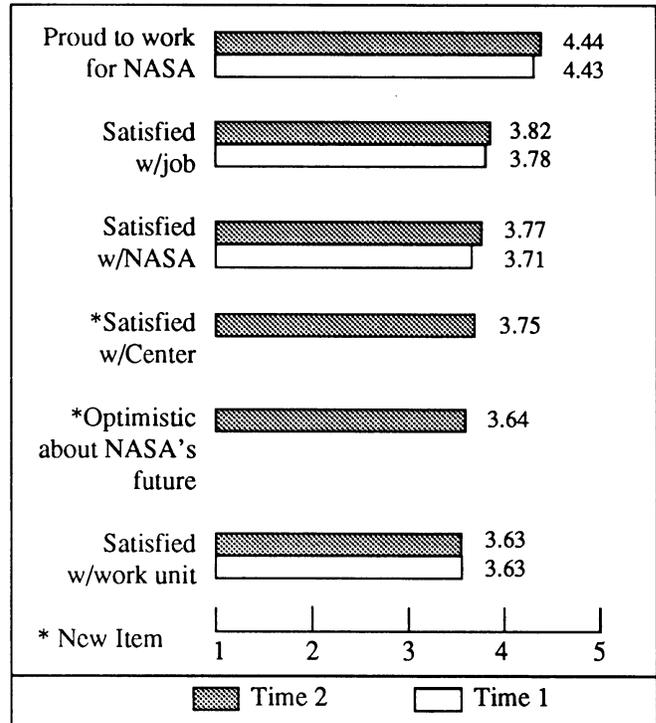


Figure 4. Survey Results: Work Satisfaction

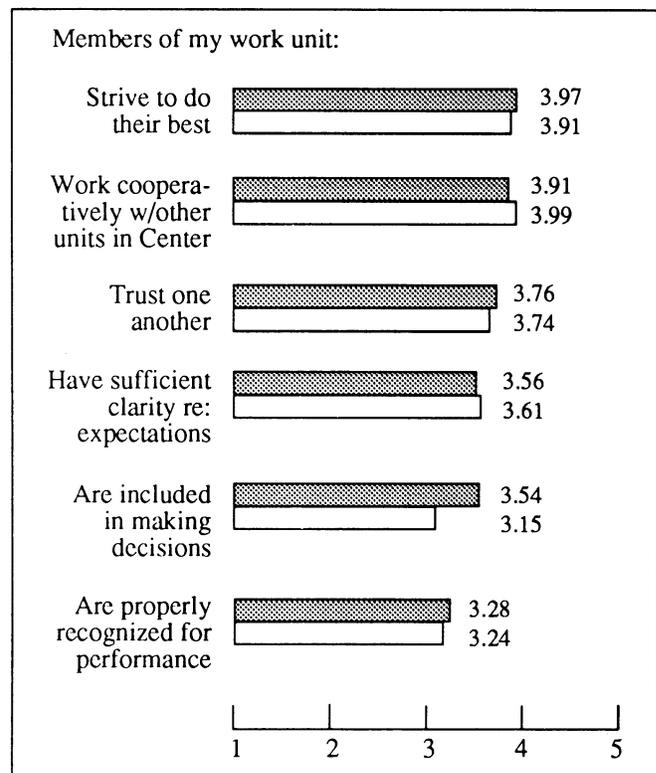


Figure 5. Survey Results: Work Unit Climate

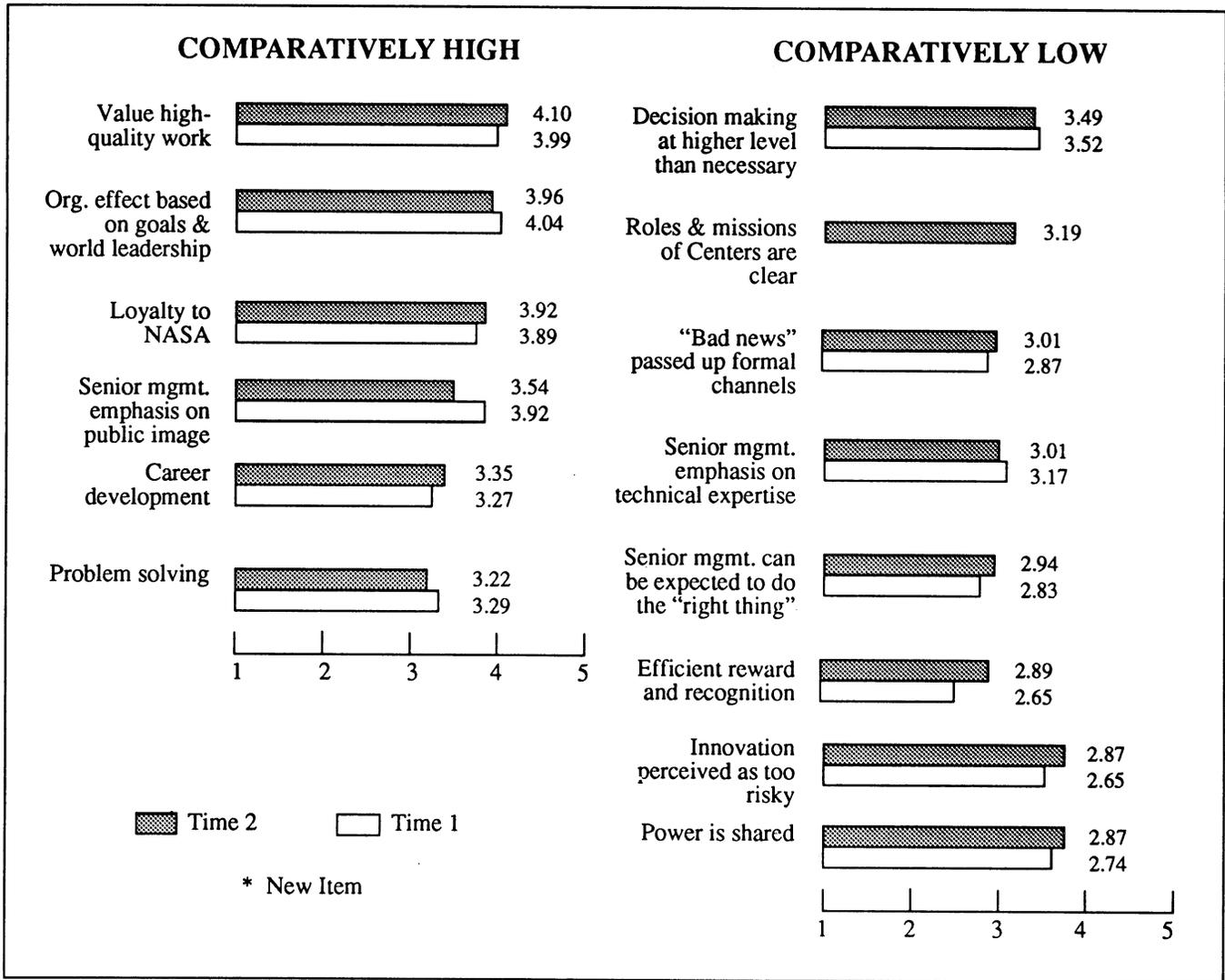


Figure 6. Survey Results: NASA Culture

Both surveys indicate that employee satisfaction is high and that employees are optimistic about the future. A picture emerges of a work force that is materially satisfied, all things considered, and feels secure in its jobs. Figure 5 shows that teamwork is accepted, and that people trust and respect their coworkers but that management is not communicating goals and expectations with clarity. Also, unit members would like to get more recognition for their work. Note that on the question "Members of my work unit are included in making decisions that affect their work" the rating was 3.15 in the first survey and 3.54 in the second, a large improvement.

Apparently, the efforts to change the NASA culture after the Challenger accident were successful and have resulted in more low-level participation in the decision-making process.

Figure 6 deals with perceptions of the NASA culture. It is not surprising that most responses agree that the Agency values high-quality work and world leadership. Loyalty to NASA is also perceived as being part of the NASA culture. A significant drop is noted for "career development" and an even lower rating was recorded for "sufficient reward and recognition." Therefore, these two areas are not perceived as being important in

the NASA culture. Both areas address the self-esteem and self-actualization needs of the employees and offer an opportunity for NASA management to motivate the work force.

The significant increase in participative management could be improved further. Responses to "power is shared" yielded a 2.87 rating, which is less than "somewhat descriptive." This is corroborated by the perception that decision-making takes place at higher levels than necessary, a 3.49 rating, which is "somewhat descriptive."

