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Motivational and Productivity Factors

that Influence the

Naval Construction Force

by

Timothy W. Burns

A thesis submitted in partial fulfillment
of the requirements for the degree of

Master of Science in Civil Engineering

University of Washington

Naval Postgraduate School

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To my parents.

CHAPTER 1

INTRODUCTION

No other industry in the United States promises as large a payback for performance improvement as does construction. In 1989, U.S. contractors accounted for $148 billion in domestic construction projects (Engineering News-Record, May 24, 1990). An improvement of even a fraction of a percent would produce millions of dollars in savings. However, perhaps no other industry so steadfastly resists abandoning traditional, reactive management methods. As competition for contract awards becomes increasingly competitive and profit margins become smaller, organizations are investigating methods to increase the productivity of their largest and costliest resource - labor. Numerous studies have been conducted to identify factors which influence the motivational and productivity factors of a construction worker. While much research has been conducted on industrial workers, these studies cannot be translated as being directly applicable to construction. Unlike other industry workers, construction workers are generally motivated by factors which are intrinsic to the work itself.

To understand this phenomenon of the intrinsic motivational aspects of construction work, the construction industry and the type of work performed will be briefly discussed. Construction is different from manufacturing and industrial types of work when compared on the basis of productivity and motivation (Oglesby, 1989). First, the nature of the "business" itself must be described. Most construction projects are unique and generally fast paced with a set completion date, so the total organization is not static. In addition, each construction project is typically undertaken by a reconstituted project organization consisting of differing combinations of owners, architects, engineers, construction managers, field supervisors, work crews, equipment and materials. As these "parties" change, so do their objectives, which effect the organization and workers alike. Therefore, combining these factors (lack of repetition, accelerated schedules, variety of designs and objectives, and changing parties) makes the task of applying "standard" productivity and motivational techniques to all projects very difficult.

The second difference between construction and other industries relates to the adversarial nature of the parties involved in construction contracts, i.e., the contractual structure of construction is seldom conducive to cooperation between parties. Contracts set up "boundaries"

in which certain parties will not (or are afraid to) cross. Each party will have different objectives resulting in a project organization in which conflict can readily occur. Construction projects involving extensive subcontracts create an atmosphere in which the rigid hierarchical structure thwarts easy "chain of command" communication by limiting informal discussions and delaying decision making.

All too often, new projects are undertaken without considering lessons learned from previous projects. This is the natural result of the uniqueness of individual projects and the changing makeup of the parties involved in subsequent projects. Management and workers forget or ignore the unfavorable consequences of previous deficient management-worker decisions. They must then take the time to correct these deficiencies as they occur and maintain an organizational team that can adapt to all situations that may arise. In construction project management, Warren (1984) states that:

> productivity means simply achieving schedule, quality and safety goals at the lowest cost. This requires the field manager to not only have a comprehensive knowledge of field practices, methods of engineering and cost control, but also a working familiarity with the psychology of motivating the construction work force.

Experience has shown that motivation and productivity are interdependent. Increased motivation causes increased productivity and, as noted on construction projects, increased productivity results in increased motivation. Figure 1 (Warren, 1989) illustrates this relationship.

How does a worker's motivation influence individual productivity? According to Maloney (1981) "motivation is a psychological and physiological drive to satisfy one's needs, or both, and is manifested by behavior to obtain the means of satisfying those needs."

Maslow (Rush, 1969) defines motivation as "the state of having an <u>internal</u> motive that incites the individual to some kind of action. Motivation comes from within the individual and cannot be imposed on the individual."

The Business Roundtable (1982) found that a highly motivated workforce enhances productivity and project effectiveness. Conversely, demotivators are a significant deterrent to high productivity. Surveys have found a significant list of construction worker demotivators including the most common:

> lack of materials, project confusion, communication breakdowns, rework, unavailability of tools and equipment, disrespectful treatment, lack of recognition, little participation in decision-making,

Figure 1.   Motivation vs. Productivity

lack of cooperation among crafts, incomplete engineering, restrictive or burdensome procedures and regulations, poorly trained supervisors, and restrictive work practices in labor agreements.

In the construction industry Maloney (1981) states:

there are four determinants of a worker's productivity: First, the _duration_ of the worker's effort; Secondly, the _intensity_ of the worker's effort; Thirdly, the _effectiveness_ with which the worker's effort is combined with technology and other resources; and lastly, the _efficiency_ of the workers effort.

Past research has provided information on the performance factors concerning construction workers in the "civilian community." Does this research apply to the "military construction community?" Are Navy construction workers motivated to be productive by the same factors as their civilian counterparts? This research will investigate motivational and productivity factors within the Naval Construction Force (NCF). The NCF is the organization within the Navy which is responsible for construction, operation, maintenance, and repair of facilities and utilities in support of Naval Operating Forces. The NCF is comprised of numerous units which are responsible for various specialized construction operations. Within these units are officers and enlisted personnel (known as "Seabees") with the technical, military and leadership skills to execute the mission of each organization. This

study focuses on the enlisted Seabees in two of these organizations - Naval Mobile Construction Battalions and Construction Battalion Units.

Managers and supervisors at every level, in every industry, are expressing a general dissatisfaction with today's workforce. It is a dissatisfaction filled with frustration at how to keep their best workers, as well as how to get the most productivity from all their workers. This may be an unwarranted dissatisfaction. Today's workers are different in terms of values, attitudes and expectations. A manager must take the time to understand what has changed and how that affects motivation. Only then can the manager act rationally to increase productivity.

In the "old days" money and fringe benefits were the prime motivators while the human factors were a secondary consideration. Today, worker attitudes have changed where the human factors are very important and constitute a major component in the productivity equation. These human factors include job satisfaction, self-esteem, sense of accomplishment and other factors inherent to the work itself. Today's managers and supervisors that are successful have the ability to develop a self motivating environment to achieve personal and organizational goals and maximize the capabilities of their workers.

The purpose of this research is to identify motivational and productivity factors that influence a Seabee's performance. For significant findings, recommendations are to be developed for their implementation in the NCF.

CHAPTER 2

LITERATURE REVIEW

Section 1: MOTIVATION

INTRODUCTION

To understand motivation in the workplace, one must ask the following questions (Steers, 1983):

1. What energizes human behavior?

2. What channels or directs such behavior?

3. How is this behavior maintained or sustained?

Prevalent in the discussions of the various motivational theories in this chapter will be answers to these questions.

An objective of learning motivational theories and techniques is to improve work attitudes and work performance. But what is work and why is it so important to the lives of individuals? Steers (1983) identified several reasons why work is important in society today:

1. Reciprocity - all workers, at all levels, receive some sort of rewards for their services, either extrinsic or intrinsic. These "rewards" affect the levels of performance of workers and organizations.

2. <u>Social</u> <u>functions</u> - work provides an individual the opportunity to meet new people and to interact with them.

3. <u>Status</u> - a person's skill level often provides status or rank in society, as well as, what they do at their job.

4. <u>Personal</u> <u>meaning</u> - work can be an important source of identity, self-esteem and self-actualization for an individual. Conversely, work can also be a source of boredom, frustration and feeling meaninglessness. The nature of the job and the meaning it has for the employee can have a great impact on employee attitudes, work behavior, and motivation.

Theories of motivation are generally classified into two theoretical categories: <u>content</u> <u>theories</u> and <u>process</u> <u>theories</u>. Content theories are identified with an individuals basic needs, the fundamental assumption that man will expend energy to satisfy these needs.

> The content theories start with basic human needs and then skip to behavior that is directed at satisfying these needs. What has been skipped over is a person's conscious process: What is a person thinking? What are their perceptions? These questions are the keys to the process theories (Tribett, 1984).

The process theories have been the subject of considerable research, however, they do not seem to be consistently

utilized outside the academic community. Many management styles of organizations use content theories by establishing situations in which an individual can best satisfy their needs by working for company goals.

Worker motivational theories have been evolving since the early 1900's (figure 2). A review of the more popular motivational theories are discussed in this chapter.

CONTENT THEORIES

Hierarchy of Needs - Abraham Maslow

Perhaps the motivational theory most well known and often used by American managers is Abraham Maslow's "Hierarchy of Needs." Maslow based his theory on the premise that man is motivated to reach a certain goal because he has an internally generated "need" to reach it. Maslow identified five basic "needs," and ranked them into a conceptual hierarchy:

Self Actualization

Ego Needs

Social Needs

Security Needs

Physiological Needs

	CONTENT MODELS	PROCESS MODELS		
1910	SCIENTIFIC MANAGEMENT (Wage Incentives) F.W. Taylor	EXPECTANCY-CONCERNS Kurt Lewin E.C. Tolman		
	HUMAN RELATIONS ("Hawthorne" experiment - economic, security conditions) Elton Mayo			
1935				
1950	HIERARCHY OF NEEDS Abraham Maslow		COGNITIVE DISSONANCE L. Festinger G.C. Homans	COGNITIVE EVALUATION F. Heider R.C. deCharmes
	MOTIVATION-HYGIENE THEORY F. Herzberg	VALENCE/ EXPECTANCY Victor Vroom		
	THEORY X and Y D. McGregor		EQUITY THEORY J.S. Adams	LOCUS OF CONTROL J.B. Rotter
		PERFORMANCE - SATISFACTION Lyman Porter E.E. Lawler		SELF-PERCEPTION D.J. Bem
	ERG NEEDS C.F. Alderfer			ATTRIBUTION H.H. Kelley
	THEORY Z W.G. Ouichi	EPO E.E. Lawler		
Present				

Adapted from Luthans, F., "Organizational Behavior"
(3rd Edition), p.176. McGraw-Hill, New York, 1981

Figure 2.   Work Motivation Theories:

A Look at Where We've Been

This hierarchy emphasizes the fundamental point that until a lower need is fulfilled, a person's behavior is not motivated by the next higher level.

The needs, as defined by Maslow, are as follows (Tribett, 1984 and Rush, 1969):

Physiological needs are the basic needs of survival: food, warmth, shelter, rest, water, sexual fulfillment, and other bodily needs.

Security needs are concerned with ones future well-being. These include physical and emotional security and safety, job security, health care, money and insurance.

Social needs are the requirements for acceptance by others, for giving and receiving affection and friendship, and for belonging.

Ego needs are based on the belief that a person has a basic need for self-respect (feeling of personal worth, adequacy and competence); and the need of the esteem of others (respect, admiration, recognition and status from others). Social and Ego needs are closely interrelated, since how people feel about themselves influences how others feel about them; conversely, how they relate to others greatly influences how people feel about themselves.

Self actualization is to excel at what one does, to develop one's self to the fullest human potential.

"Although Maslow's theory is widely known, there exists little empirical evidence to support its validity" (Wahaba, 1973). However, this theory has made management aware of the diverse needs of people at work. Central to Maslow's "hierarchy of needs" is the proposal that each of the lower level needs must be satisfied before the next higher level can become a motivator.

Motivation - Hygiene Theory - Frederick Herzberg

Herzberg's motivation - hygiene theory is based on factors generated by asking interviewees (engineers) the following two questions: "When have you felt especially good about your job?" and "When have you felt especially bad about your job?" (Tribett, 1984).

Factors (content factors) related to good feelings about one's job were categorized as "motivators" or "satisfiers." Factors (context factors) related to bad feelings associated with the physical characteristics of the work environment, were categorized as "hygiene" factors or "dissatisfiers."

Herzberg identified content factors (job satisfiers) to include: achievement, recognition, the work itself, responsibility, advancement, and growth. Context factors (job dissatisfiers) include: company policy and

administration, supervision, working conditions, interpersonal relations, salary, status, job security and personal life.

Herzberg called the job satisfiers "motivators" because they were effective in motivating workers to greater productivity, and are within the control of workers to manipulate the factors to produce desired results.

Job dissatisfiers were called "hygiene" factors by Herzberg and are relatively fixed and beyond the control of workers. Their importance was felt only in their absence.

Industry tends to stress "hygiene" factors in its attempt to motivate workers while ignoring the "motivator" factors. "Herzberg insists that hygiene factors are important and that they, like Maslow's lower needs, must be adequately provided if a person is to rise above them to the self-actualizing concerns of involving himself in meaningful tasks" (Rush, 1969).

Further research, by Herzberg, on the subject of the needs of self actualizing workers resulted, in two additional motivational principles: <u>job enrichment</u> and <u>job enlargement</u>. According to Herzberg:

job enrichment means actually increasing the
challenging content of the job that will cause the
employee to grow both in skill and in his feeling of
accomplishment, and that job enlargement (a more
commonly used term) may mean loading the employee
down with more to do, while providing him no
opportunity to grow (Rush, 1969).

Job enlargement is referred to as "horizontal" job loading
and a demotivator, whereas job enrichment is referred to as
"vertical" job loading.

If used properly a job enrichment program can be used by
management as a motivating tool for workers. Herzberg
recommends the following guidelines to for an effective job
enrichment program (Harvard Business Review, 1968):

PRINCIPLES OF VERTICAL JOB LOADING

Principle	Motivators Involved
A. Removing some controls while retaining accountability	Responsibility and personal achievement
B. Increasing the account-ability of individuals for their own work	Responsibility and recognition
C. Giving a person a com-plete natural unit of work (module, division, area, and so on)	Responsibility, achieve-ment, and recognition

D.	Granting additional authority to employees in their activities: job freedom	Responsibility, achievement, and recognition
E.	Making periodic reports directly available to the worker rather than to the supervisor	Internal recognition
F.	Introducing new and more difficult tasks not previously handled	Growth and learning
G.	Assigning individuals specific or specialized tasks, enabling them to become experts.	Responsibility, growth, and advancement

Herzberg's satisfier/dissatisfiers theory of job factors has been criticized by other motivational theorists. One such critic was Gautschi (1987) who discusses the concept that employee satisfaction and increased productivity do not necessarily go hand in hand. For example, "an employee who whistles while they work is not necessarily the model of productivity." He provides four employee "characters" that combine productivity with a healthy employee attitude:

1. High productivity/Low satisfaction - an employee is very productive because they are afraid of losing their job.
2. Low productivity/Low satisfaction - an employee does not produce because they are unhappy, nor are they afraid of losing their job.

    3. Low   productivity/High   satisfaction - an
employee likes their job and benefits, but does not
feel pressured to produce.
    4. High productivity/High satisfaction - a happy
and productive employee. [Author's note: "Every
organization's goal"].

One conclusion agreed upon by both Herzberg and his critics

is the need for additional "on the job" research to test

his theory. Nevertheless, Herzberg has drawn attention to

the importance of job content and the development of job

enrichment my management.

Douglas McGregor - "The Human Side of Enterprise"

Douglas McGregor's work built upon the groundwork laid down

by Abraham Maslow (Hierarchy of Needs). Assuming that most

workers have satisfied their basic needs, to some extent,

then monetary incentives will not motivate workers. This

is because the upper level needs for love, esteem and self-

actualization will not be fulfilled by monetary rewards.

    McGregor hypothesizes that managers made assumptions
    about human beings that would significantly affect
    the way they treated employees and ultimately the
    employee's performance. McGregor called these
    assumptions Theory X and Theory Y (Tribett, 1984).

Theory X assumptions include:

    a. Average persons have a dislike of work and will

avoid it if they can.

    b. Individuals must be coerced, controlled, directed,

or threatened with punishment to get them to put forth adequate effort ("management by threat," see Section 2).

c. Average persons prefer to be directed, wish to avoid responsibility, have little ambition and want security above all.

Management tends to take two extreme positions within the Theory X principal. "Hard management" is the first, where coercion and threats are used to obtain desired behavior from workers. Secondly there is "soft management," where management satisfies the worker's demands to try to keep harmony within the organization. According to McGregor, "the factors underlying motivation (cause) and the evidence of motivated productivity (effect) are ignored in Theory X" (Rush, 1969).

Theory Y assumptions include:

a. Physical and mental effort in work is natural.

b. External control and threats are not the only methods to get workers to meet company goals.

c. Commitment of goals is a function of the rewards associated with achievement.

d. Average workers learn to accept and to seek responsibility.

e. Most people are capable of imagination, ingenuity, and creativity in solving problems.

f. The intellectual potential of the average person is only partially used on most jobs.

According to McGregor, the Theory Y assumptions show an unlimited potential for personal and organizational growth, and it is management who must tap this hidden potential of the workers. Employees must assume some responsibility by showing a commitment to organizational objectives.

One misconception of his work that McGregor continually clarified was that "Theory X and Theory Y are not polar opposites; they do not lie at extremes of a scale. They are simply different cosmologies" (Rush, 1969).

As Maslow's theories were criticized, McGregor's were also criticized for not being well supported by empirical data. Similar to Maslow, McGregor made a positive contribution by raising questions about the nature of human motivation.

Theory Z - William Ouichi

Japan's productivity growth in the past three decades has outpaced the U.S. rate by a factor of two to three (Steers, 1983). This growth cannot be entirely attributed to management practices since Japan's capital investments per worker is very high. Nevertheless, many American companies

have expressed interest in the Japanese style of management that is associated with high productivity, low turnover, and low absenteeism.

The most important element of Japanese management is the focus on human resources: the utilization of employees to their maximum potential and an implicit understanding of how an organization should be managed. This focus on human resources is revealed in three interrelated strategies by Hatvany and Pucik (1981):

> First, an internal labor market is created to secure a quality labor force and to induce the employees to remain in the firm. Second, a company philosophy is articulated that expresses concern for employee needs and emphasizes cooperation and teamwork in a "unique" environment. Third, close attention is given both to hiring people who will fit well with the values of the particular company and to integrating employees into the company at all stages of their working life.

William Ouichi's <u>Theory Z</u> (Ouichi, 1981) is currently gaining popularity in America. Ouichi identified characteristics of Japanese management (Theory J) and American management (Theory A). He then combined certain features of Theories A and J to identify a model company, which he calls "Theory Z." Management characteristics, employed by Japanese companies, include the following (Hatvany, 1981):

      a. Employ key people for "life" (i.e., until forced retirement at the age of 55-60).

      b. Rotate employees through various job functions.

      c. Promote employees very slowly and according to more of a seniority than merit system.

      d. Place responsibility on groups rather than on individuals.

These characteristics enable Japanese firms to (Hatvany, 1981):

      a. Treat their employees as a total people;

      b. Build the kind of trust that facilitates bottom-up consensual decision making; and

      c. Control employees in a subtle, indirect manner.

American companies, on the other hand, employ the following management characteristics (Hatvany, 1981):

      a. Employ personnel only as long as the individual is contributing.

      b. Specialized job functions with rotation reserved only for people on a general manager track.

      c. Little concern for the total person.

      d. Rapid feedback and promotion.

      e. Explicit formal control systems.

      f. Individual responsibility.

      g. Individual top-down decision making.

According to Ouichi's Theory Z, companies should emphasize the following management characteristics (Steers, 1983):

      a. Lifetime employment

      b. Slower rates of promotion

      c. Somewhat more implicit, less formal control/systems

      d. More concern for the total person

    e. More cross-functional rotation and emphasis
on becoming a generalist
    f. Some level of participation and consensual
decision making
    g. A continued emphasis on individual
responsibility as a core valve.

Ouichi has shown that companies that develop management

styles similar to Theory Z companies have higher morale and

loyalty, and generally more healthy, positive feelings at

all levels when compared to Theory A companies.

However, as Schein (1982) points out,

> what is missing (in Ouichi's Theory Z concept), is
> convincing evidence that those companies which fit
> the Theory Z model are more "effective" than
> comparable companies which operate more on the theory
> A bureaucratic model.

Schein also indicates that the Theory Z process, being

rooted in an altogether different set of cultural values,

is not readily adapted to the American society. It has

also been noted that this management style is not

universal, even in Japan (Hatvany, 1981).

As with other content theories, Theory Z gives the

practicing manager useful ideas to apply to motivational

problems.

PROCESS THEORIES

VIE Theory - Vroom

One of the early process theories was the Expectancy Theory, or VIE Theory (Valance - Instrumentality - Expectancy) proposed by Victor Vroom (1967). "The underlying assumption of this theory is that a person chooses among alternative courses of action in a manner consistent with psychological events that occur at the same time as the behavior" (Tribett, 1984).

Vroom (Tribett, 1984) proposes that the amount of effort an individual exhibits will depend on three elements:

1. Valance - an individual's "affective response" to a particular outcome. It could be positive (e.g., money), negative (e.g., poor work conditions) or neutral.

2. Instrumentality - an individual's perception that successful performance of a specified behavior will in fact lead to particular outcome. This is expressed as a probability.

3. Expectancy - an individual's perception that a person can actually succeed in performing a specific behavior if an effort is made. Expectancy is expressed as a probability.

For example, individuals will be highly motivated: if they believe that they can perform a task (high expectancy); if they believe that successful task completion will lead to a certain outcome (high instrumentality); and if they have a strong desire for that certain outcome (high positive valance).

Vroom's theory contended that job performance is a product of ability and motivation, expressed as (Steers, 1983):

$$F = \sum [E (i,j) \quad x \quad V (j)]$$

where   F   =   force to perform

         E (i,j)   =   the perceived probability
                     (expectancy) that the "ith" amount of
                     effort will lead to the achievement
                     of performance level "j"; and

         V (j)   =   the valance of each performance level

Expectancy is a probabilistic estimate with a range from 0.0 to 1.0. Whereas, valance is the strength of a person's positive or negative desires for the outcome. The valance of a task is described further as:

$$V(j) = \sum [I(j,k) \times V(k)]$$

where $I(j,k)$ = instrumentality of performance level "j" for the attainment of outcome "k"; and

$V(k)$ = the perceived desirability of outcome "k"

The values of instrumentality range from -1.0 to +1.0, representing negatively or positively related outcomes.

Note that if any of the aforementioned elements are zero, or if the valance is negative, the individual will not be motivated. The instrumentality or valance could be zero if the individuals do not believe they can perform the task, or do not believe that the desired outcome will result from the performance of the task.

Vroom points out two valuable insights into his VIE theory. First, the importance of individual perception. It focuses on the fact that people respond to their perceptions of the environment rather than to a universally accepted belief reality. Secondly, this theory draws attention to "individual differences." Since this theory emphasizes an individual's perceptions it is highly

unlikely that two people will respond in an identical manner.

When diagnosing a situation, (work or non-work related), an individual consciously or subconsciously asks the following questions:

1. Can I perform the task?

2. Does my desired outcome depend upon my performance?

3. Do I desire the outcome?

4. What is in it for me?

A negative response to any of these questions will result in an unmotivated worker. Thus, it is the responsibility of the manager to motivate the worker. Managers must take steps to strengthen the perceived relationships between performances and outcomes.

Expectancy Theory - Porter and Lawler

Vroom's VIE Theory and subsequent studies opened up a whole new field of process theories. One of the more prominent of these is Porter and Lawler's Expectancy Theory (Porter, 1975). This theory expands on Vroom's VIE Theory in that it includes "environmental" variables (e.g., intrinsic and extrinsic rewards). A significant aspect of Porter/Lawler's expectancy theory is the reversal of an important belief of previous theories, the assumption that

satisfaction leads to performance. Porter/Lawler (Tribett, 1984) proposed that "performance leads to rewards, and if these rewards prove to be adequate, satisfaction is attained."

Porter and Lawler developed an Expectancy Model, shown by figure 3. The model shows "a thinking person making choices based on far-from perfect information, a person limited by forces both in himself and the environment."

The components of the model shown by figure 3 are as follows:

1. <u>Value of reward</u> - the valance or attractiveness of various outcomes to the individual. The input from "satisfactions" implies that rewards become attractive as a function of their ability to "satisfy."

2. <u>Perceived effort/reward probability</u> - increased effort will lead to acquisition of a valued reward.

3. <u>Effort</u> - how "hard" an individual works, rather than how effectively an individual performs.

4. <u>Abilities and traits</u> - characteristics of the individual such as intelligence, personality, and psychomotor skills. These abilities and traits are considered to be "boundary conditions" (limits) for performance.
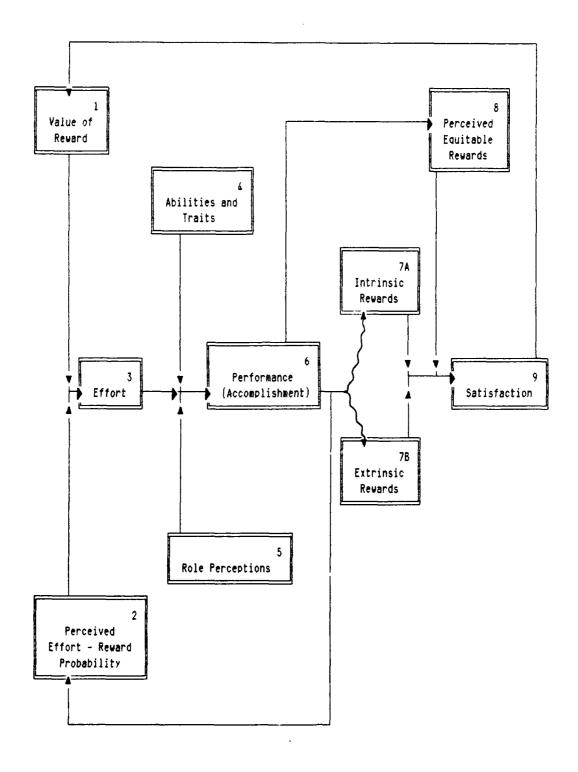
Figure 3.   Porter and Lawler Expectancy Model

5. _Role perceptions_ - an individual's perception of successful performance on a particular task.

6. _Performance_ - level of accomplishment that an individual achieves.

7A. _Intrinsic rewards_ - rewards that satisfy higher order needs (in the Maslow sense). These rewards are administered by the individual to themselves. The "wavy line" indicates a direct relationship may exist between performance and intrinsic rewards when the worker feels challenged in the completion of job related activities.

7B. _Extrinsic rewards_ - rewards that are received from an external "agent". This type of reward is not always provided upon completion of a task and is indicated by the "wavy line."

8. _Perceived equitable rewards_ - the level of rewards that individuals feel are "appropriate" for their performance.

9. _Satisfaction_ - determined by comparisons made by individuals with what they consider to be an equitable reward with the actual reward. If the equitable reward is greater than the actual reward then the individual is dissatisfied. If the actual reward is greater than the perceived equitable reward, then the individual is satisfied.

The expectancy model simplifies a complex theory into a step by step process that is easy for most managers to understand. A useful exercise for managers is to suggest ways that a manager may directly affect each component in the model, both positively and negatively.

Equity Theory - J.S. Adams

Another notable process theory is the Equity Theory of J.S. Adams (1963). Adams states that a major influence on job performance and satisfaction is the degree of equity, or inequity, that people perceive in their work environment. Individuals compare the ratios of their own inputs and outcomes to similar ratios of others. This theory is represented by the following equation:

$$\frac{\text{Outcome (self)}}{\text{Input (self)}} = \frac{\text{Outcome (other)}}{\text{Input (other)}}$$

It is important to note that the conditions necessary to produce equity or inequity are based on the individual's perceptions of inputs and outputs. In other words, the objective characteristics of the inputs and outcomes are of less importance than the person's perceptions. In addition, inequity is a relative phenomenon, where it does not necessarily exist if an individual has high inputs and low outcomes as long as the comparison with "others" has a similar ratio. Perceived input may include education, age, sex, training, social status, position or work effort.

Perceived outcomes may include pay, rewards intrinsic to job, job and social status, promotion, or job related benefits.

The basic premise to this theory is that when equity exists, there will be no motivation. Where inequity exists, motivation will also exist with the strength of the motivation varying directly with the amount of inequity. When individuals perceive that the proportion is out of balance, they will manipulate their inputs and/or outcomes in such a manner as to re-establish their perception of equity. According to Adams, individuals will generally take that course of action which is personally least costly.

The following actions illustrate how individuals can reduce inequity (Adams, 1963):

1. Increase their input if it is low relative to "Other's" input and to their own outcome.

2. Decrease their input if it is high relative to "Other's" input and their own outcome.

3. Increase their outcome if it is low relative to "Other's" outcome and their input.

4. Decrease their outcome if it is high relative to "Other's" outcome and their input.

5. "Leave the field" (quit) when inequity is experienced, especially if equity can only be achieved at a high personal cost.

6. Psychologically distort their input and outcome, increasing or decreasing them as required.

7. Increase, decrease or distort the input and outcome of "Others," or force "Other" to leave the field.

8. Change referent "Other" to another when inequity is experienced.

One of the weakest elements of the equity theory is the process by which an individual chooses an "Other" for comparison. An individual may choose the referent "Other" based on which "Other" will provide the least possibility for inequity, thus providing a flexible standard of reference for comparison.

The equity theory offers a useful approach to understanding a wide variety of social relationships in the work place. Individuals may purposely create perceived inequities to improve their situation or achieve certain goals. For example, a crew leader may attempt to convince crew members that they are not contributing as much as fellow workers or at a level expected for their rank/paygrade.

Workers are seldom passive observers of the events that occur in the workplace. They form impressions of others and the events that affect them and behaviorally respond based on their perceived positive or negative evaluations.

<div align="center">

Scanlon Plan (Reward System)

</div>

Another type of process theory is the Reward System which is a participative, and human relations oriented plan which uses economic rewards to motivate employees. A reward system can potentially motivate workers into two types of behavior: <u>participation</u> in the organization and <u>performance</u> in the organization.

Participation in an organization includes membership (joining and/or remaining) and attendance. Performance or the "decision to produce," has two distinct subcategories: normal (expected job performance) and "extra-role behavior." Normal performance meets minimal expected standards designed by the organizations for the level of monetary compensation assigned for a position. Extra-role behavior is the level of performance that goes "above and beyond" what is normally expected by the organization. Normally, monetary rewards do not motivate individuals to this higher level of performance and organizations must find alternative methods.

One of the more well known of the reward systems which is orientated towards using economic rewards to motivate employees is the Scanlon Plan. The object of the plan is to develop a participative management and suggestion plan program that will benefit workers and management as a whole. This plan, in essence, jointly rewards employees and managers on the basis of labor cost savings that are achieved after ideas or suggestions of the workers have been implemented (Porter, 1975 and Whyte, 1955).

Contrary to traditional "suggestion plans" where individuals are rewarded for suggestions, the Scanlon plan rewards all employees. The plan establishes two groups, the production committee and the screening committee, to review employee suggestions. These committees consist of workers, managers, and union representatives. The committees discuss and review suggestions and recommend changes to upper management for approval and implementation. According to Whyte (1955), the advantages of the Scanlon plan include:

1. Fostering a growth of cooperation between management and employees by stimulating informal discussions between all levels;

2. Strengthening of the organizations competitive position;

3. Elimination of restrictions on production; and

4. Increased payouts to workers in the form of bonuses and wages.

Whyte recommends the following actions to improve the chances of the successful implementation of the Scanlon Plan in most organizations:

1. Management must reevaluate its perception of its functions and behavior in relation to employees and union representatives;

2. Management must respond to suggestions from its employees;

3. Management must make some changes, as suggested, to show employees that it is willing to incorporate suggestions, thus motivating employees to strive further toward improving their work environment and production; and

4. Involvement of the entire organization from top to bottom.

Studies (Porter, 1975) have shown that the Scanlon plan is more effective in motivating performance in a smaller organization than a larger one. The reason for this is that the plan relies on employee's suggestions and an organizational bonus. In a smaller organization the bonus is distributed to a smaller group and thus the employees see the reward to a greater extent than those in a large organization.

Behavior Modification

The basic concept of behavior modification is that it assumes that human behavior can be controlled by manipulating the reward structures (reward system) of various forms of behavior. This is "positive reinforcement", where performance standards are set and improvement results from the application of positive feedback and recognition of satisfactory performance. The basic premise is that an employee's desire for rewards (positive feedback and recognition) will in large measure provide the necessary motivation to perform satisfactorily in anticipation of such rewards.

A key aspect of this theory is that negative feedback and/or punishment is rarely used. Withholding of praise or recognition will clearly indicate to most employees that their performance is at an unacceptable level.

Positive reinforcement (feedback) can be used in various forms (Hamner, 1976):

 1. Praise or recognition;

 2. Money;

 3. Freedom to choose one's own activity;

 4. Opportunity to see oneself become better, more important, or more useful; and

5. Power to influence both co-workers and management.

Hamner and Hamner (1976) suggest that a successful positive reinforcement program involves four stages:

1. _Stage One_ - managers must clearly inform employees which behavior/performance is desirable and gets rewarded, and which does not get rewarded.

2. _Stage Two_ - develop and set goals for each employee. Provide continuous feedback to employees concerning the nature and quality of their work. Allow employees to keep a record of their work. This allows self feedback for personal goals.

3. _Stage Three_ - Rewards must be equitable to performance. If employees are doing a good job, let them know it! This is probably the most important aspect of behavior modification and the hardest for many supervisors to accomplish.

4. _Stage Four_ - All employees must not be rewarded equally (unlike the Scanlon Plan), but rewards must be based on performance levels. Employees must clearly see a relationship between performance and rewards or they will not exert increased energies for completion of tasks.

With this four stage program, an employee has two chances to be successful (Hamner, 1976). First, the employee can exceed a previous level of performance by others, or

secondly, exceed a previous level of personal performance. Additionally, with the behavior modification theory, negative feedback generally comes only from the employee, whereas positive feedback comes from both the supervisor and the employee.

Goal Setting - Task Motivation

Goal setting is a simple, straightforward, and highly effective technique for motivating employee performance. Essentially, goal setting relies on the premise that workers will expend energy to achieve clearly defined and attainable goals. It is based on a very fundamental theory, one which most other theories depend upon for their motivational effectiveness. For example, behavior modification is basically goal setting with feedback.

In simple terms, goal setting is "the assignment of a specific amount of work to be accomplished - a specific task, a quota, a performance standard, an objective, or a deadline" (Latham, 1979).

For goal setting to work effectively, Latham and Locke (1979) suggest the following guidelines:

1. Goals must be assigned prior to performance and should be specific (increase paving production by 10%)

rather than vague (increase paving production). Also, goals should have a time limit assigned to them.

2. The goal must be challenging yet reachable. Difficult goals lead to better performance than easy ones. Also, employees will not accept goals nor will they get a sense of achievement if they perceive goals as unattainable.

3. Goals should be set and accepted by both management and the employees. This will ensure that both parties will remain committed to the goals.

4. Availability of necessary resources to attain goals (manpower, equipment, and materials) should be ensured.

5. Ensure that the employee has sufficient skills and knowledge to reach the goals.

At times employees will resist goals. They may think that the goal is unreachable due to their lack of confidence, ability or knowledge. Secondly, they may not see any personal benefit (such as external rewards or personal pride) in reaching the goals.

To overcome employee resistance to goals, management should try to provide more skill training (raise level of self-confidence); allow the employee to participate in goal setting; or offer external rewards (e.g., money, time off).

A necessary condition to improve motivation and performance of goal setting is to provide feedback. Employees need to know the degree to which they are reaching or falling short of the assigned goal. As with other process motivational theories to improve performance, goal setting will work only if combined with good managerial judgement.

SUMMARY

This chapter has briefly examined some of the more popular and well known of the motivational theories. Which theory is correct? Which should be used to maximize the productivity of employees? No one theory is necessarily correct. The problem of how to motivate employees has puzzled and frustrated supervisors and managers for generations. Human motivation is a highly complex topic - motivation ultimately comes from within an individual and cannot be observed directly.

Steers and Porter (1983) suggest that variables which affect motivation can be found at three levels within an organizational environment.

> First, some variables are unique to an individual (such as one's attitudes, interests, and specific needs). Second, other variables arose from the nature of the job itself (responsibility and

accountability). Thirdly, variables are found in the work situation, or organizational environment itself (such as peer group relations, supervisory practices and system wide rewards).

Rather than focusing on these variables individually, the "relationships" between them must be studied when trying to understand the concepts of worker motivation.

According to Kafka (1986), a manager cannot directly motivate an employee. The manager must create a work environment in which the employee's internal desire (motivation) to do something can be nurtured. However, a motivational environment that may influence one person may not affect another.

So what is a manger to do? It is suggested that a manager learn as much as possible about the different theories and methods of motivation, and adopt those aspects of each theory for the situation at hand. Managers are not in a position to change an individual's personality, therefore they must concentrate on methods to focus an individuals efforts to meet organizational objectives.

CHAPTER 2

LITERATURE REVIEW

Section 2: PRODUCTIVITY

INTRODUCTION

The concept of studying productivity and methods of improving it is about 100 years old. Beginning with Frank W. Taylor, many scholars, theorists, academicians, managers and supervisors have written and developed management styles and processes to improve the productivity of the "worker." Several of the more noteworthy pioneers and methods will be discussed in this chapter.

Webster's (1980) dictionary defines production as "something being produced; the making of goods available for human wants." Depending upon the industry and who is being asked, this can be interpreted in many ways. The U.S. Department of Commerce defines productivity as "dollars of output per manhour of labor input" (Adrian, 1982). Warren (1989), with a bit of cynicism, defines it as:

the completion of construction work at unit rates more economical than the average, less than those published in estimating handbooks, and better than those used in producing the estimate for a given project.

When discussing productivity and its improvement, the common misconception is to focus solely on labor. One must consider all resources available within the work environment, including tools, equipment, materials, management styles, safety, and human factors.

Scientific Management

"Scientific management" is the term used to describe the study of productivity. The following paragraphs will briefly discuss the pioneers of scientific management and their contributions.

Father of Scientific Management

Frank W. Taylor is considered by many as the "Father of Scientific Management." Taylor developed the "first class worker" theory in which he concluded that "each task should be performed in some optimal time by a first class worker." He also advanced the "art of management" where managers need to "know exactly what you want men to do and then seeing that they do it in the best and cheapest way." He was also the first to suggest that profits were a poor measure to evaluate the quality of management.

Taylor defined scientific management as "the study of motions of workers and the simplifications of their movements and acts. It is not speeding up but rather the elimination of waste motion and soldiering." Soldiering is a deliberate objective by the workers of concealing from their employer how fast the work could actually be done.

Taylor's goal of scientific management was higher wages for workers while maintaining low labor costs. He went on to state that scientific management is a "mental revolution" consisting of workers and management viewing each other as allies for their mutual benefit, resulting in:

1. more profits for employers;

2. higher wages for workers; and

3. lower prices for consumers.