Figures 7 to 11 compare what NASA employees perceive to what they think should be. Under the column "what is," the high quadrant lists responses with ratings higher than 3.5 and the low quadrant lists items ranked lower than 3.5. The "what should be" high quadrant gives the percentage of responses that listed that item. For the NASA culture (Figure 9), the "what should be" includes three self-esteem and self-actualization motivators and two standards-clash issues. The respons-

	WHAT IS:	WHAT SHOULD BE:
HIGH	Value high quality work	Value high-quality work - 66%
	Value excellence	Maintain expertise within NASA - 60%
	Expect long NASA career	Value excellence - 57%
	Base effectiveness on image as world leader	Sufficient individual reward/recognition - 50%
LOW	Employees very loyal to NASA	Clear roles/missions of NASA installation - 43%
	Sufficient individual reward and recognition	
	Agency senior management can be expected to do the right thing	
	People willing to share power	
	Clear roles and missions of NASA installations	

Figure 7. NASA Culture Comparison

es value "high-quality work" and "value excellence" demonstrate pride in the work done and address fulfillment of self-actualization needs. "Sufficient individual reward and recognition" is a self-esteem issue. "Maintain expertise within NASA" probably refers to the practice of subcontracting certain tasks. Subcontracting is an Agency policy and can be classified as a standards clash. "Clear roles" is also a standards clash. Both standards clashes are demotivators.

The "what is" responses "value high-quality work" and "value excellence" in Figure 7 are in agreement with "what should be." However, the "what is" column also includes some hygiene needs, such as "expect long NASA career" (safety and security) and loyalty to NASA (belongingness). That these needs do not appear in the "what should be" column indicates that hygiene needs have ceased to concern NASA employees. A disconnect in Figure 7 is the importance of "sufficient individual reward and recognition." It is ranked low in the "what is" and high in the "what should be." This self-esteem need apparently is not being met and would be a strong motivator. This same message is repeated in Figure 10.

Figure 8, which addresses decision-making, shows a strong demotivator, an experts clash. The "what is" column includes budget and scheduling, typical management concerns. But the highest ranked "what should be" is "decisions based on research not politics," which is ranked low in the "what is" column. This clash can be addressed by delegating to technical personnel the authority and accountability for meeting budget and schedule constraints.

Figure 9, which addresses power sharing, repeats the experts clash observed in the decision-making process: "people (presumably management) quietly hold onto their power," and "authority is highly centralized." This clash too can be addressed by delegating authority and accountability to lower levels of the organization. Apparently, NASA management is not delegating

	WHAT IS:	WHAT SHOULD BE:
HIGH	Budget pressures greatly affect decisions	Decisions based on research, data, technical criteria; not politics - 39% Decisions based on open discussion/debate - 19% Implementors involved in decisions - 14% Mgmt. communicates decisions and rationale to employees - 9%
	Schedule pressures greatly affect decisions	
LOW	Decisions delegated to lowest possible level	
	Decisions based on research, not politics	
	Management communicates decisions and rationale to employees	
	Decisions based on open discussion and debate	

Figure 8. Decision-making Comparison

enough to satisfy the high expectations of the work force even though progress was made during the time between surveys.

Figure 10 covers the subject of rewards, a self-esteem need. The “what is,” stating that rewards are political, stands in sharp contrast with “what should be,” which is recognition for individual and work unit performance. Clearly, NASA management can enhance the morale and motivation of the work force and encourage better performance by upgrading the reward system.

Another disconnect that appears in Figure 10 is the statement that “people orientation is important for advancement.” This is ranked high in the “what should be” and low in the “what is.” This may explain the previous finding that people are

less satisfied with the unit and the Center than with NASA. It appears that the supervisor-employee interaction is one of demotivation. The implication is that unit managers must be sensitized to the human needs of their employees.

A significant unmet need is career satisfaction. In Figure 11 the “what should be” responses present the message that clearly defined career paths are expected. These expectations are not always satisfied. The following two disconnects are present: “managers take time to discuss career planning” and “there are viable career paths for non-supervisory employees” are both ranked high in the “what should be” and low in the “what is.” The third disconnect, “higher level manager taking personal interest,” can also be explained as a reflection of the same desire for formal and clear career paths.