In addition, Taylor developed what is known as the "time study", the art of recording, analyzing and synthesizing the time elements of any operation, whether mental, physical or mechanical.

Motion Studies

Another pioneer of scientific management was Frank Gilbreth who is well known for the development of his "motion studies" (Hinze, 1990). He studied the motions of workers

and reduced them as rapidly as possible to standard sets of least in number, least in fatigue, and most effective motions. Gilbreth concluded that wastefulness can be eliminated by removing unnecessary, ill-directed and inefficient motions. He identified three factors affecting productivity:

1. The worker (e.g., anatomy, emotions, health, living conditions, experience).

2. The environment (e.g., surroundings, equipment, tools, rules and regulations).

3. Motions (e.g., speed, distance to move, direction, acceleration, ft-lbs of work to be done).

Based on his studies, Gilbreth identified three sources of fatigue:

1. Improper rest - fatigue brought to work.

2. Unnecessary fatigue - waste motions.

3. Necessary fatigue - caused by work output.

Management Planning

Henry Gantt is renowned for his innovations in developing various charts to track work progress and productivity. He is credited with developing the Bar Chart used for scheduling projects. His "charts" forced management to plan and to monitor work progress.

Gantt believed that before a system of management can be referred to as "scientific management" it should aim to meet the following criteria:

1. Provide a means of utilizing all of the available knowledge concerning the work at hand.

2. Provide a means of seeing that the knowledge furnished is properly utilized.

3. Award liberal compensation for those who so use it properly.

4. Provide a means of acquiring new knowledge by scientific investigation with adequate rewards for success.

Principles of Efficiency

Harrington Emerson developed and published "The Twelve Principles of Efficiency" in 1911. He identified the following principles (Hinze, 1990):

1. Have clearly defined ideals (there should be a clear focus and all energy should be pulling in one direction).

2. Use common sense (the level headed approach).

3. Employ competent counsel (the world of business is complex whether it involves engineering, law accounting, etc...)

4. Have discipline (do what you say you will do; do not be arbitrary; be organized).

5. Be fair (be imaginative and creative but do not lose your sense of justice).

6. Maintain documentation (maintain reliable, current and adequate records of work performed).

7. Work with dispatch (do not delay; work quickly).

8. Set standards and develop schedules (time and motion studies may be used or required).

9. Use standardized conditions (e.g., lighting, hours).

10. Use standardized operations (the method used should be the correct one).

11. Have written standard practice instructions (this is helpful in training).

12. Employ rewards for efficiency (relate pay to performance, but remember that there are nonmonetary rewards also; a "pat on the back" can go along way in rewarding a worker for good performance).

Scientific Management and Construction

Daniel Hauer was one of the first to collectively apply the scientific management principles to construction and referred to it as "efficiency engineering". He stressed the need for preplanning and applied time and motion studies to construction.

MANAGEMENT STYLES

Introduction

Studies have shown that the single most important factor that affects productivity is the management style used by managers and supervisors alike. To maximize productivity, managers must provide an acceptable motivational climate for their employees. Warren (1989) identified eight basic responsibilities of managers to provide the proper motivational climate. They are:

1. establish direct communication links;

2. provide consistent management;

3. remove sources of frustration;

4. fine tune the work force;

5. assure a safe working environment;

6. provide basic personal comforts;

7. provide training; and

8. recognize achievement.

Management and employees must be committed to support any type of organizational program to improve productivity. There have been many existing methods to develop the "correct" management style. In reality, there is no "right" style that works, what leaders must do is review and extract those concepts that will work for them in their work environment. Most of all, leaders must be flexible in

their management style to adapt to the ever changing work climate.

Management by Threat

Perhaps the oldest management style is "management by threat", or as Warren (1989) called it, "the cussin' approach". This was probably the most popular management technique until the 1960's. Managers and supervisors believed that if they berated, threatened, intimidated and told the workers what to do, they would get the maximum productivity from the workers. This technique is probably still prevalent on many construction projects today.

Because of this management style, workers actually became less productive, since the worker's only motivation was to survive the workday. The worker would produce only enough quality and quantity to avoid being admonished by a supervisor.

Only in the past 30 years has this style been on the decline. As the educational levels and technical skills of workers and management have risen, so has the awareness of the psychological needs of the workers.

Management Grid

Probably the most widely used technique for management improvement is the management grid (Blake-Mouton Approach). The managerial grid addresses a manager's ability in two categories. The categories are the manager's <u>concern for production</u> and <u>concern for people</u>. The manager is rated in these two categories with values ranging from 1 to 9 with 1 being the poorest and 9 the best. The effect of the varying degrees of concern for production and people is illustrated in Figure 4 (Adrian, 1987 and Hinze, 1990).

A (1, 9) management approach is referred to as the "country club" or "free in" style. This style stresses the elimination of worker conflict and encourages the determination of goals by the workers themselves.

The (9, 1) approach is known as "task management" or "authoritarian" style. Workers tend to be viewed as tools for high production. This approach may in fact be effective if the educational level of the workers is somewhat low and they tend to be submissive. Over the long run, productivity is generally poor.

A (1, 1) manager is basically the "middle man" between upper management and the workers. This type of manager

```
              1       2       3       4       5       6       7       8       9
(High)  9 ┌─────────────────────────────────────────────────────────────────┐ 9
          │ (1,9)                                                      (9,9) │
          │ Thoughtful attention to                    Work accomplishment is from │
          │ needs of people for satisfying               committed people; inter- │
          │ relationships leads to a                   dependence through a 'common │
        8 │ comfortable friendly                         stake' in organization │ 8
          │ organization atmosphere                          purpose leads to │
          │ and work tempo.                                relationships of trust │
          │                                                     and respect. │
        7 │                                                                   │ 7
   C      │
   O      │
   N      │
   C      │
   E    6 │                                                                   │ 6
   R      │
   N      │
                                        (5,5)
   F                               Adequate organization
   O    5 │                    Performance is possible through               │ 5
   R      │                    balancing the necessity to get out
          │                     work while maintaining morale
   P      │                            of people at a
   E      │                          satifactory level.
   O    4 │                                                                   │ 4
   P      │
   L      │
   E      │
        3 │                                                                   │ 3
          │
          │                                          Efficiency in operations
          │ Exertion of minimum                        results from arranging
        2 │ effort to get required                   conditions of work in such │ 2
          │ work done is appropriate                  a way that human elements
          │ to sustain organization                    interfere to a minimum
          │ membership.                                        degree.
          │ (1,1)                                               (9,1)
(Low)   1 └─────────────────────────────────────────────────────────────────┘ 1
              1       2       3       4       5       6       7       8       9

        (Low)                    CONCERN FOR PRODUCTION                (High)
```

CONCERN FOR PEOPLE

Adapted from Lawrence and Seiler, 'Organizational
Behavior and Administration', p. 941

Figure 4. Management Grid

makes no independent decisions, only passing along the decisions and policies of their superiors. As expected, production is low for this type of management style.

The goal of every manager is to be a (9, 9) type manager. These managers get their people involved in setting goals, and decision making. The manager's role is more of an advisor, coach, consultant, and helper. Realistically, few managers can achieve the (9, 9) level, however, a manager may settle for something less ideal, such as a (5, 5) level.

Leadership Styles

Similar to the management grid approaches, there are four basic leadership styles used by construction managers (Adrian, 1987). First there are the "<u>authoritarian</u>" or "<u>autocratic</u>" leaders who centralize power and decision-making to themselves. Subordinates have little influence in decision-making and job assignments resulting in a high level of discontentment. "Management by threat" is often identified with this type of leader.

The second type is the "<u>participative</u>" leader who shares responsibilities with workers. Subordinates are involved

in decision making, but only when the leader feels they are needed.

Thirdly, there is the "democratic" leader who decentralizes the decision making even more than the participative leader. This leader delegates most of the authority and responsibilities to groups of workers. Characteristics of this style include a high emphasis on worker interests, initiatives, expressions and cooperation.

A "free rein" or "country club" leader is the fourth type of leadership style. This is similar to a (1, 9) manager on the managerial grid. This style results in worker disorganization, a high level of nonproductive time, and play orientated behavior due to the leaders lack of asserting authority.

To be an effective leader, one must be concerned for both company goals and the workers as individuals. A leader who can balance these two interpersonal traits can be assured of managing an efficient and productive organization.

Path-Goal Model

The "Path-Goal" leadership model was developed by R.J. House based on Vroom's theory of motivation (discussed in a subsequent chapter of this study). House's model suggests

that a leader must select a style that is most appropriate
to a given situation. The objective is to increase the
personal satisfactions of subordinates for work (goal
attainment), and making the path to these satisfactions
easier to obtain (Hinze, 1990).

The leadership style to be used is determined by two
variables:

1. characteristics of subordinates; and

2. task structure.

How a subordinate views a leader's behavior is important in
this theory. A leader's behavior should be adapted so that
it is acceptable to a subordinate. To be acceptable, the
subordinate must see such behavior as either a source of
immediate satisfaction or needed for future satisfaction.
Leaders will exhibit two basic types of leadership. First,
"supportive leadership" is shown by persons who show
concern for the needs and well-being of their workers.
Secondly, "directive leadership" is where leaders make all
decisions and take an authoritarian approach to directing
their workers.

The second variable is task structure, whether it is
routine and repetitive, or complex in nature. Tasks which
are routine and repetitive have little intrinsic value and

will require a supportive leadership style, whereas tasks which are complex and varied (high intrinsic value) will require a directive leadership style.

This theory is illustrated by figure 5 (House, 1974). When the task is structured (routine and/or repetitive), the leader who gives little direction is likely to have highly satisfied workers. Conversely, tasks that are unstructured (complex and/or varied), the leader who gives more directions is likely to have highly satisfied workers. Interestingly, replacing job satisfaction with other variables (e.g., performance, supervisor satisfaction, promotion satisfaction) will not change the relationship shown by figure 5.

Quality Circles

Quality circles are work teams from all levels of the workforce involved in productivity studies to take advantage of group thinking and interact in solving problems. The use of quality circles in construction is rare today. Reasons cited are (Oglesby, 1989):

1. Management and workers fail to work as a team. More often than not, an adversarial relationship develops with an absence of trust or respect between the parties.

2. Top management fails to provide adequate support in the form of continued attention and financial investments.

Figure 5.   Path-Goal Leadership Model

3. Quality circles appear to be a threat to middle managers and foremen. They may feel they are no longer the "boss" but merely a "team member."

For the quality circles concept to work, the following guidelines are recommended (Oglesby, 1989):

1. Long term commitment to the program at all levels of the organization.

2. Allow groups to meet on "company time."

3. Membership in groups must be voluntary.

4. Staff and management cooperation is essential.

5. Rules for operating the group must be made clear at the outset.

6. The group must understand that all their recommendations will not be automatically approved by top management. However, management must not arbitrarily dismiss recommendations, as this will defeat the purpose of the program.

Work Improvement

"Work smarter, not harder" is the slogan for developing work improvement techniques. This concept analyzes project tasks to determine how the project can be completed with less effort, at less cost, in less time and more safely (Hinze, 1990).

There are two major steps in this method:

1. Focus on the details of the task being analyzed (work sampling, delay surveys, time and motion studies).

2. Take the "operation" away from the project site for analysis (use flow diagrams and process charts, crew balance charts, and learning curves).

Work improvement techniques have not been used much in the construction industry (Hinze, 1990). Some critics claim that a construction project is too customized for applying these techniques. While a project's end product may be customized, the tasks utilized to construct most project components are very repetitive and make an excellent opportunity for work improvement applications. Another misconception is that construction companies do not want to train their workers in new techniques because the workers are only temporary employees. Studies have shown the opposite to be true, i.e., most construction workers tend to remain with the same employer for more than a year.

Work improvement techniques can be utilized at any time throughout the "life" of a project, however, they are best used during the planning phase to identify, as early as possible, the resources and tasks required of the project.

Human factors, often not adequately considered, also play an important part in productivity. Nunnally (1987) states that:

> a worker's physical capacity, site working conditions, morale, and motivation are important elements in determining the most effective work methods and the resulting productivity for a particular task. Other techniques available to assist the construction manager in improving construction productivity and cost effectiveness include network planning methods, economic analyses, safety programs, quantitative management methods, simulation, and the use of computers.

SUMMARY

The Construction Industry Cost Effectiveness study, conducted by the Business Roundtable (1977-1982), identified numerous problems in the U.S. construction industry; however, the study concluded that a majority of the problems could be overcome by improved management of the construction effort. Poor safety, lack of control of the overtime, inadequate training and education, low worker motivation and failure to adapt modern management systems were some of the consequences of poor project management.

CHAPTER 2

LITERATURE REVIEW

Section 3: NAVAL CONSTRUCTION FORCE

MISSION AND ORGANIZATION

INTRODUCTION

To obtain a cursory working knowledge of the Naval Construction Force (NCF), this chapter will discuss the overall organization and functions of the various units of the NCF. It will concentrate on the Naval Mobile Construction Battalion (NMCB) and Construction Battalion Units (CBU) organizations, as these most resemble construction contractor organizations that are found in private industry.

> The Naval Construction Force is a generic term applied to that group of naval organizational components which have the common characteristics of possessing the capability to construct, maintain, and/or operate shore, inshore, and/or deep ocean facilities in support of U.S. Navy and U.S. Marines Corps, and when directed, other agencies of the U.S. Government (NAVFAC P-315, 1983).

UNITS OF THE NAVAL CONSTRUCTION FORCE

The various NCF units may be: active units; units of the Naval Reserve; units planned (neither active nor reserve) for establishment when required in a contingency; units primarily to exercise command and control of the construction units (active, reserve, and/or planned); and units providing support to the construction units.

Commander, Naval Construction Battalion. The Naval Construction Battalion (NCB) exercises operational and administrative control of assigned NCF components. The Commanders and their staff provide policy and guidance in areas such as operational effectiveness, deployment schedules, readiness training, equipment management, and logistics support. There are two such units in the Navy: Commander, Construction Battalions Pacific Fleet (COMCBPAC) and Commander, Construction Battalions Atlantic Fleet (COMCBLANT). Figure 6 shows the construction organization levels from the Commander, Naval Construction Battalions to the construction projects.

Naval Construction Regiment (NCR). The NCR exercises operational and administrative control of two or more Naval Mobile Construction Battalions.
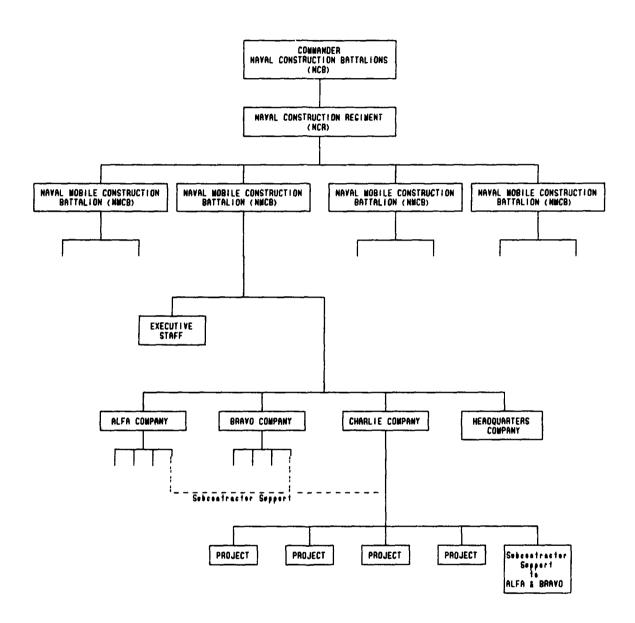
Figure 6. Typical NCF Construction Organization

The NCR develops construction execution plans; assigns construction projects to NCF units; monitors progress and assures adherence to quality standards; directs redistribution of units, equipment, and materials; and reviews plans and operations reports to determine training and equipment requirements.

There are two Naval Construction Regiments, one each for the Pacific Fleet and Atlantic Fleet.

<u>Naval Mobile Construction Battalion (NMCB)</u>. An NMCB provides responsive military construction support to Naval, Marine Corps and other forces; constructs base facilities; conducts defensive operations; and conducts disaster control and recovery operations. There are currently eight NMCB's, four each for the Pacific Fleet and the Atlantic Fleet.

<u>Construction Battalion Unit (CBU)</u>. A CBU is assigned to the operating forces of a shore establishment primarily as a means to maintain technical skills of Seabees while on shore duty. These units are used on construction, alteration, repair, and non-recurring maintenance projects which enhance technical training proficiency of the Seabee and the unit. Presently, there are 23 CBU's in the NCF which are located at various naval bases throughout the United States.

There are several other units of the NCF that are not directly associated with NMCB's or CBU's. These units have specialized functions which are an important integral of the NCF. However, these units were not included in this study because their missions are too specialized for comparison to a typical nonmilitary construction organization. The following paragraphs describe these units, and figures 7 and 8 show where these units fit into the overall NCF organization.

Naval Construction Brigade (NCB). The NCB is primarily a wartime entity which exercises operational and administrative control of two or more Naval Construction Regiments in a geographic area.

Naval Construction Force Support Unit (NCFSU). The NCFSU provides operational logistics support for an NCR. The NCFSU is responsible for materials and supply support, and repair of auxiliary equipment. This unit is primarily a wartime entity.

Amphibious Construction Battalion (PHIBCB). A PHIBCB provides engineering support to the Naval Beach Group during the initial assault and landing phase of amphibious operations, including assembly and installation of pontoon causeways and ship-to-shore fuel systems; operation of self-
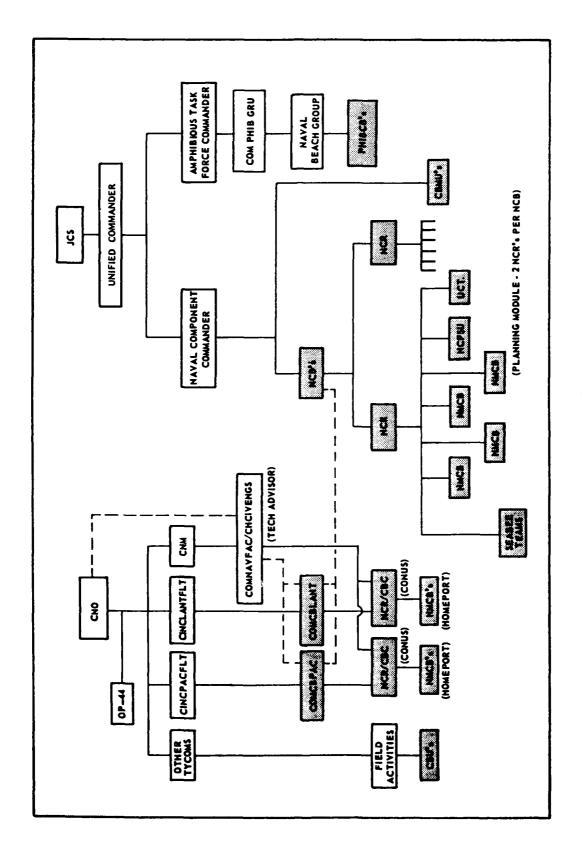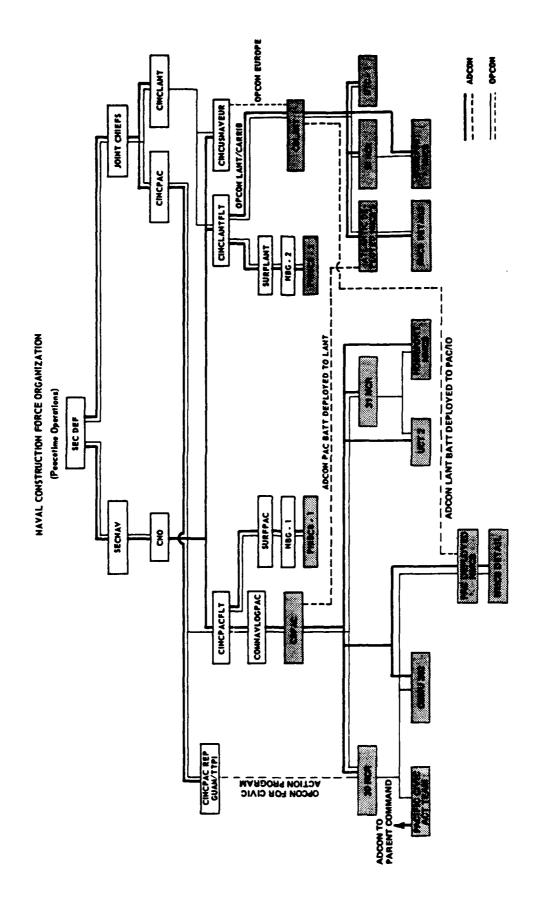
Figure 7. NCF Organization (Wartime)

NAVAL CONSTRUCTION FORCE ORGANIZATION
(Peacetime Operations)

Figure 8. NCF Organization (Peacetime)

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propelled pontoon barges; the maintenance of construction equipment for the Naval Beach Group; and limited construction in support of beach improvement.

Construction Battalion Maintenance Unit (CBMU). A CBMU operates and maintains public works and public utilities at overseas and forward area bases after construction has been completed. Only one CBMU is maintained in the NCF during peacetime and more can be readily established if priorities dictate.

Seabee Team. A Seabee Team is a small, mobile, air transportable component established to provide a construction and construction training capability to support counterinsurgency, civic action, rural development, and other similar operations, usually in underdeveloped areas of the world.

Underwater Construction Team (UCT). The UCT provides underwater engineering, construction and repair capability to meet the needs of the Navy, Marine Corps and other military forces, both in contingency execution and national security operations.

Naval Support Unit, State Department. The Naval Support Unit, State Department provides construction support to the U.S. Department of State involving the inspection of foreign contract construction and the accomplishment of minor construction and repairs within secure areas of overseas foreign service buildings.

Naval Energy and Environmental Support Activity (NEESA). NEESA provides environmental protection and energy conservation support; radiological affairs and occupational safety and health support; and field technical and engineering management of Mobile Utilities Support Equipment to naval commands.

Although Seabees are distributed throughout all NCF units, the majority of Seabees are in the Naval Mobile Construction Battalions and the Construction Battalion Units. This study will concentrate on these two units regarding motivational and productivity factors that influence the performance of Seabees.

NAVAL MOBILE CONSTRUCTION BATTALION

MISSION

The mission of the Naval Mobile Construction Battalion (NMCB), simply stated, may be expressed as one of construction defense and disaster preparedness operations. The Chief of Naval Operations has stated the mission in these terms (NAVFAC P-315, 1983):

(1) Construction: to maintain a state of operational readiness to provide responsive military construction support to Naval, Marines Corps and other forces in military operations; to construct base facilities.

(2) Defense: to be prepared to conduct defensive operations when required by the circumstances of the deployed situation.

(3) Disaster Preparedness: in time of emergency or disaster, to be prepared to conduct disaster control and recovery operations, including emergency public works functions as directed.

ORGANIZATION

The NMCB is organized for dual purposes of construction and military support operations. This chapter will focus on the construction side of operations and only briefly discuss the military support organization.

The NMCB is designed to be a self-sufficient unit requiring a replenishment of consumables only (food, fuel, ammunition, and miscellaneous low cost supplies). Figure 9 provides a typical organizational chart for both construction and military support organizations.

The adaptability of the organizational structure for changing circumstances cannot be overemphasized for various mission objectives (construction, defense, and disaster preparedness). The organizational structure provides a clear representation of the chain of command and paths of communication within the NMCB. This is a very important aspect, whether in the military or any business organization.

ELEMENTS OF THE NMCB ORGANIZATION

Commanding Officer. The Commanding Officer (CO) is responsible for all aspects of the battalion's performance, security, efficiency, and well-being in accomplishing the mission as designated by higher authority. Pertaining to construction operations, the CO is directly responsible for the timely preparedness and successful completion of all assigned construction projects.
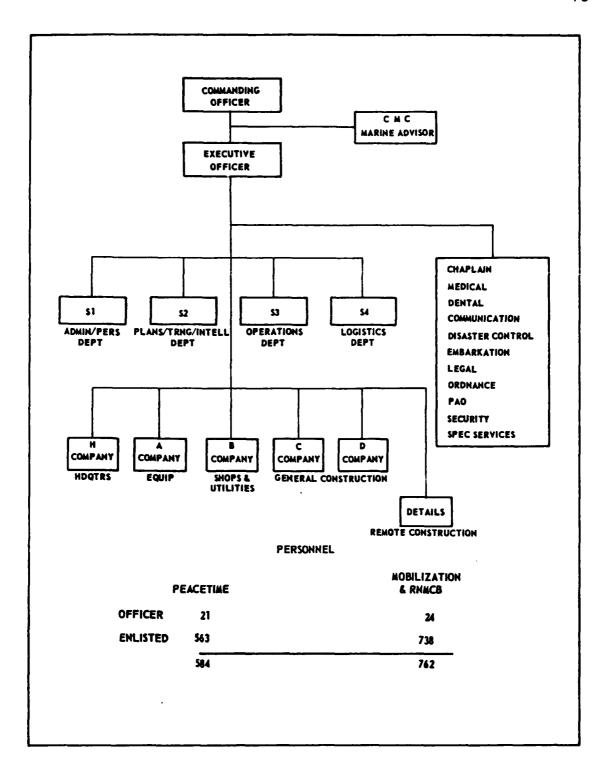
COMMANDING OFFICER	
	C M C MARINE ADVISOR
EXECUTIVE OFFICER	

S1	S2	S3	S4
ADMIN/PERS DEPT	PLANS/TRNG/INTELL DEPT	OPERATIONS DEPT	LOGISTICS DEPT

CHAPLAIN
MEDICAL
DENTAL
COMMUNICATION
DISASTER CONTROL
EMBARKATION
LEGAL
ORDNANCE
PAO
SECURITY
SPEC SERVICES

H COMPANY	A COMPANY	B COMPANY	C COMPANY	D COMPANY
HDQTRS	EQUIP	SHOPS & UTILITIES	GENERAL CONSTRUCTION	

DETAILS

REMOTE CONSTRUCTION

PERSONNEL

	PEACETIME	MOBILIZATION & RNMCB
OFFICER	21	24
ENLISTED	563	738
	584	762

Figure 9.   Organizational Structure and

Personnel Staffing of the NMCB

Executive Officer. The Executive Officer (XO) is a "direct representative" of the CO and is responsible for good order and discipline, all administrative matters, training, and executing the policies of the CO. Pertaining to construction operations, the XO has no operational control, however, the XO must be familiar with the overall construction operation in the event the duties of the CO must be assumed.

Executive Staff. The Executive Staff assists the CO and XO in establishing command policy and making command decisions. The Executive Staff is comprised of:

    (1) Administrative and Personnel Officer (S-1)

    (2) Training and Intelligence Officer (S-2)

    (3) Operations Officer (S-3)

    (4) Supply Officer (S-4)

Special Staff. The Special Staff assists the CO and XO in specialized programs/areas. The duties are either full time or collateral and consist of:

    (1) Full time: Chaplain, Medical Officer, Dental Officer, and Legal Officer.

    (2) Collateral Duties: Communication Officer, Disaster Preparedness Officer, Embarkation Officer, Ordnance

Officer, Public Affairs Officer, Security Officer, and Special Services Officer.
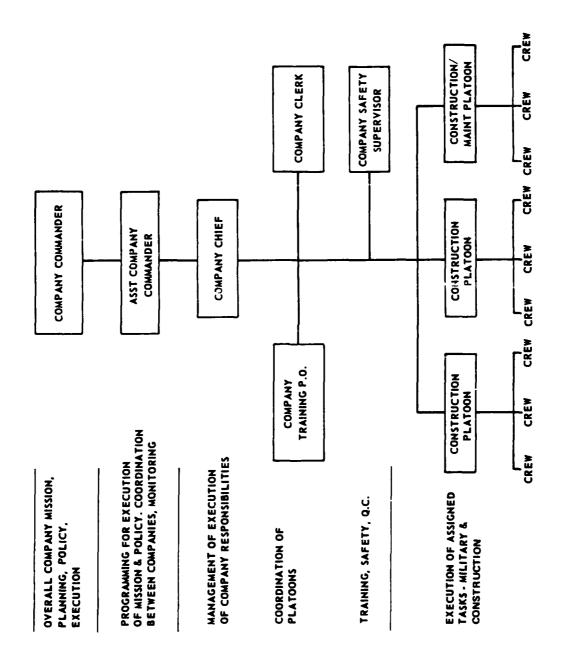
Company Organization. The organization of each company in the battalion serves as the "element in the overall NMCB organization by which the unit's mission is accomplished." The Company Organization is designated by two categories:

(1) Headquarters Company, "which serves as a military and administrative organization for the personnel assigned to the Executive and Special Staffs." Headquarters Company personnel provide support only, and no direct labor toward construction operations. This is similar to the "general office" department in a civilian construction organization.

(2) Construction or Line Companies are designated as ALFA, BRAVO, and CHARLIE Companies. (A DELTA Company is sometimes utilized, its mission and organization is generally the same as CHARLIE Company). Figure 10 provides a typical construction company organizational structure.

Each of the Construction companies has a specific mission within the NMCB:

(1) ALFA Company. As the "equipment company," (figure 11), ALFA Company is responsible for the operation

OVERALL COMPANY MISSION,
PLANNING, POLICY,
EXECUTION

PROGRAMMING FOR EXECUTION
OF MISSION & POLICY. COORDINATION
BETWEEN COMPANIES, MONITORING

MANAGEMENT OF EXECUTION
OF COMPANY RESPONSIBILITIES

COORDINATION OF
PLATOONS

TRAINING, SAFETY, Q.C.

EXECUTION OF ASSIGNED
TASKS - MILITARY &
CONSTRUCTION

COMPANY COMMANDER

ASST COMPANY
COMMANDER

COMPANY CHIEF

COMPANY CLERK

COMPANY SAFETY
SUPERVISOR

COMPANY
TRAINING P.O.

CONSTRUCTION
PLATOON

CONSTRUCTION
PLATOON

CONSTRUCTION/
MAINT PLATOON

CREW CREW CREW CREW CREW CREW CREW CREW CREW

Figure 10. Functional Structure of the Construction Company

Figure 11. ALFA Company Organization

and maintenance of all Civil Engineer Support Equipment (construction equipment) in the NMCB. In addition, ALFA Company serves as the "prime contractor" for all heavy equipment and horizontal construction projects; and provides equipment support as "subcontractor" to BRAVO and CHARLIE Company projects.

(2) <u>BRAVO Company</u>. As the "shops and utilities company" (figure 12), BRAVO Company serves as the "prime contractor" on all utility projects; provides utility installation as "subcontractor" for other companies; and provides maintenance and operation of the NMCB camp utilities.

(3) <u>CHARLIE Company</u>. As the "general construction company" (figure 13), CHARLIE Company serves as "prime contractor" for all vertical construction projects; and "subcontractor" support to the other construction companies. CHARLIE Company provides manpower with skills to perform concrete work, carpentry, welding, steelwork, and timber construction.

(4) <u>Detail Organizations</u>. An NMCB is usually assigned construction projects in remote locations in various parts of the world. To accomplish these projects, a Detail organization is formed. The Detail organization is very
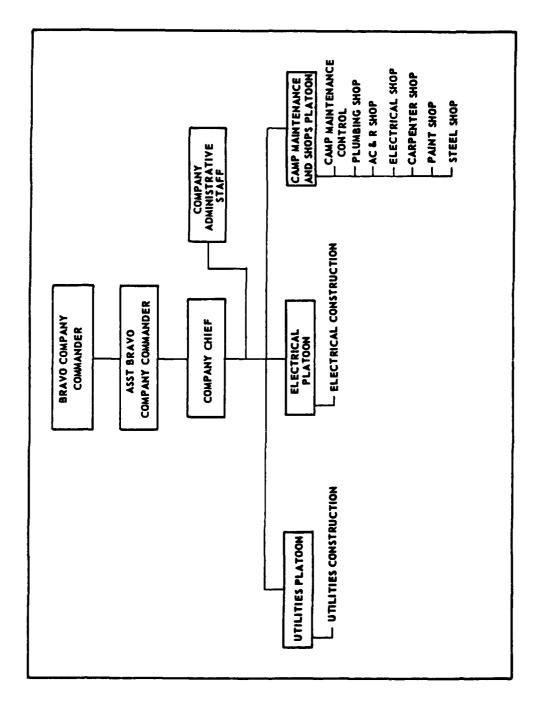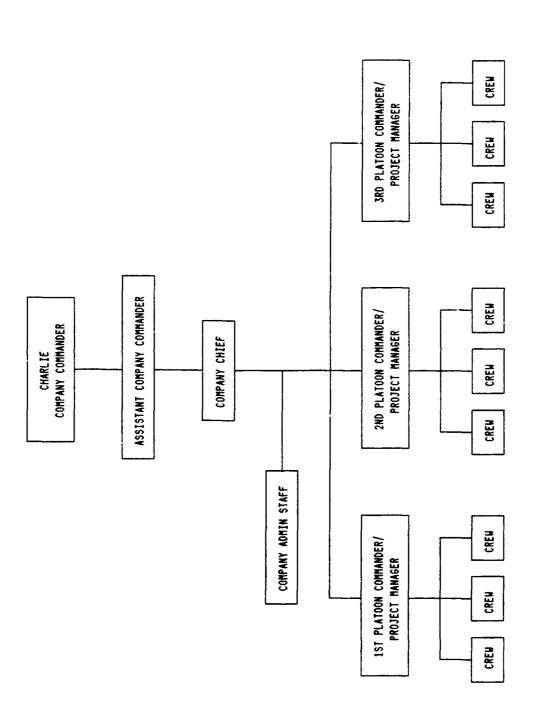
Figure 12. BRAVO Company Organization

Figure 13. CHARLIE Company Organization

similar to the CHARLIE Company organization but is supplemented with personnel from ALFA, BRAVO, and Headquarters companies, depending upon the assigned project type.

ENLISTED RATING SYSTEM

The Navy enlisted community consists of 24 "occupational fields" comprised of over 70 "ratings." Ratings are career fields that require particular skills, training and duties, and provide a career path for the enlisted person.

The Seabee construction skills are referred to as Occupational Field 13 (OF-13) skills. This field consists of seven ratings (figure 14):

(1) <u>Builder (BU) Rating</u>. Builders perform tasks related to construction and repairs of wooden, concrete and masonry structures; painting and interior finish work; and carpentry skills.

(2) <u>Steelworker (SW) Rating</u>. Steelworkers perform tasks related to fabrication and erection of steel structures, welding, and sheetmetal work.

BUILDER (BU)	CONSTRUCTION ELECTRICIAN (CE)	
CONSTRUCTION MECHANIC (CM)	ENGINEERING AID (EA)	
EQUIPMENT OPERATOR (EO)	STEELWORKER (SW)	UTILITIESMAN (UT)

Figure 14.   Occupational Field 13 Rating Identification

(3) <u>Engineering Aid (EA) Rating</u>. Engineering Aids perform tasks related to surveying, drafting, materials testing; and minor design work.

(4) <u>Construction Electrician (CE) Rating</u>. Construction Electricians perform tasks related to installing and servicing all electrical systems and components, and wire communication systems.

(5) <u>Utilitiesman (UT) Rating</u>. Utilitiesmen perform tasks related to installing and servicing of mechanical systems and components, water and wastewater systems, HVAC systems and components, and refrigeration systems.

(6) <u>Equipment Operator (EO) Rating</u>. Equipment Operators perform tasks related to the operation of automotive, materials handling, and construction equipment; operation of quarries and batch plants; well drilling; and horizontal construction operations.

(7) <u>Construction Mechanic (CM) Rating</u>. Construction Mechanics perform tasks related to the maintenance and repair of all automotive, materials handling, and construction equipment, along with the maintenance of small gas-powered tools.

In addition, each NCF unit has many essential support personnel that are not in the OF-13 construction field. The following occupational fields are represented: General Seamanship, Ship Maintenance, Weapons Control, Ordnance Systems, Health Care, Administration, Logistics, Media, Master-at-Arms, and Communications. These personnel are considered to be "Seabees" while part of the NCF unit.

CONSTRUCTION OPERATIONS

Construction operations for an NMCB can be organized under several different organizational structures depending upon the assigned projects, details, and objectives of each deployment. This section will briefly describe the most typical concept for familiarization for the reader.

The "Prime Contractor" concept is the most common construction organization for an NMCB, as shown by figure 15. As discussed earlier, the CO is directly responsible for the timely preparedness and successful completion of all construction projects assigned to the NMCB. The Operations Officer is responsible to the CO to manage the construction operations and is given operational control over the battalion's construction resources: personnel, equipment, and materials. The Company Commanders are directly responsible to the Operations
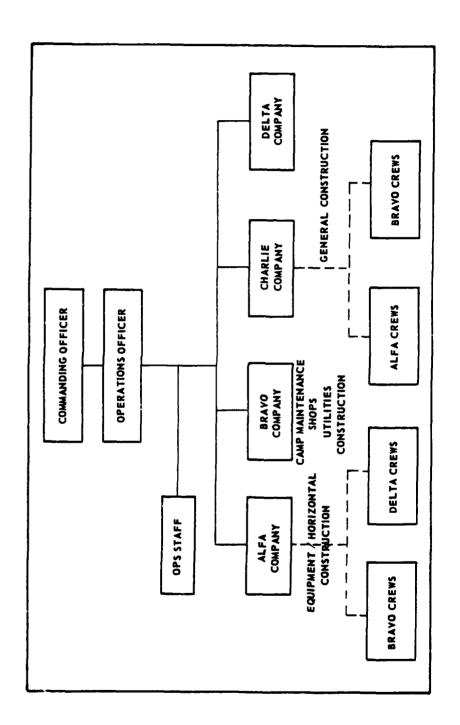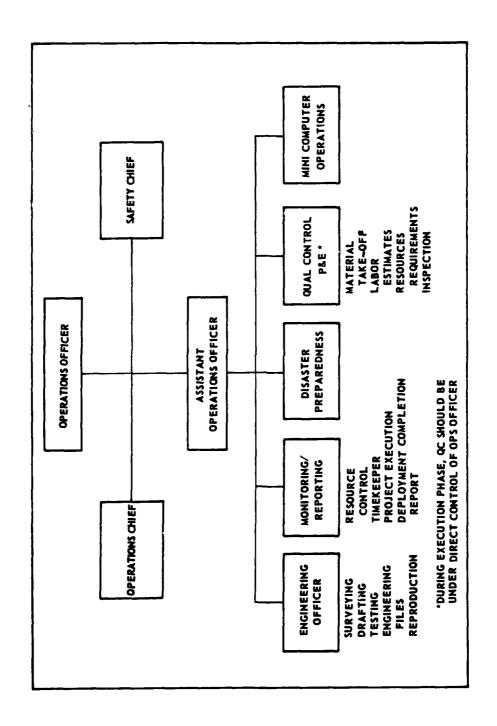
Figure 15. "Prime/Sub" Construction Organization

Officer for the timely completion of projects assigned to them. The line companies are assigned as "prime contractor" to projects as determined by the scope and skills required for each project. "Subcontractor" crews are assigned to each project to assist the prime contractor with construction. Similar to private industry, the prime contractor coordinates and supervises all efforts, including subcontractor resources. The line companies are staffed primarily by OF-13 personnel:

(1) ALFA Company: Equipment Operators

Construction Mechanics

(2) BRAVO Company: Construction Electricians

Utilitiesmen

(3) CHARLIE Company: Builders

Steelworkers

The Operations Department responsibilities include: planning and estimating; engineering; safety; quality control; resource control; inspection; and testing. Figure 16 shows a typical Operation Department organization.