	WHAT IS:	WHAT SHOULD BE:
HIGH	People with technical knowledge can get things done	People are willing to share their power - 39%
	People quietly hold onto their power and authority	People with technical knowledge can get things done - 23%
	Authority is highly centralized	Employees are treated fairly and equitably - 21%
LOW	Employees are treated fairly and equitably	
	People are willing to share their power	

Figure 9. Power-sharing Comparison

	WHAT IS:	WHAT SHOULD BE:
H I G H	Real reward is work itself	For individual performance there is recognition and reward - 40%
	Getting rewarded is political	People orientation is important for advancement - 17%
		For work unit performance there is recognition and reward - 14%
		Real reward is work itself - 12%
L O W	People orientation is important for advancement	
	For individual performance there is recognition/reward	
	For work unit performance there is recognition/reward	
	PA system provides useful discussion of work performance	

Figure 10. Rewards Comparison

Conclusions

Table 6 lists some lessons that have been learned from this research. First, it can be concluded that the needs theories of motivation, especially Herzberg's and Maslow's, agree with the results of the NASA culture surveys. The responses to the surveys appear to indicate that NASA employees are satisfied in their hygiene needs and are striving to satisfy self-esteem and self-actualization needs. The most significant observation is that the need for belonging is satisfied. NASA employees are proud to be part of the Agency and have a high opinion of their coworkers. With their belonging needs satisfied, NASA employees enjoy a greater degree of employment satisfaction than the general population (Cf. Mondy, 298). The consequence is that to motivate their employ-

	WHAT IS:	WHAT SHOULD BE:
H I G H	Higher level manager taking personal interest is important for advancement	Career management is shared responsibility of employee and manager - 39%
	Managers are encouraged to attend formal development activities	Managers take time to discuss career planning with their people - 19%
	Career management is shared responsibility of both employee and manager	There are viable career paths for non-supervisory managerial employees - 14%
L O W	Managers take time to discuss career planning with their people	
	There are viable career paths for non-supervisory/managerial employees	
	There are people at the Center who provide career guidance and counsel	

Figure 11. Career Satisfaction

ees, NASA managers must address self-esteem and self-actualization needs. Two possibilities are recognizing accomplishment and establishing better and clearer career growth paths. The first addresses self-esteem and the second, self-actualization. More consistent use of these motivators would result in a more productive organization.

In the two culture surveys NASA employees sent a clear message that not enough is being done in the areas of recognition and career planning. This deficiency should be remedied because recognition and career growth are the most important sources of satisfaction and motivation for older and more experienced workers. Career growth need not mean a move into management. The dual-ladder option, where opportunities for promotion to higher grades are available to non-supervisors, is a good alternative. What is important is that employees know that they are moving toward a desirable career goal.

Table 6. Motivation of Employees: Lessons for NASA Managers

THEORY AND SURVEY RESULTS	LESSON
<p>1. Needs theories describe the behavior of NASA employees: NASA employees have satisfied their hygiene needs (safety, security, and affiliation).</p> <p>NASA employees strive to satisfy self-image and self-actualization needs. Managers should not confuse hygiene and motivation needs</p>	<p><i>Continue present practices in areas of safety, job security, and team building.</i></p> <p><i>Address self-image with awards; address self-actualization with career planning. Note that pay and performance appraisals are hygiene factors and will not motivate. Use professional growth as a motivator.</i></p>
<p>2. Needs theories give an indication of valence V (i.e., desirability of the outcome) in the expectancy theory.</p> <p>Motivation = E x V x I</p>	<p><i>Identify and address the needs of employees.</i></p>
<p>3. Employee training is important because of expectancy E (i.e., the effort leads to performance).</p> <p>Motivation = E x V x I</p>	<p><i>Continue and expand training programs.</i></p>
<p>4. Communication is important because of instrumentality I (i.e., rewards are tied to performance).</p> <p>Motivation = E x V x I</p>	<p><i>Use newsletters and awards ceremonies to celebrate significant accomplishments.</i></p>
<p>5. NASA employees are dissatisfied with the lower levels of the organization. Employees want people-oriented managers.</p>	<p><i>Make unit managers more sensitive to the needs of employees. Develop training programs.</i></p>
<p>6. NASA has made progress in implementing participative management, but practices are still below employee expectations.</p>	<p><i>Expand manager's awareness and training.</i></p>
<p>7. Work groups are desirable because they promoted interaction. But groups in existence for long period of time lose effectiveness.</p>	<p><i>Use concurrent engineering, quality circles, and teamwork. Reorganize teams and committees periodically and add new members.</i></p>
<p>8. More outside influence is better than complete autonomy.</p>	<p><i>Negotiate goals and objectives between manager and employee. Review periodically.</i></p>