Figure 16. Standard Operations Department Organization

DEPLOYMENT CYCLE

Presently, there are eight Naval Mobile Construction Battalions in the navy, four within the U.S. Pacific Fleet and four within the U.S. Atlantic Fleet. The battalions deploy to four major camp sites: Roosevelt Roads, Puerto Rico; Rota, Spain; Okinawa, Japan; and Guam. From each deployment site, the battalion sends details to smaller sites such as: Bermuda, United Kingdom, Italy, Greece, Caribbean Islands, Japan, Alaska, Phillipines, Diego Garcia, Africa, and some sites in the continental U.S.

The deployment cycle of the battalions has been established such that there are generally four battalions deployed and four battalions in homeport at a given time. Battalions deploy for about seven months and are in homeport for seven months in each deployment cycle. While in homeport, a battalion prepares and plans for the upcoming deployment by: undergoing military and construction skills training; planning, estimating and scheduling for deployment projects; performing small homeport construction projects; and participating in various military exer⁻ises. While on deployment, NMCB's perform construction projects (alterations, repairs, non-recurring maintenance and new construction) for the local bases, enhancing the base's

mission capabilities, recreational and service facilities, utility distribution systems, transportation networks, security systems, and housing facilities.

An NMCB is analogous to a medium to large construction contractor organization in the private industry. A comparison of the two organizations is shown by figure 17.

CONSTRUCTION BATTALION UNIT

ORGANIZATION

The Construction Battalion Unit (CBU) was created in 1969 to provide more meaningful shore duty for enlisted personnel in the OF-13 ratings. The CBU provides individual and unit training in technical (construction) and military skills for the assigned Seabees.

A CBU is assigned to a shore activity commanded by an Officer-In-Charge, and is comprised of between 30-75 men and women (Note: Presently, women are not allowed in NMCB's since this organization is a "combat unit"). Several staff and support functions (e.g., safety, supply, training and operations) found in an NMCB are accomplished by individuals in a CBU. Most notably different from an

**NAVAL MOBILE
CONSTRUCTION BATTALION**

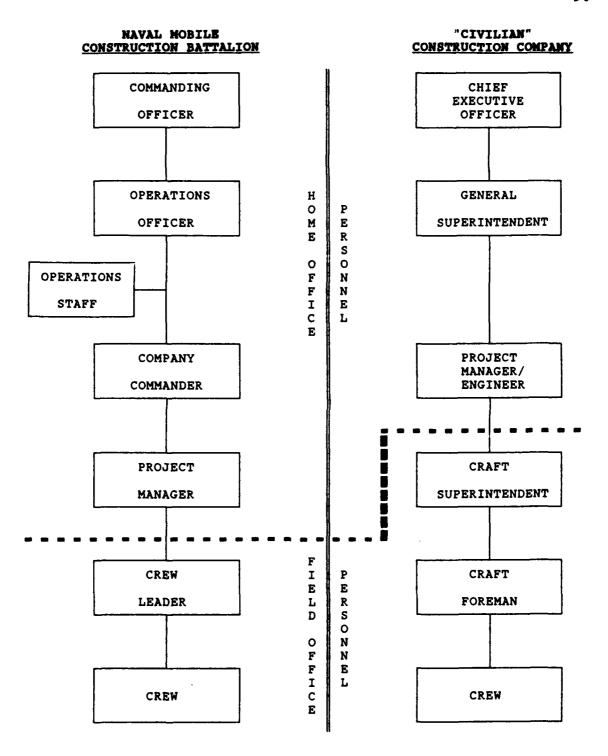**"CIVILIAN"
CONSTRUCTION COMPANY**

Figure 17.   Construction Organization Comparison

NMCB is that a CBU is not a self-sustaining unit. The CBU's host activity must provide berthing, messing, disbursing, accounting, and medical/dental support. A CBU's organization is similar to a mini-NMCB as shown by figure 18. In the example shown by figure 18, the first, second and third squads represent ALFA, BRAVO, and CHARLIE companies, respectively, and the Support Section represents HEADQUARTERS Company.

MISSION

NAVFAC P-315 (1983) defines the mission of the CBU to be:

> new construction, alteration, repair or non-recurring maintenance projects which clearly provide for attaining and maintaining technical unit proficiency, or on projects where use of civilian personnel would be restricted by security requirements. CBU personnel will not be used in competition with civilian labor when such use can be avoided. CBU's will exert a positive effort to assist local shore activities in the implementation of an effective facilities self-help program to improve living conditions ashore. The unit will be tasked with specific projects clearly defined as to scope and resources available, and for which the unit can plan, and exercise its organic military construction capability.

In addition, the CBU is required to provide time for individual and construction skill training; unit emergency or disaster training; and unit and individual Fleet Hospital training.
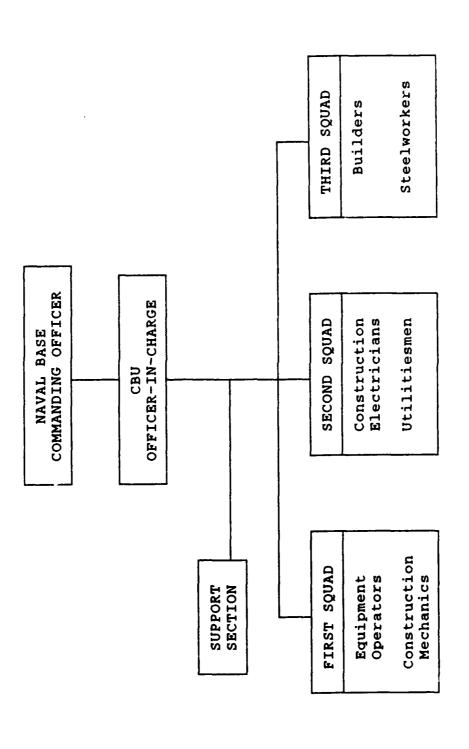
Figure 18. Typical CBU Personnel Allowance

CHAPTER 3

DEVELOPMENT OF HYPOTHESES

Several studies of motivational and productivity factors in the construction industry have been done in the past. A few of the more notable studies were used as a review in developing the hypotheses for this research.

Borcherding and Oglesby (1974 and 1975) identified job satisfiers and dissatisfiers that influenced persons at various levels of construction organizations. Maloney (1987), Samelson and Borcherding (1980), and Hinze and Kuechenmeister (1981) discussed the role of foremen and how they introduce various motivational and productivity factors into the construction workplace. Maloney (1981) provided a review of motivational practices and influences in the construction industry. Hinze and Parker (1978) presented research into project safety and its influence on productivity.

The experience of the author as a U.S. Navy Civil Engineer Corps (CEC) Officer was also a resource for developing hypotheses. Discussions with other CEC officers and the

author's faculty advisor proved to be useful in developing relevant hypotheses.

The hypotheses are as follows:

H1. Seabees who have a positive working relationship with their supervisor are more productive.

H2. The productivity of a Seabee will increase as the sense of accomplishment that is derived from their work increases.

H3. Seabees with a lower number of injuries are more productive.

H4. Seabees with opportunities for nonmonetary rewards are more productive.

H5. Seabees that feel they are adequately recognized for contributions are more productive.

H6. Supervisors that are good motivators have more productive Seabees.

H7. Seabees who are self motivated to set and achieve personal goals are more productive.

H8. Seabees who enjoy their work are more productive.

H9. Seabees who perform meaningful work are more productive.

H10. Seabees who are proud to be in the Navy and their unit, and proud to be "Seabees" are more productive.

H11. Seabees who feel they are respected are more productive.

H12. The type of work will influence the productivity of a Seabee.

H13. Safety conscious Seabees are more productive.

H14. Seabees who are concerned with job security are more productive.

H15. Effective chain of command communication will improve a Seabee's performance.

H16. Seabees who are concerned about quality are more productive.

H17. As the effects and presence of substance abuse decreases, production will increase.

H18. A work environment that promotes good morale will result in productive Seabees.

H19. Seabees that receive "support" for personal problems are more productive.

H20. Seabees who are motivated by training opportunities are more productive.

H21. Seabees with proper training are more productive.

H22. "Good" supervisors are respected by their subordinates.

H23. "Good" supervisors tend to have cohesive crews.

H24. Seabees who enjoy their work have a positive working relationship with their supervisor.

H25. Seabees who perform meaningful work will enjoy their work more.

H26. Seabees who achieve personal goals enjoy their work.

H27. Seabees who set personal goals are more satisfied with their work and their contributions to their unit.

H28. Seabees with less than one year of service tend to have more severe accidents.

H29. Seabees who have "alot" of minor injuries are more likely to have lost time accidents.

All of the previous hypothesis (H1-H29) were found to be statistically significant towards influencing the performance of a Seabee. These hypotheses and findings are discussed in subsequent chapters. A number of additional hypotheses were tested but were not found to be statistically significant (level of significance greater than 10%). These hypotheses were not supported (or refuted) by the data and are not discussed in this study, but are provided below for informational purposes only:

H30. Seabees who are concerned with advancement are more productive.

H31. Seabees who receive a higher degree of job satisfaction from their work are more productive.

H32. The productivity of a Seabee will improve as the pay and benefits increase.

H33. Seabees who have a positive working relationship with their crew members are more productive.

H34. Seabees who like the location of their work are more productive.

H35. Seabees who have adequate tools and materials are more productive.

H36. Seabees who adequately plan and schedule their work are more productive.

H37. Seabees who are not under alot of stress are more productive.

H38. Seabees who have thorough and complete project plans are more productive.

H39. Seabees who are physically fit are more productive.

H40. Seabees who participate in making decisions concerning their project are more productive.

H41. Seabees who have served or plan to serve more than 20 years are more productive.

CHAPTER 4

RESEARCH METHODOLOGY

Numerous studies have been conducted to identify those factors which influence the motivation and productivity of construction workers. The more notable early studies include research conducted by Borcherding and Oglesby (1974 and 1975) who examined the relationship between job satisfaction, job dissatisfaction and construction productivity, and how these relationships affected owners, home office managers, field supervisors and workers. The role of foremen and how they introduce various productivity and motivational factors into the construction workplace have been presented by Maloney (1987), Samelson and Borcherding (1980), and Hinze and Kuechenmeister (1981). Maloney (1981) provided a review of motivational practices and influences in the construction industry. Project safety and its influence on productivity was presented by Hinze and Parker (1978). The Business Roundtable (1982) reported that a highly motivated workforce enhances productivity and project effectiveness.

It has been shown by previous studies that factors that motivate construction workers to be productive are different than factors for other industrial workers. Construction workers are generally motivated by factors which are intrinsic to the work itself (e.g., job satisfaction, personal goals, meaningful work, recognition). Are Seabees motivated by the same factors? What extrinsic factors affect the productivity of a Seabee? Since the examination of the existing literature did not provide answers to these questions, a study was conducted with the Seabees to gain enlightenment in the area of Seabee work motivation.

The primary research instrument was a questionnaire designed to obtain information on the factors, extrinsic and intrinsic, that influence the performance of a Seabee.

This research is different from previous studies in one major respect:

1. The population studied consisted of military construction workers (Seabees) in the Naval Construction Force (NCF). As a result of studying only military personnel, the following can be stated:

a. Organized labor agreements and associated problems (e.g., jurisdictional disputes, potential strikes, use of union or nonunion workers) are not a factor.

b. The work environment and procedures are well defined due to the addition of military duties and decorum.

c. The primary mission of the Seabees and the preponderance of their training is towards "contingency" construction operations. Whereas their civilian counterparts are primarily concerned with "commercial" construction operations.

RESEARCH PROCEDURE

Since the literature search on this subject revealed no previous studies concerning motivational and productivity factors as they pertain to the Naval Construction Force (NCF), data collection was to be compiled in a "scientific" manner for this study. Research was conducted in three phases:

1. Preliminary phase

2. Pilot phase

3. Final phase

A questionnaire evolved as the research progressed through these phases. The questionnaire focused on factors that may influence motivational and productivity in the NCF. The original list of factors and questions were developed by the author, based on personal experience and observations in the NCF. The preliminary phase

questionnaire was distributed and reviewed by a group of six Naval Civil Engineer Corps officers with NCF experience. Modifications to the questionnaire were made in response to comments from these officers and other individuals who agreed to examine and comment on the questionnaire. The resultant pilot phase questionnaire was given to 44 men and women of Construction Battalion Unit 418 (Bangor, WA). The questionnaire was again revised for use in the final phase (see Appendix A). To obtain a representative sample, the questionnaire was targeted toward Seabees in Naval Mobile Construction Battalions (NMCB's) and Construction Battalion Units (CBU's), as these construction operations closely resemble the operations of nonmilitary construction contractors and trades.

It was recognized that construction workers are not the type to sit down, complete paperwork, and supply written information that would be time-consuming and require a great deal of effort. Thus, the questionnaire was designed to be completed in a relatively short time (about 20 minutes) with a minimal amount of writing.

QUESTIONNAIRE FORMAT

The final questionnaire consisted of predominately closed ended questions. A few questions were of the multiple-

choice variety, but most consisted of a five-point scale on which the respondent would indicate the extent of agreement with a given statement or proposition. Once familiar with the scale, a respondent would be able to answer a large number of questions in a short period of time.

QUESTIONNAIRE CONTENT

The questionnaire consisted of three major sections: General Information, Productivity Factors, and Motivational Factors (see Appendix A).

General information required of each respondent included rate, paygrade, time in the navy, time at their present command and position, and organization type.

Questions concerning motivation discussed the following factors: rewards, money, benefits, recognition, personal goals, training, travel, job satisfaction, patriotism and camaraderie, advancement, job security, respect, and meaningful work.

Productivity questions concerned the following factors: supervisor relations, crew and fellow worker relations, type of work, location of work, tools, equipment, materials, training, substance abuse, computers, planning

and estimating, safety, personal problems, communication, morale, family separation, stress, methods of construction, project plans, physical fitness, discrimination and decision making.

SURVEY PROCEDURE

As previously noted, the data was to be collected from NMCB's and CBU's only. One hundred questionnaires were distributed to each of the eight NMCB's and 25 questionnaires were sent to a representative sample of eight CBU's from various parts of the United States. A total of 1,000 questionnaires were distributed.

The data collection began by contacting the NMCB's and CBU's by letter and explaining to them what this research is designed to achieve (see Appendix B). Survey package recipients were requested to distribute the questionnaires to Seabees in the Occupational Field - 13 (OF-13) ratings (construction) at various paygrades.

Two important points were stressed in the letter. First, the questionnaires were to be regarded as strictly confidential to allow the respondent to be as honest as possible when completing the questionnaire. Secondly, the questionnaires were not to be regarded as a test; there

being no "right" or "wrong" answers. It was stressed that each answer was simply an expression of the respondent's individual opinion and observations.

The questionnaires were mailed with the letters to each organization. The author provided a postage paid envelope for each organization to return the questionnaires. All responses were sent back to the author within seven weeks of distribution.

Responses and the willingness to participate in this study were excellent. Seven of eight NMCB's and six of eight CBU's participated in the research with a total of 618 completed questionnaires returned. Table 1 provides a summary of responses to this study. Interestingly, one nonparticipating organization decided not to distribute the questionnaire because they had just finished a Command Management Equal Opportunity survey and were correcting problems, and felt that this questionnaire would "jeopardize their progress and confuse the situation." The other two nonparticipating organizations did not indicate why they were not participating.

A few of the organizations returned questionnaires filled out by non-OF-13 Seabees for use as a comparison to OF-13 Seabees. Even though these additional questionnaires were

Table 1.

Summary of Responses to Study

Sample Group	Organization Type	Questionnaires Mailed	Questionnaires Returned	Deployed or Homeported
1	NMCB	100	101	H
2	NMCB	100	31	D
3	NMCB	100	55	H
4	NMCB	100	65	D
5	NMCB	100	94	D
6	NMCB	100	0	H
7	NMCB	100	61	D
8	NMCB	100	88	H
9	CBU	25	0	N/A
10	CBU	25	24	N/A
11	CBU	25	21	N/A
12	CBU	25	0	N/A
13	CBU	25	14	N/A
14	CBU	25	16	N/A
15	CBU	25	24	N/A
16	CBU	25	24	N/A
TOTAL		1,000	618	

not used, (not enough for a representative sample) the author thanks them for the effort and initiative.

Each question provided a variable for analysis by the "Statistical Package for the Social Sciences" computer program (discussed later in this chapter).

Answers to questions (raw data) were coded into a data set as values (numbers) representing that particular variable. Appendix C provides the data set matrix for this study. Each questionnaire (case) is represented by three rows of data. The computer program interprets the data using a data definition file. The data definition file is illustrated by Appendix D.

The study's data was compiled by 618 questionnaires (cases), each consisting of 160 variables. Most questions required answers based on the degree of agreement expressed towards a statement, on a defined scale. A five point scale was utilized, using 1 to indicate "to a very little extent", 2 to indicate "to a little extent," 3 to indicate "to some extent," 4 to indicate "to a great extent," 5 to indicate "to a very great extent," and 6 to indicate "not applicable." The remaining questions required an alphanumeric response which was coded as a numeric value.

Some respondents failed to answer a few of the questions (errors attributed to missing questions, an entire page, or refusing to answer). This data was treated as a "missing value" and coded into the data file appropriately.

The following guidelines were used by the author for interpreting and coding questionable data:

1. If a range of values were provided, then the average value was used. For example, if the reply to "number of hours worked each week" was 40-50, then 45 was used.

2. If "N/A" was used to answer the questions concerning the number of injuries, then zero was used.

3. If all choices for questions "E" (productivity factors) and "B" (motivational factors) were chosen, then all choices were coded as missing values.

4. If the rate and paygrade indicated a Master Chief Petty Officer then the following rates were coded:

      a. CUCM ==> BU

      b. UCCM ==> UT

      c. EQCM ==> EO

DEPENDENT VARIABLES

To provide meaningful results of this study, the use of several dependent variables which were considered in the development of the questionnaire. Dependent variables were obtained through measures of the production efficiency and safety performance of each worker. These variables were then correlated with the independent variables, such as supervisor relations, type of work, personal goals, etc., as influenced by rate, paygrade, or position.

Each worker was asked to provide information on:

1. What percent of your work time do you perform at your fullest potential?

2. How many hours do you work each week?

3. Since you have been in your present unit/command, how many injuries have you received that:

    a. required first aid treatment only?

    b. required a doctor's attention?

    c. were lost time accidents?

4. How much longer do you expect to remain in the Navy?

PRODUCTION EFFICIENCY

The "production efficiency" of each worker was defined using the following equation:

$$\text{Production Efficiency, (\%)} = \frac{\text{WPERC X WHRSWEEK}}{\text{AVGWK}}$$

where, WPERC = percent of work time performing at

fullest potential

WHRSWEEK = number hours worked each week

AVGWK = average number of hours worked each

week

For NMCB: AVGWK = 49.2

CBU: AVGWK = 41.9

The production efficiency provides a percentage value comparable to workers performing at 100% of their potential throughout their work time. Dallavia (Adrian, 1982) developed a Production Range Index in which he classified production efficiency into three basic ranges: Low, Average, and High. Low production indicates a production efficiency of less than 55%, average production 55-85%, and high production greater than 85%.

Note that production efficiency is based on how productive workers perceive themselves, which probably results in a higher estimate than one that is based on perceptions of others.

SAFETY PERFORMANCE

A measure of "safety performance" was calculated for all workers based on the number and types of injuries that they experienced while with their present unit or command. The safety performance for each worker indicated the type and number of injuries per 1,000,000 hours of worker exposure. It was assumed that each worker worked 48 weeks per year (Seabees are allowed four weeks "vacation" each year). The average number of hours worked per week was provided by each Seabee.

The safety performance of each Seabee was measured by:

Safety Factor = (# injuries per million manhours)

= (# injuries/# yrs in unit)

x (1,000,000 hrs/million mhrs)

x (1 week/# hrs work) x (1 yr/48 weeks)

Three measures of safety were defined for each respondent:

1. Injuries requiring first aid treatment only (treated on the worksite);

2. Injuries requiring a doctor's treatment (off the work site); and

3. Injuries resulting in lost workdays (the day of the injury does not count as a lost workday).

ANALYSIS OF DATA

Upon receipt, the completed questionnaires were coded into a data file. The coding format is shown by the definition file in Appendix D, and the raw data is provided by the data file in Appendix C.

STATISTICAL ANALYSIS

Based on the large number of participants and upon review of the "frequencies" and "histograms" of the responses to each question, it was assumed that the data is normally distributed. Therefore, a parametric statistical analysis method was used. The analysis was performed by using the "Statistical Package for the Social Sciences" (SPSS) computer program developed for use with personal-type computers.

To test the significance of correlations, <u>Pearson's Correlation Coefficient</u> was used. This coefficient measures the "amount" and "direction" of linear relationship between two variables. The values of the coefficient can range from -1 to +1, with a value of 0 indicating no linear relationship. For example, if one pair of variables has a correlation coefficient of +0.8, while another pair has a coefficient of -0.8, the strength of the relationship is

the same for both. It is the direction of the relationship that differs.

A positive relationship between two variables implies that as the value of one variable increases, the value of the other variable also increases. As the value of one variable increases and the value of another decreases, then a negative relationship exists (Norusis, 1988).

To determine if a relationship between two variables is statistically significant, it was decided that a level of significance of 5% would be used. A finding with a level of significance between 5% and 10% would be considered as an indicator of a strong tendency toward significance. For example, if a finding has a level of significance of $p = .02$, then there are only 2 chances in 100 trials that the finding is due to random occurrence.

Prior to performing a correlation between a dependent variable (e.g., production, safety) and an independent variable (e.g., supervisory relations, type of work, recognition), or between two independent variables, a few points concerning the independent variable must be considered. First, an independent variable may be generated by a single question or a combination of more than one question from the questionnaire. If more than one

question is used, the independent variable is the "mean" of the sum of the questions used to generate the independent variable.

Secondly, all questions were "recoded" such that "not applicable" responses were treated as "missing values." This precludes the use of these responses in computing the "mean" of the independent variable. Using the "not applicable" answer would tend to result in a "mean" that is skewed to the "high side" of the five-point scale.

Lastly, several questions required the numerical (five-point scale) responses to be recoded inversely (e.g., 1=5, 2=4, 4=2, 5=1). These questions generally emphasized a "negative perspective" of a motivational or productivity factor. In other words, the "preferred" answer to these questions would be "to a very little extent," whereas the "preferred" answer to the remaining questions is "to a very great extent." The "negative perspective" questions that required recoding are identified in chapters 5 and 6.

Questions utilized to compute the independent variables, for each motivational and productivity factor are provided in the results of this study (chapters 5 and 6). After each question, the "mean" value (on a five point scale) of the responses is provided.

Each independent variable and its relative productivity efficiency are provided in tabular form (in the chapters 5 and 6). Each of the independent variables were divided into two groups:

a. less than or equal to the "median value" of the response; and

b. greater than the "median value" of the response.

A few independent variables were divided into three "equal" groups because the variables could not be "equally" split at the median value. For each response group, the mean and median productivity efficiency values are provided. The number of valid cases do not include those cases which contain "missing values" for any of the pertinent questions used in developing the independent variable.

In addition to the correlation analysis, a <u>multiple linear regression analysis</u> was used to determine the relationship between a single dependent variable (production efficiency) and the independent variables. This analysis made it possible to identify the importance of each interrelated independent variable in predicting the productivity of a Seabee. The conclusions drawn from this analysis is based solely on the data provided and included only those factors found to be "statistically significant."

CHAPTER 5

RESULTS: FACTORS RELATED TO MOTIVATION

INTRODUCTION

In this chapter, results pertaining to motivational factors that influence a Seabee's performance are presented. Several factors show correlations with productivity that are statistically significant. In each section a discussion about a factor, its relevance to construction productivity, and the implication of the findings is presented. Questions have been designed to test at least one hypothesis relating to each factor. In each case pertinent questions with the corresponding "mean" response are presented. All significant findings are discussed in the following sections.

TRAINING

Chapter 6 discusses results pertaining to training as related to productivity (quality workmanship and construction methods). This chapter will discuss training as a motivational factor, i.e., learning a career orientated skill and the opportunity to augment these skills by attending technical schools will motivate a Seabee to be productive.

Flippo (1971) notes that "training can increase productivity, morale, reduce the work load on supervisors, improve safety, and improve organizational efficiencies." Organizations that offer training opportunities as a reward, will provide an atmosphere that will motivate workers to improve their performance for the chance to be selected for training. Stitt (1989) claims that a motivated individual is continuously involved in learning new skills and ideas, and it is important to allow this learning process to be nurtured.

It was hypothesized that Seabees who are motivated by training opportunities available to them, are more productive workers [H20, see chapter 3]. Respondents were asked:

1. Are you learning a useful career skill at your present position? ("mean" answer = 3.45, see chapter 4 and Appendix A)

2. Since you have been in the Naval Construction Force, have the duty assignments, training, and experience, that you received, been what you expected? (3.03)

The analysis indicated a positive relationship between training and productivity (i.e., as a Seabee receives the training that is expected, productivity also increases.

This supports the findings of Flippo (1971) and Stitt (1989).

Responses	Valid Cases	Productivity	
		Mean	Median
Less training opportunities	233	73.6	76.8
More training opportunities	292	82.2	81.3
Level of Significance < .001			

PERSONAL GOALS

Goals which individuals strive to attain may be of two types according to Tannenbaum and Massarik (1950). First there are the goals of the organization. Secondly, there are the "desired" goals of the individual. Individuals may strive for monetary and nonmonetary rewards, prestige, power (extrinsic factors); or they may strive for certain psychological gratification (job satisfaction, recognition) which are intrinsic to the work itself.

An objective of management is ideally to make both organization and individual goals compliment each other. In this manner, as workers contribute their services for attainment of organizational goals, they make possible the attainment of their personal goals. Kerr (1957) postulated that a rewarding psychological climate is one in which

workers are encouraged to participate in setting attainable goals and the methods to reach these goals. Workers who feel they are part of the management system will have a higher productivity.

It is postulated in this study that Seabees who are "self motivated" to set and achieve personal goals are more productive [H7]. Seabees were asked:

1. Do you tend to be a self motivator? (3.94)

2. Do you set personal goals for yourself? (3.99)

3. Do you achieve your personal goals? (3.72)

4. Do you know what your superiors expect of you? (3.66)

5. Are you satisfied with your contribution to the command? (3.66)

Responses	Valid Cases	Productivity	
		Mean	Median
Does not set personal goals	268	73.8	76.4
Sets personal goals	252	82.3	83.2
Level of Significance < .001			

The analysis showed that the postulation was correct, i.e., Seabees who are orientated towards personal goals are more productive than those who are not.

The findings of this study also supported the hypothesis that Seabees who set personal goals for themselves are more satisfied with their work and their contributions to their unit [H27].

Sets Personal Goals	Valid Cases	Satisfied with Contributions	
		Mean	Median
Does not set personal goals	307	3.147	3.000
Sets personal goals	275	4.236	4.000
Level of Significance < .001			

Seabees who set personal goals enjoy their work more [H26] than Seabees who do not set personal goals.

Sets Personal Goals	Valid Cases	Enjoys the work	
		Mean	Median
Does not set personal goals	298	3.409	3.000
Sets personal goals	270	4.119	4.000
Level of Significance < .001			

PRIDE

Pride in one's organization promotes self respect and the feeling of personal worth (Maslow's ego needs). Pride also promotes the "team" concept of an organization which ultimately provides a motivational atmosphere for productive work performance.

It was postulated that Seabees who have a sense of pride in being a Seabee, being in their unit, and being in the Navy are more productive [H10]. To measure this relationship the following questions were asked:

1. Do you have pride in yourself as a member of the Navy? (3.81)

2. Are you proud to be a member of your present command? (3.28)

3. Are you proud to be a Seabee? (4.05)

Combining these questions into one variable for analysis, the findings supported this postulation.

Responses	Valid Cases	Productivity Mean	Median
Less pride in organization	256	74.8	77.2
More pride in organization	275	82.0	81.3

Level of Significance < .001

RECOGNITION

The Business Roundtable (1982) found that on the average, construction workers received little or no recognition for their work, despite findings that it is very important to workers. Recognition is sometimes more effective than monetary rewards. In the Naval Construction Force (NCF) these types of recognition can be in the form of crew of the month awards, letters of appreciation/commendation, "positive" performance evaluations, or just a "pat-on-the-back" for a job well done.

It was hypothesized that Seabees who feel they are adequately recognized for their performance are more productive [H5]. To test this hypothesis the respondents were asked the following questions:

    1. Do you feel that you are adequately recognized for contributions:

        a. By your superiors? (2.69)

        b. By your peers? (3.04)

        c. By your subordinates (3.06)

    2. Do your evaluations accurately reflect your performance? (3.22)

    3. If you received a "less than average" evaluation, would you try to improve your performance? (3.85)

4. If you received an "above average" evaluation, would you work harder to maintain your performance level? (4.01)

Combining these questions into one variable for analysis, the resultant correlation showed a positive relationship, i.e., as the degree of recognition increased, so did the productivity of a Seabee. This determination supported the importance of proper recognition as stated by the Business Roundtable Report (1982).

Responses	Valid Cases	Productivity	
		Mean	Median
Does not receive proper recognition	203	74.5	76.4
Receives proper recognition	236	81.2	81.3
Level of Significance < .01			

SUPERVISOR MOTIVATION

The importance of the supervisor's role in motivating workers has been mentioned previously in this study. The major role of supervisors is to motivate their workers, or provide an atmosphere for worker self motivation. This study presumed that supervisors who are good "motivators" have more productive Seabees [H6].

Respondents were asked "Is your supervisor a good motivator of personnel" (3.31)? The finding of this analysis supported this presumption and the findings of the Business Roundtable (1982) and Hinze (1981) discussed in Chapter 6. It must be noted that respondents were not asked about the "methods" used by supervisors to motivate them.

Responses	Valid Cases	Productivity	
		Mean	Median
"Bad" supervisory motivation	277	75.2	77.2
"Good" supervisory motivation	249	82.0	82.3
Level of Significance < .01			

JOB SECURITY

According to Maloney (1983), job security does not necessarily increase productivity directly, but will do so in an indirect manner. For example, job security influences whether or not a new "productivity improvement program" will be accepted by workers. If an employee's job is protected from adverse economic consequences resulting from the increased productivity, then the productivity improvement program will be accepted by the worker.

It is postulated by this study that Seabees who are concerned with job security are more productive [H14]. Respondents were asked "Does the job security of being in the Navy influence your performance" (2.81)? The analysis revealed that as job security becomes more important to Seabees, their productivity will also increase supporting the proposed postulation.

Responses	Valid Cases	Productivity	
		Mean	Median
Not concerned with job security	188	74.3	80.4
Generally concerned	167	79.5	81.1
Greatly concerned	152	81.3	82.5
Level of Significance < .01			

RESPECT

A study by Pryor and Mondy (1978) indicates that a mutual attitude of respect between supervisor and subordinate will increase productivity. Mutual respect would minimize, or eliminate, the credibility gap between supervisor and worker. This would stimulate more open communication and create an environment conducive to greater productivity. This study proposes a parallel postulation that Seabees are more productive when they feel they are respected by others

[H11]. The following questions were asked:

    1. Do you feel that you earned the respect from your:

        a. Superiors? (3.30)

        b. Peers? (3.49)

        c. Subordinates? (3.57)

    2. Is the respect of others an influence on your performance? (3.66)

The analysis found that Seabees are more productive when they feel that they are respected by others. This finding supports the conclusion of the study by Pryor and Mondy (1978).

Respect

Responses	Valid Cases	Productivity	
		Mean	Median
Not respected	262	75.4	77.2
Greatly respected	227	81.3	82.3
Level of Significance < .02			

REWARDS

A reward system exists in the NCF to aid in motivating Seabees. As stated previously in Chapter 2, a reward system can motivate workers into two types of behavior, *participation* and *performance* in an organization.

Participating (e.g., "membership") is a major factor in the NCF where the potential for economic and noneconomic rewards exist. Attendance, or in other words, the avoidance of absenteeism is not a problem in the NCF, due to the strictly enforced military regulations in this area. A method used by the NCF for noneconomic rewards is the rewarding of awards and privileges such as medals, letters of commendation and appreciation, and special liberty passes.

This study hypothesized that Seabees are motivated to be productive by the opportunity for noneconomical rewards [H4]. Seabees were asked "Does the opportunity for rewards (letters of appreciation/commendation, medals, special liberty, etc...) improve your performance" (3.35)?. The analysis revealed a positive relationship between rewards and productivity. As the opportunities to receive rewards become greater, so does the production of the Seabees.

Responses	Valid Cases	Productivity	
		Mean	Median
Less opportunity for rewards	256	75.0	79.3
Greater opportunity	242	81.0	81.3

Level of Significance < .04

Further review of the analysis revealed that 48% of the respondents stated that the opportunity for noneconomic rewards greatly influenced their performance.

RANKING OF MOTIVATIONAL FACTORS

Respondents were provided a list of fifteen motivational factors (see Appendix A) and they were asked to select and rank the five most important factors that influence their performance. Using a "five point" scoring system (five points for the most important factor, four points for the next most important factor, etc...) the factors could be ranked.

Table 2 provides the ranking of each of the motivational factors as selected by the respondents. The ranking of the factors by "position" is also provided by Table 2. The top ten most important motivational factors that influence a Seabee's work performance are ("S" and "D" identify "satisfiers" and "dissatisfiers" respectively, as defined by Herzberg's "Motivation - Hygiene" Theory):

1. Money (D)

2. Job satisfaction (S)

3. Meaningful work (S)

4. Recognition (Tie) (S)

4. Personal goals (Tie) (S)

6. Advancement (S)

Table 2.

Motivational Factors

RANKING OF
MOTIVATIONAL FACTORS

Factor	All Respondents	Project Managers	Crew Leaders	Workers	Staff	Others
Money	1	4	1	1	1	3
Job Satisfaction	2	1	2	4	2	1
Meaningful Work	3	2	3	5	3	3
Recognition	4	3	4	7	5	10
Personal Goals	4	6	6	3	8	2
Advancement	6	9	8	8	4	5
On-the-Job Trng.	7	12	10	2	13	7
Training	8	11	5	8	6	8
Respect	9	5	7	10	7	6
Travel	10	8	13	6	9	9
Benefits	11	15	12	11	11	12
Job Security	12	10	11	13	13	11
Rewards	12	14	9	12	12	14
Patriotism	14	7	14	14	9	13
Other	15	13	15	15	15	15

7. On-the-job training (S)

8. Training and educational programs available (S)

9. Respect (S)

10. Travel (D)

As stated previously, the "satisfiers" are those factors related to the good feelings one receives from their work, and "dissatisfiers" are associated with the physical characteristics of the work environment. It is interesting to note that by Herzberg's definition, the factor "travel" is a "dissatisfier," but the opportunity for travel is appealing to some Seabees and thus a "satisfier" to them.

It is important to note that four of the top five factors (job satisfaction, meaningful work, recognition and personal goals) are inherent to the work itself. This is similar to the results of Borcherding and Oglesby's (1974) study. These factors are an important end product of the type of work ("most important productivity factor" selected in Chapter 6) that a Seabee performs.

The results of this group parallel Herzberg's (Tribett, 1984) "Motivation-Hygiene" Theory (discussed in Chapter 2). Eight of the top ten motivational factors are considered to be "job satisfiers" (motivational factors). Job satisfiers are within the control of the Seabees to manipulate the factors to produce the desired results.

The ranking of the motivational factors by position is shown by Table 2. The top five most important motivational factors for each position will be discussed, as well as possible explanations for any differences between the positions. Money, job satisfaction and meaningful work were selected by all respondents, regardless of position, as being important.

Project Managers felt that recognition and respect were also important motivators. Project Managers are generally more experienced personnel who come to expect respect from their subordinates, peers, and superiors to a greater degree than do their subordinates.

Similarly to Project Managers, recognition is important to Crew Leaders. In addition, training opportunities are important to Crew Leaders. Crew leaders are at a level in the organization (both in seniority and experience) where more "formal" schools for technical and leadership training are available, and the competition for the opportunity to attend is very high.

Workers consider on-the-job training and personal goals the second and third most important motivational factors, respectively. Most "worker" Seabees are relatively inexperienced and they are developing their construction

skills to fulfill their objective (personal goal) for joining the Seabees.

Advancement and recognition are considered to be included in the most important motivational factors for staff personnel. Staff personnel are generally more senior (E5 and above). At this level, advancements are very competitive and the importance of preparing for and completing requirements for advancement is greater.

"Other" personnel are those Seabees who are in an "overhead" position (e.g., Command Master Chief, Company Chief) and are usually more senior. These Seabees felt that personal goals were the second most important motivational factor. For the same reasons as staff personnel, "other" personnel felt that advancement is one of the top five motivational factors.