An important consequence of accepting the needs theories of motivation is a reduced dependence on salary as a motivator. Of course money is important, and workers that are not compensated fairly for their efforts can be unhappy and demotivated. As stated by the equity theory of motivation, the perception of fairness in compensation can be an important factor in demotivation. But after acceptable compensation is reached, other factors can be more effective in promoting superior per-

formance and excellence. Thus, reliance on “pay for performance” as a motivator overlooks more effective approaches. Similarly, performance reviews are not motivators. Some good reasons for having performance reviews include the opportunity for the manager to communicate to the employee the goals of the organization and for the employees to state their own. But it is unreasonable to expect the performance appraisal process to be a source of motivation.

The expectancy theory of motivation is an important extension to the needs theory. By proposing expectancy E, valence V, and instrumentality I as the causes of motivation, the theory gives practicing managers a good indication of what needs to be done to motivate subordinates. In addition to addressing the basic human needs, managers must support training and be fair and open when awarding promotions and rewards.

The responses to the surveys show that NASA employees are unhappy with the lower levels of the organization. Specifically, they want unit managers to be more people oriented. Unit managers must do a better job of career counseling and they must do more to make participative management a reality. These issues can and should be addressed through training programs for supervisors.

■ Lessons for NASA Project Managers

Finally, work groups are good and should be encouraged as much as possible. The same is true for all kinds of interactions, such as project and task reviews and staff meetings. They should be used by management to promote interaction between employees.

Projects are high-intensity, goal-oriented endeavors. In the course of day-to-day activities the project manager and staff must continuously rank all the demands on the limited resources available to the project. In such an environment it is easy to rank employee needs and motivation below other more immediate concerns, such as schedules and cost targets. This is not done on purpose, and the assumption usually is that the sacrifices are temporary and needed to achieve a short-term goal.

Unfortunately, designating employee needs and morale as issues of secondary importance is detrimental to the project's host organization. An example of this was reported in *The Soul of a New Machine* (Kidder, 1981). The book records

the design and development of a new computer. Although all the technical goals were achieved in record time, the feat was accomplished at great cost to the organization because one year after the new computer was introduced, all the members of the design team had left the company.

Although this may be an extreme example, anyone with project experience can give examples of poorly motivated people working well below their capabilities. If management truly believes that employees are the organization's most valuable resource, this situation is not acceptable.

The use of surveys allows project managers to track the status of their team, the human portion of their system. The important results of these surveys are the trends, and, therefore, surveys must be repeated periodically. The survey is analogous to the feedback signal in a control system. By continuously monitoring the attitudes and motivation of a team, a project manager can take a proactive approach to problem solving. An example of an attitude survey is included in Figure 12; it is kept short to compensate for the frequency of survey repetition.

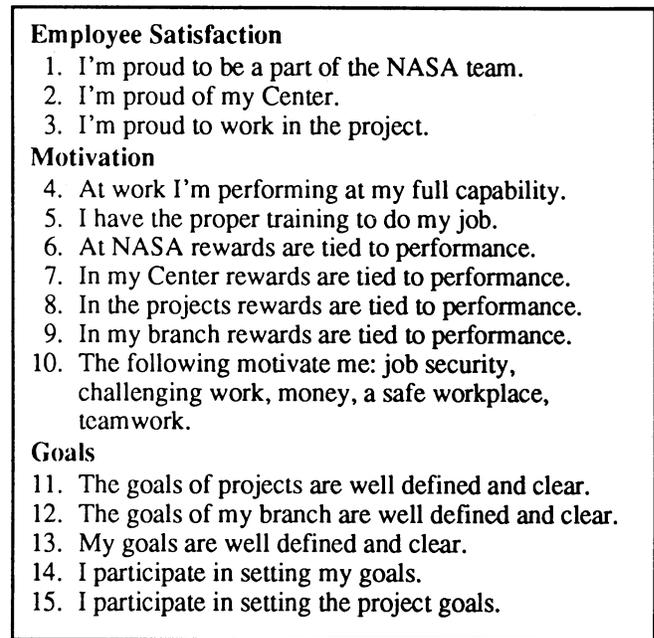


Figure 12. Sample Survey

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