SUMMARY

This chapter presented those motivational factors that were found to be statistically significant towards increasing productivity of a Seabee. The relevance of each factor towards Seabee construction productivity and the results of the analysis of each factor were discussed. The ranking of motivational factors by Seabees in the order of importance was also presented.

CHAPTER 6

RESULTS: FACTORS RELATED TO PRODUCTIVITY

INTRODUCTION

In this chapter, the results pertaining to productivity factors that influence a Seabee's work performance are presented. Several factors show correlations with productivity, while others, although not statistically significant are indications of trends. In each section a discussion about a factor, its relevance to construction productivity, and the implication of the findings is presented. Questions have been designed to test at least one hypothesis relating to each factor. In each case pertinent questions with the corresponding "mean" response are presented. All significant findings and strong trends are discussed in the following sections.

SUPERVISOR RELATIONS

Most workers begin their jobs highly motivated to be productive, according to Pryor and Mondy (1978). However, an employee's motivation and subsequent performance can quickly make a turn toward the worse because of a poor supervisor. If a supervisor is thoughtless and neglectful,

or incapable, insensitive or apathetic, then an employee will become demotivated.

The study by Maloney and McFillen (Sep 1987, pp. 399-415) revealed "that better supervision produces better results, at least from the workers' perspective." A supervisor must match workers to their responsibilities to satisfy both management and the worker. Maloney and McFillen (Sep 1987, pp. 416-426) also found that "workers who described themselves as more motivated, higher performing, and more satisfied, reported that their organizations demonstrated a more positive, constructive, and humanistic management style. "Supervisors are often unable to motivate workers to be productive," according to the Business Roundtable (1982). However most workers can motivate themselves, so the supervisors must make sure the work environment is conducive for workers to meet their needs. When examining the potential for productivity improvement, the need for highly motivated and responsible supervisors is at the forefront.

Hinze and Kuechenmeister (1981) have shown that foremen (supervisors) have a direct impact on the productivity of their crews and employees. They found that crews were more

productive when:

    1. Foremen are more experienced (greater then 6 months).

    2. Foremen are familiar with crew's abilities.

    3. Foremen are fair in dealing with crew members.

    4. Foremen are considerate of individual feelings and are easy to approach.

    5. Foremen set challenging yet attainable goals.

    6. Foremen communicate well with crew members.

In this study it is postulated that Seabees who have a supervisor that is concerned about their well being are more productive [H1, see chapter 3]. To measure the relationship between the Seabees and their supervisors, the following questions relating to the supervisors were asked:

1. Willing to help workers with personal problems? ("mean" response = 3.61, see chapter 4 and Appendix A)

2. Friendly and easy to approach? (3.76)

3. Sets a good example on and off the job? (3.68)

4. Encourages teamwork? (3.77)

5. Praises and recognizes workers for good performance? (3.45)

6. Properly disciplines workers when necessary? (3.62)

7. Shows favoritism to certain crew members? (2.26, recoded responses for correlation, see chapter 4)

8. Respected by workers? (3.51)

9. Competent in day to day duties? (3.81)

10. Willing to work for the same supervisor again? (3.51)

11. Considers suggestions from crew? (3.68)

12. Consider supervisor to be a good leader? (3.68)

Combining all of these questions into one variable for analysis showed supervisors who are "concerned about their people" have more productive Seabees. This finding supports the results reported by Hinze and Kuechenmeister (1981).

Responses	Valid Cases	Productivity	
		Mean	Median
"Bad" Supervisor	195	71.9	75.2
"Good" Supervisor	243	83.4	83.0
Level of Significance < .001			

For the remaining discussion, supervisors with positive relations with their workers will be referred to as "good supervisors" and vice versa for "bad supervisors."

Other findings concerning "good supervisors" are reinforced by the study. "Good supervisors" are respected by their subordinates [H22];

Supervisor Relations	Valid Cases	Respect of Supervisor	
		Mean	Median
"Bad" Supervisor	227	2.683	3.000
"Good" Supervisor	264	4.167	4.000
Level of Significance < .001			

"good supervisors" have cohesive crews that work as a team [H23]; and

Supervisor Relations	Valid Cases	Crew Relations	
		Mean	Median
"Bad" Supervisor	206	3.350	3.333
"Good" Supervisor	240	3.553	3.500
Level of Significance < .001			

"Good supervisors" have Seabees who enjoy their work [H24].

Supervisor Relations	Valid Cases	Enjoy the Work	
		Mean	Median
"Bad" Supervisor	217	3.516	4.000
"Good" Supervisor	257	3.949	4.000
Level of Significance < .001			

All of the above determinations support the findings by Maloney and McFillen (Sep 1987, pp. 416-426) that a more humanistic management style results in higher productive, more motivated and more satisfied workers.

TYPE OF WORK

The type of work performed will influence the motivation of Seabees to be productive by providing intrinsic rewards that are inherent to the work itself. These rewards include a sense of accomplishment, comfortable work environment, enjoying the work, and performing meaningful work.

The "act of construction" itself motivates workers to be productive. The Business Roundtable (1982) reports that construction workers get job satisfaction from seeing "their" building being constructed and get a sense of "pride and ownership" on the job. Borcherding (1974) states that construction workers "identify with the physical structure on which they were working and that they felt intimately involved with the construction process."

In this study it is hypothesized that the type of work will influence a Seabee's productivity [H12]. The following questions were asked to measure the extent to which the type of work will influence performance:

1. Do you generally work within your rating? (3.59)

2. Are you happy with your rating? (4.08)

3. Have you ever performed work that you know could have been done better by another method? (3.61, recoded responses for correlation, see chapter 4)

4. Are you comfortable in your present work environment? (3.27)

5. Are you satisfied with the quality of your work? (3.89)

6. Does your work give you a sense of accomplishment? (3.75)

7. Do you enjoy your work? (3.73)

8. Is the type of work you perform meaningful? (3.59)

The analysis showed that a Seabee's productivity is positively influenced by the type of work performed.

Responses	Valid Cases	Productivity	
		Mean	Median
Less intrinsic rewards from work	243	73.7	76.4
More intrinsic rewards	222	82.8	82.3
Level of Significance < .001			

The productivity of a Seabee is also increased with a sense of accomplishment that is derived from doing work [H2].

Responses	Valid Cases	Productivity	
		Mean	Median
No sense of accomplishment from work	171	73.0	76.2
Some sense of accomplishment	180	77.3	80.9
Great sense of accomplishment	137	86.4	87.8
Level of Significance < .001			

Further findings on this subject reveal that the productivity of a Seabee will increase as their enjoyment of the work increases [H8];

Responses	Valid Cases	Productivity	
		Mean	Median
Does not enjoy work	184	74.6	76.4
Generally enjoys work	200	76.7	81.3
Enjoys work greatly	143	84.0	82.1
Level of Significance < .05			

Seabees become more productive as the work becomes more meaningful to them [H9]; and

Responses	Valid Cases	Productivity	
		Mean	Median
Less meaningful work	227	75.1	79.3
More meaningful work	310	80.6	81.3
Level of Significance < .02			

Seabees who perform meaningful work will enjoy their work more [H25].

Meaningful Work	Valid Cases	Enjoy the Work	
		Mean	Median
Less meaningful work	254	3.264	3.000
More meaningful work	332	4.093	4.000
Level of Significance < .001			

These findings support the aforementioned hypothesis and the studies conducted by the Business Roundtable (1982) and Borcherding (1974).

TRAINING

Training is the primary Seabee peacetime function (NAVFAC P-315, 1983). Unfortunately, this emphasis may be reduced when "work in place" frequently relegates training to a lower priority. Production pressures dictate that a Seabee skilled in a certain area be used in that area exclusively without allowing the inexperienced Seabee the opportunity to develop new skills.

It was presumed that Seabees who have been properly trained, whether by technical schools or on-the-job training, will be more productive [H21]. The respondents were asked:

1. Does the formal training adequately prepare you for your assigned duties? (2.96)

2. Do your current duties provide adequate on-the-job training? (3.29)

Results of the analysis showed that properly trained Seabees are more productive.

Responses	Valid Cases	Productivity Mean	Median
Less training received	267	75.4	77.2
More training received	237	81.5	81.3

Level of Significance < .001

Adequate training will facilitate improved workmanship of a construction worker. Poor workmanship was found to be a significant "dissatisfier" by Borcherding (1975). Training provides the opportunity for a worker to "grow" which is one of Herzberg's "context factors" that provides "job enrichment."

COMMUNICATION

Communications is the lifeblood of progress and smooth construction operations. Mistakes invariably occur when someone does not receive the proper information.

Borcherding (1974) found in his study that a major "motivator" for all levels of a construction organization is a good working and personal relationship between crew members and their supervisors. The most important factor for good working and personal relationships to develop is to have open communication between all parties. Baird and Bradley (1978) state in their study that the single most influential element in enhancing job satisfaction and group consciousness is superior-subordinate communication.

Open communication at all levels in an organization plays a significant role in influencing employees to be more productive. Pryor and Mondy (1978) asked workers in their study the question: "How can a company encourage workers to

be more productive?" Forty-one percent replied "tell them (workers) what is going on." This was also found in this study, i.e., communication and respect between supervisors and workers are interrelated.

The Business Roundtable (1982) found that effective communication between workers and management is essential in carrying out instructions/directions properly.

In this research, Seabees were asked:

1. Do you feel that the communication within your chain of command is effective? (2.68)

2. Have you or your crew ever performed rework due to poor communications between crew and supervisor? (3.19, recoded responses for correlation, see chapter 4)

Seabees who feel there is effective communication within their chain of command are more productive than Seabees with ineffective communications [H15]. This finding supports the aforementioned studies and hypothesis.

Responses	Valid Cases	Productivity Mean	Median
Poor chain of command communication	249	75.9	81.3
Good chain of command communication	242	81.1	81.3
Level of Significance < .01			

INSPECTIONS

Seabees were asked: "Does the inspection program ensure quality work" (3.27)? This study revealed that Seabees who are concerned about quality work are more productive than the average Seabee [H16].

Responses	Valid Cases	Productivity	
		Mean	Median
Not concerned with quality	287	74.5	76.4
Concerned with quality	215	83.4	82.3
Level of Significance < .01			

This finding reflects the assumption that Seabees, knowing that the quality of their work will be scrutinized, will be concerned about a higher quality product. The Seabees who are concerned with quality work are the workers who are more productive.

SUBSTANCE ABUSE

The National Institute on Drug Abuse (Maloney, 1988) estimates that substance abuse reduces a worker's productivity by 30-50%, and impaired workers are involved in more accidents and safety problems as compared with other workers.

Seabees were asked:

   1. Has the performance of your crew ever been affected by a crew members substance abuse (drugs or alcohol)? (1.97)

   2. Has your performance ever been affected by substance abuse? (1.63)

The analysis supported the hypothesis that Seabee productivity increases as the effects of substance abuse decreases [H17].

Responses	Valid Cases	Productivity	
		Mean	Median
More substance abuse	160	74.7	76.8
Less substance abuse	217	80.8	81.3
Level of Significance < .04			

Further analysis of this topic revealed that 30% of the respondents stated that their crew's performance was, at least to some extent, affected by substance abuse. Furthermore, nearly 20% of the respondents revealed that their own performance was affected, at least to some extent, by substance abuse.

SAFETY

A strong organizational safety program will be a motivator of workers according to the Business Roundtable (1982). This will display management's concern for the well-being of workers which may move the workers to be more productive.

Hinze and Parker (1978) found that good safety performance and increased productivity coexist. They conclude that:

> Good safety performance and high productivity are compatible, one does not have to sacrifice one for the other. Good safety performance is related to management styles, and applying excessive pressure, by any means to the workmen results in increased injuries. Excessive pressures do not contribute to better productivity, only injuring more people.

This study postulated that safety conscious Seabees are more productive [H13]; and Seabees with a lower number of injuries are more productive [H3]. Seabees were asked:

1. Do safety regulations restrict your ability to work effectively? (2.70, recoded responses for correlation, see chapter 4)

2. Do you understand the need for safety awareness on the projects? (4.48)

3. Do you feel that you work in a safety conscious environment? (4.06)

4. Are daily safety lectures effective? (3.39)

5. Have you observed any major safety violations that were unreported? (2.07, recoded responses for correlation, see chapter 4)

Combining these questions into one variable and correlating it with the production efficiency of each Seabee, it was determined that safety conscious Seabees are indeed more productive than Seabees who are not.

Responses	Valid Cases	Productivity	
		Mean	Median
Not concerned with safety	234	74.6	80.5
Concerned with safety	213	79.6	80.5
Level of Significance < .03			

There was a strong tendency of significance that higher productive Seabees had less injuries.

Responses	Valid Cases	Productivity	
		Mean	Median
Greater number of injuries	225	76.7	81.1
Least number of injuries	235	80.2	81.3
Level of Significance < .06			

These findings support the Business Roundtable (1982) and Hinze and Parker (1978) studies that a good safety program increases productivity.

Further analysis revealed that Seabees with 10 years or less of service have a significantly larger number of injuries than Seabees with more than 10 years of service (see Table 3). This may be easily explained since Seabees with less than 10 years of service are generally in a "direct labor" position, while Seabees with more than 10 years of service tend to be in supervisory or other indirect/overhead positions.

Seabees with less than one year of service (Group I) and those with 1 to 10 years of service (Group II) had basically the same number of total injuries per million hours of work exposure. The differences were in the types of injuries.

Group II Seabees had a significantly higher number of "first aid" type injuries. These are the type that can generally be treated at the worksite using the first aid kit located at the project site. This high number can probably be attributed to the fact that Group II Seabees are more experienced and may become sensitized to injuries. They may have the attitude of "just slap a band-aid on it and I'll be fine," whereas a Group I Seabee, who is less experienced, may prefer to see a doctor for treatment even on injuries that could have been treated at the project site.

Table 3.

Number of Injuries by Time in Service

	Number of Injuries			
Time in Service	First Aid	Doctor's Attention	Lost Time	Total
< 1 yr	501	599	296	1,396
1-10 yrs	729	532	127	1,388
> 10 yrs	317	275	72	664
All Respondents	(608)	(479)	(133)	(1,220)

Notes:

1. Values reflect number of injuries per million hours of work exposure.

2. First aid injuries are of the type that can be treated at the project site with a first aid kit.

3. Injuries requiring a doctor's attention are the type where the injured Seabee returns to work within 24 hours, either at full duty or light duty.

Group I Seabees have a much larger number of more severe injuries than other Seabees [H28]. This can be attributed to these Seabees being less experienced. Less experienced Seabees tend to be assigned to the more labor intensive tasks which are potentially more hazardous. Also, less experienced Seabees are generally less attentive to detail and thus more careless than the "experienced" Seabees. This carelessness will lead to more injuries.

It was postulated that Seabees who tend to have more minor injuries (first aid and doctor type) will also have more lost time accidents [H29]. The analysis of this assumption showed a strong positive correlation that this is true.

| | | Lost Time Accidents | |
Minor Accidents	Valid Cases	Mean	Median
Least no. of minor injuries	248	11.2	0.0
Greater no. of minor injuries	225	262.8	0.0
Level of Significance < .001			

This reveals that if Seabees focus on reducing minor injuries then the more severe injuries will decrease as a result. This can be accomplished with additional emphasis

on safety and more attentiveness to detail at the worker level.

MORALE

Dillon (1977) states that when morale is high, production and quality levels are high. At the root of good morale is job satisfaction, and as seen earlier in this study, production is higher when a Seabee's needs are met (job satisfaction). Based on these conclusions it was hypothesized that more productive Seabees work in an environment where morale is good [H18]. Respondents were asked the following questions:

1. Is morale generally good in your work environment? (2.99)

2. Has low morale ever effected your crew's work performance negatively? (3.22, recoded responses for correlation, see chapter 4)

The analysis showed a strong positive relationship between productivity and morale. Seabees who perceived a work environment that has good morale features had higher production efficiency than Seabees with a lower morale environment. This finding supports the study by Dillon (1977).

Responses	Valid Cases	Productivity Mean	Median
Poor morale	215	77.3	81.3
Good morale	286	80.1	81.3
Level of Significance < .03			

PERSONAL PROBLEMS

Construction is a dangerous type of work when compared to other types of work. For this reason, it is imperative that workers concentrate on their assigned tasks to ensure safety, quality and production. When workers are confronted with personal problems (e.g., family matters, financial, medical) that are troublesome to them, their concentration on the job slackens, resulting in poor quality, reduced production and worst of all, more accidents. It is important that a Seabee knows who to see for guidance for handling problems that may be encountered, and for resolving them in a satisfactory and expeditious manner.

An employee who is listened to will probably open up and reveal the basic reasons for dissatisfaction. If the problems are aired, chances are that solutions can be found. One common problem is the lack of appreciation from

superiors or being taken for granted. This feeling violates one of Maslow's basic needs - Ego needs.

In this study it is postulated that a Seabee will be more productive if it is known where to go to receive assistance, and when it is known that their supervisor is concerned for their personal problems [H19]. Seabees were asked:

1. Have personal problems ever affected your crew's work? (2.72, recoded responses for correlation, see chapter 4)

2. If you had a personal problem, would you know where to go to seek help to resolve the problem? (3.82)

3. Is adequate assistance provided by your command to resolve a member's personal problem? (3.29)

4. Do you feel that your superiors are concerned about your personal problems? (2.89)

The analysis showed that Seabees who receive "support" for personal problems are more productive.

| | Valid | Productivity | |
Responses	Cases	Mean	Median
Poor support for personal problems	241	77.9	81.3
Greater support	227	78.5	81.2

Level of Significance < .04

An interesting observation is that 36% of the respondents felt that their supervisors were not concerned about their personal problems. Seabee supervisors must be involved with the overall welfare of their workers, not just on the job but off the job as well. Seabees must feel confident that discussing their problems (in confidence) with their supervisors, (usually the first echelon in their chain of command), will facilitate resolving their problem.

OTHER FACTORS

The analysis revealed a few factors, related to productivity, that were not significant (level of significance less than 5%) but showed a strong tendency to be significant (level of significance between 5% and 10%). These factors included computers, equipment, family separation, and construction methods. It was found that a Seabee's productivity will somewhat increase when the following occurs:

1. Newer construction methods are incorporated.

Responses	Valid Cases	Productivity	
		Mean	Median
Outdated construction methods	229	74.2	76.8
Modern construction methods	260	80.6	81.3
Level of Significance < .06			

2. The extent of family separation is reduced.

Responses	Valid Cases	Productivity	
		Mean	Median
More family separation	162	76.1	79.4
Some family separation	145	78.0	78.2
Less family separation	163	82.4	83.9
Level of Significance < .07			

3. Adequate equipment support is provided to the project.

Responses	Valid Cases	Productivity	
		Mean	Median
Poor equipment	190	76.2	80/9
Good equipment	262	78.7	81.3
Level of Significance < .08			

4. Computer utilization is increased in construction operaticns.

Responses	Valid Cases	Productivity	
		Mean	Median
Less computer use	133	77.5	81.3
More computer use	177	81.6	81.3

Level of Significance < .10

RANKING OF PRODUCTIVITY FACTORS

The questionnaire provided a list of twenty-two productivity factors, see Appendix A. Each respondent was requested to select and rank the five most important factors from each group that most influence their performance. Using a "five point" scoring system, discussed in chapter 5, the factors were ranked.

Table 4 provides the ranking of each of the productivity factors as selected by the respondents. The ranking of the factors by "position" is also provided by Table 4. The top ten most important productivity factors that influence a Seabee's work performance are ("S" and "D" identify "satisfiers" and "dissatisfiers" respectively, as defined

Table 4.

Productivity Factors

RANKING OF
PRODUCTIVITY FACTORS

Factor	All Respondents	Project Managers	Crew Leaders	Workers	Staff	Others
Type of Work	1	1	1	1	1	2
Supervisor	2	2	2	2	1	1
Morale	3	4	3	4	7	4
Tools	4	6	4	3	2	6
Plan./Scheduling	5	5	5	10	3	3
Material	6	3	6	6	10	8
Weather	7	7	9	5	8	10
Training	8	11	7	8	4	8
Equipment	9	8	8	7	9	13
Location	10	9	14	9	5	11
Communication	11	12	12	11	6	5
Safety	12	10	10	11	11	6
Constr. Methods	13	15	13	13	13	19
Family Sep.	14	13	10	14	14	16
Stress	15	13	15	17	15	14
Phys. Fitness	16	17	16	15	19	22
Personal Probs.	17	19	18	16	18	15
Plans & Specs.	17	18	17	18	17	11
Computers	19	19	19	19	16	18
Other	20	15	20	21	20	16
Substance Abuse	21	21	22	21	21	20
Discrimination	22	22	21	20	22	21

by Herzberg's "Motivation - Hygiene" Theory):

1. Type of work (S)

2. Supervisor (D)

3. Morale (S)

4. Tools (D)

5. Planning and scheduling (D)

6. Materials (D)

7. Weather (D)

8. Training (S)

9. Equipment (D)

10. Location of work (D)

As stated previously, the "satisfiers" are those factors related to the good feelings one receives from their work, and "dissatisfiers" are associated with the physical characteristics of the work environment.

The results show an interesting parallel to Herzberg's (Tribett, 1984) "motivation-hygiene" theory (discussed in chapter 2). Seven of the top ten productivity factors are considered to be "job dissatisfiers" (hygiene factors). These factors are beyond the control of the individual and their importance is felt only in their absence.

The ranking of the productivity factors by position is shown by Table 4. The top five most important productivity

factors for each position will be discussed, as well as possible explanations for any differences between the positions. Type of work, and supervisor relations were selected by all respondents, regardless of position, as being the two most important factors affecting the work performance of a Seabee.

Project Managers felt that material, morale, and planning and scheduling were also important factors. A requirement of a Project Manager's assigned tasks entails planning and scheduling of their projects, and tracking materials (as well a tools and equipment) to ensure their crews have all the resources required to allow work to progress smoothly. This allows the Crew Leader to remain on the job site to adequately supervise the work.

Similarly to Project Managers, morale and planning and scheduling are important to Crew Leaders. In addition, availability of adequate tools is important to Crew Leaders. The Crew Leader's number one objective is the safe, quality, and timely completion of the assigned project. A major factor to accomplish this is to have the proper tools, materials, equipment, and an accurate project schedule available for use.

Workers consider <u>tools</u>, <u>morale</u>, and <u>weather</u> to be among the most important factors affecting productivity. Weather is a major concern of only the workers because they are generally the only persons exposed to the weather on a daily basis. For the workers to properly perform their construction tasks, it is paramount that they have the proper tools for the job at hand. Planning and Scheduling was ranked very low on the worker's list of important factors. The reason for this is the fact that the workers generally do not get involved with the day-to-day planning of a project, they rely on the crew leader and project manager to plan the work.

Unlike the other positions, the staff personnel do not rank morale in their top five important factors affecting productivity. Staff personnel consider <u>tools</u>, <u>planning and scheduling</u>, <u>training</u>, and <u>location</u> to be important. Staff personnel include the training department and operations department whose job it is to ensure that the workers are properly trained to perform their construction tasks. Staff personnel perform indirect labor tasks that generally are independent of the type of construction projects assigned to the organization. Since the type of work does not effect them, they may be more concerned with the location of their workplace or duty station.

In addition to planning and scheduling, and morale, "other" personnel consider communication to be an important productivity factor. "Other" personnel consist of those Seabees who perform the "overhead" (administrative) tasks. These persons are exposed to a majority of the "complaints" that could have been resolved within the chain of command.

SUMMARY

This chapter presented those productivity factors that were found to be statistically significant, and factors that are indicators of trends towards increasing productivity of a Seabee. The relevance of each factor towards Seabee work performance and the results of the analysis of each factor were discussed. The ranking of productivity factors by Seabees in the order of importance was also presented.

Utilizing a multiple linear regression analysis of the data provided, it was possible to determine which of the motivation and productivity factors have the greater influence on the productivity of a Seabee. This multiple linear regression analysis identified the ten most important motivational and productivity factors as:

1. Type of Work

2. Recognition

3. Safety

4. Personal Problems

5. Training Received

6. Supervisor Motivation

7. Rewards

8. Inspections

9. Morale

10. Supervisor Relations

CHAPTER 7

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Section 1: SUMMARY

This report describes research conducted to investigate the effects of different motivational and productivity factors on Naval Construction Force (NCF) Seabees. Hypotheses were developed based on the findings of previous investigators. These hypotheses, as well as new ones, were tested in this study.

METHODOLOGY

Data collected consisted of asking Seabees in eight Naval Mobile Construction Battalions (NMCB) and eight Construction Battalion Units (CBU) to fill out a questionnaire. These organizations were targeted since their construction operations closely resemble the operations of nonmilitary construction contractors and trades. The study was conducted in three phases. First, a preliminary phase questionnaire was reviewed by a group of Naval Civil Engineer Corps officers with NCF experience. Secondly, the pilot study phase questionnaire was completed by a local Construction Battalion Unit. After each of

these two phases, some modifications to the questionnaire were made for the final phase which consisted of surveying the Seabees as noted above.

After completed questionnaires were received from the Seabees, responses were coded and the findings tested for their statistical significance. Since this research was an exploratory one, the findings which had a level of statistical significance of less than 5% were considered strong findings, while those which were between 5% and 10% were considered to show a strong tendency.

FINDINGS

In the following discussion the significant findings are categorized and presented. Motivational factors, as perceived by each respondent, which were found to influence the productivity and performance of a Seabee include:

1. <u>Training</u>. Seabees are motivated by the training opportunities available to them.

2. <u>Personal Goals</u>. Seabees who are "self motivated" to set and achieve personal goals are more productive. Seabees who set personal goals are more satisfied with their work; more satisfied with their contributions to their organization; and enjoy their work more.

3. <u>Pride</u>. Seabees who have a sense of pride in being a Seabee, being a member of their unit and being in the Navy are more productive.

4. <u>Recognition</u>. Seabees are motivated to be productive when they know that they will receive proper recognition for their efforts.

5. <u>Supervisory Motivation</u>. Seabees who feel that their supervisors are "good motivators" are more productive.

6. <u>Job Security</u>. Seabees who feel secure in their job are more productive.

7. <u>Respect</u>. Seabees are motivated to be more productive when they feel that they are respected by superiors, peers, and subordinates alike.

8. <u>Rewards</u>. The opportunity for noneconomical rewards (letters of appreciation/commendation, medals, and special liberty) will motivate a Seabee to be more productive.

9. <u>Ranking of Factors</u>. The top ten most important motivational factors that influence the work performance of a Seabee are:

    a. Money

    b. Job Satisfaction

    c. Meaningful Work

    d. Recognition

    e. Personal Goals

    f. Advancement

g. On-the-Job Training

h. Training and Educational Programs Available

i. Respect

j. Travel

Productivity factors, as perceived by each respondent, which were found to influence the performance of a Seabee include:

1. <u>Supervisor Relations</u>. Seabees who have a supervisor that is concerned that their overall well-being are more productive. Supervisors who are considered to be "good" supervisors by their subordinates, are respected by subordinates; have cohesive crews that work as a team; and have Seabees who enjoy their work.

2. <u>Type of Work</u>. The productivity of a Seabee increases with an increase in the degree of intrinsic rewards and the sense of accomplishment received from the type of construction work being performed. As the enjoyment of the work increases and as the work becomes more meaningful to them, the productivity of a Seabee will also increase.

3. <u>Training</u>. The productivity of a Seabee will increase with an increase in the amount of training that is received.

4. <u>Communication</u>. Seabees who feel there is effective communication within their chain of command are more productive.

5. <u>Inspections</u>. Seabees who are concerned with quality workmanship are more productive.

6. <u>Substance Abuse</u>. As the amount of substance abuse (alcohol or drugs) decreases, the productivity of a Seabee will improve.

7. <u>Safety</u>. Safety conscious Seabees and those with lower injury rates are more productive. Seabees with less than one year of experience have a larger number of severe injuries than do the more experienced Seabees. Seabees who have a higher number of minor injuries (first aid and doctor type) will have more lost time accidents.

8. <u>Morale</u>. Seabees that work in an environment where morale is good are more productive.

9. <u>Personal Problems</u>. Seabees who know where to go for assistance with personal problems and feel that they receive adequate assistance are more productive.

10. <u>Other Factors</u>. There is a strong tendency (level of statistical significance between 5% and 10%) that Seabees are more productive when the following occurs:

a. New construction methods are used.

b. The extent of family separation is reduced.

c. Adequate equipment support is provided.

d. Computer utilization is increased in construction operations.

11. <u>Ranking of Factors</u>. The top ten most important productivity factors, (as selected by the respondents), that influence the work performance of a Seabee are:

a. Type of work

b. Supervisor

c. Morale

d. Tools

e. Planning and scheduling

f. Materials

g. Weather

h. Training

i. Equipment

j. Location of Work

Using a multiple linear regression analysis of all statistically significant motivation and productivity factors, the top ten factors that influence the productivity of a Seabee are:

a. Type of work

b. Recognition

c. Safety

d. Personal problems

e. Training received

f. Supervisor motivation

g. Rewards

h. Inspections

i. Morale

j. Supervisor relations

CHAPTER 7

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Section 2: CONCLUSIONS

This research shows that motivational and productivity factors that influence a Seabee's performance can be classified into two groups: content factors and context factors. These groups are the basis for Herzberg's (Tribett, 1984) "Motivation-Hygiene Theory (see Chapter 2). The results of this study also closely parallel the studies of Borcherding and Oglesby (1974 and 1975) who analyzed factors that influence nonmilitary construction workers.

Content Factors relate to good feelings about one's job and are categorized as "motivators" or "satisfiers." Seabees can control and manipulate these factors to produce desired results. In this study the content factors were found to include: type of work, morale, job satisfaction, meaningful work, recognition, personal goals, advancement, training, and respect. As stated by Borcherding and Oglesby (1974):

> in construction, the satisfiers are inherent to the work itself...satisfactions came about because each

worker was, through one's individual efforts, producing a highly visible physical structure. Workers identified with the physical structure on which they were working and that they felt intimately involved with the construction process.

In this study, it was observed that as the level of satisfaction received by these content factors increased, the productivity of a Seabee increased accordingly.

The work itself can also be a "dissatisfier" for construction workers, according to Borcherding (1975). Some tasks in construction are repetitious resulting in bored and unhappy workers. As discussed in Chapter 2 a supportive leadership style is desired with less "directing" by the manager. Borcherding (1975) suggested rotating work assignments whenever possible to provide more variety for the worker. However, workers must learn to accept the bad assignments as well as the good ones.

The context factors relate to the bad feelings associated with the physical characteristics of the work environment and are categorized as "hygiene factors" or "dissatisfiers." These factors are relatively fixed and beyond the control of the individual Seabee. Their importance was felt only in their absence. In this study the context factors were found to include: supervisor relations, tools, planning and scheduling, materials,

weather, equipment, project location, money and travel. Similar to the findings of Borcherding and Oglesby's (1975), these factors "revolve around poor management or job conditions over which the affected individual has almost no control."

Herzberg (Rush, 1969) insists that these context factors are "important and that they, like Maslow's lower levels needs, must be adequately provided if a person is to rise above them to the self-actualizing concerns of involving oneself in meaningful tasks."

In this study, it was observed that as the degree to which these factors are increasingly in the favor of the Seabee, (as perceived by oneself), the Seabee's level of productivity will increase also. Basically, if any of these factors is removed from a Seabee's work environment, then their productivity will decrease.

Borcherding (1981) states that the most successful method of motivating construction workers is to reduce the negative effects of the "job dissatisfiers" and then use "job satisfiers" to motivate the workers.

CHAPTER 7

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Section 3: RECOMMENDATIONS

The goal of this study was to explore and to understand the factors that influence the motivation and productivity of Seabees and to determine how these findings might be implemented by the Naval Construction Force. The audience for the recommendations is assumed to be personnel at or above the supervisory levels, within the subject organizations. This includes Crew Leaders, Project Managers, Company Commanders and their staff, Officers-in-Charge and their staff, and Commanding Officers and their staff.

Although this study focused on the feelings, attitudes, experiences, and performances of enlisted Seabees, the results have implications for changes in the policies of Naval Mobile Construction Battalion and Construction Battalion Unit construction operations and training. The "management" personnel of these organizations have the primary role for implementation of the following recommendations:

1. <u>Train supervisors in human relations theories</u>. The supervisor's primary role is to create the proper climate for job satisfaction and self-fulfillment. Dwelling on and emphasizing what is positive builds better morale, cooperation, and productivity. There is real power in a person who has faith in oneself and those they lead. To attain success and to achieve a higher quality of supervision takes a definite amount of positive thinking. Supervisors need to know the types of factors that influence the performance of a Seabee. Discourage the "management by threat" style of leadership. Little acts of friendliness and praise will add to the ability to motivate.

2. <u>The organization must show an active and sincere concern for the welfare of their Seabees at all levels</u>. Problems that are resolved in a satisfactory and expeditious manner will contribute to a Seabee's utmost concentration to the assigned tasks, resulting in better production, quality and most of all safety.

3. <u>Provide meaningful work to the maximum extent possible</u>. Work that is meaningful to a Seabee will provide job satisfaction, a sense of accomplishment, work enjoyment, and other intrinsic rewards that are inherent to the work itself. Some repetitious and boring work is unavoidable in all construction operations. For these instances, rotate workers in and out of these positions.

This will help to prevent the "self-esteem" and "self-worth" of a Seabee from decreasing.

4. <u>Stress the importance of planning and scheduling</u>. Every effort should be made at all levels of supervision to ensure that the work is planned, and adequate resources (labor, tools, equipment, and materials) made available, so that each Seabee can be productive as the job unfolds. This will eliminate frustrations and encourage job satisfaction for the Seabee which ultimately improves production. A project that is well planned and on schedule will produce "satisfactions," whereas "dissatisfactions" result from poor project management, poor planning and falling behind schedule.

5. <u>Maintain and enforce a strong safety program</u>. A strong safety program will display the organization's concern for the well-being of their Seabees which may move the workers to be more productive. Provide additional emphasis on safety to those Seabees with less than one year of experience. Provide safety refresher training to those Seabees who have more than the average number of minor accidents; this may lower their potential for lost time accidents.

6. <u>An organization must keep their Seabees informed and establish open communication at all levels</u>. Continuous feedback on the performance of a Seabee will contribute to job satisfaction. Encourage participative decision-making

at all levels, especially between supervisors and their crews. Listen to workers' ideas, but do not be afraid to criticize constructively. Supervisors must be able to provide the type of criticism that will encourage, not discourage, improved performance. Criticism can prepare a Seabee for greater responsibility. Encourage Seabees to look for new and better ways to improve their work and social environment.

7. <u>Provide rewards and recognition for superior performance</u>. Stress the importance of accurate performance evaluations. Use noneconomical rewards (letters of appreciation/commendations, medals, and special liberty and privileges) for excellent performers. Caution must be exercised as too many rewards may desensitize Seabees to the degree that rewards will no longer be a motivating factor. The simplest form of rewarding or recognizing a worker is often the most difficult for a supervisor - a "pat-on-the-back" for a job well done. Simply expressing one's satisfaction with a worker's performance goes a long way in contributing to a worker's self-esteem and job satisfaction. It is important to keep in perspective that Seabees are the most important resource in the NCF.

8. <u>Return training to the forefront of an organization's mission and objectives</u>. Remove the "get the job done at any cost" attitude of some organizations. Allow Seabees to develop "new" skills and reinforce "old"

skills through on-the-job training, technical schools, and leadership schools. Reward excellent performers with the opportunity for career enhancing training, with attendance in the more advanced formal schools.

9. <u>Stress the negative affects of substance abuse</u>. Explain how substance abuse (drugs and alcohol) affects the health, productivity, quality of workmanship and safety of a Seabee and their unit.

10. <u>Treat Seabees at all levels with respect</u>. Mutual respect between supervisors and their workers stimulates increased productivity.

11. <u>Maintain a work environment that incites high morale</u>. High morale can be achieved when a Seabee is: treated fairly and impartial; accepted as a member of a "first class unit;" properly recognized for work done; assigned to tasks within one's abilities; properly trained; and when a Seabee's health and personal problems are cared for.

AREAS FOR FURTHER RESEARCH

This study was exploratory and provided insights for further, more specific and detailed research. Although general factors were tested and found to be influential on the motivation and productivity of Seabees in NMCB's and CBU's, more research should be directed to other NCF organizations, so that different factors, not tested in

this research, can be tested in those studies. Possible areas which can be pursued are:

1. Conduct a similar study to include other organizations of the NCF (e.g., Underwater Construction Teams, Amphibious Construction Battalions, Naval Construction Regiments). Such a study should consider differences in the type of work performed in each organization.

2. Conduct a study of the motivational and productivity factors of officers in the Naval Construction Force.

3. Expand upon the safety topic that was briefly discussed in this research. Consider more detailed analysis on the factors that influence the safety performance of Seabees, such as social, psychological and demographic factors.

4. Conduct a study that analyzes the relationship between Seabee supervisors and workers. Topics to consider should include management and leadership styles used and how effective these styles are in motivating Seabees.

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APPENDIX A

QUESTIONNAIRE

PRODUCTIVITY & MOTIVATIONAL QUESTIONNAIRE

PLEASE DO NOT SIGN YOUR NAME

INTRODUCTION: This questionnaire is to identify productivity and motivational factors that affect the Naval Construction Force (NCF). The responses will be analyzed to highlight particular areas of concern, and provide recommendations for improvement. Improving productivity and motivation includes providing adequate support and assistance to the work force and establishing a cooperative atmosphere among all levels of the NCF.

GENERAL INFORMATION
Please provide the following information about yourself:

1. Rate: _____   Paygrade: _____
   Time in Navy: _____ yrs   Time at your present unit/command: _____ yrs
2. Position: [Check one answer]
   | | Project Manager | | Crew Leader
   | | Crew member | | Staff/Support
   | | Other, Please specify: _____

   Time at your present position: _____ yrs
3. Organization Type: [Check one answer]
   | | NMCB | | CBU
   | | Public Works | | Staff
   | | Other, Please specify: _____

PRODUCTIVITY: The following questions relate to factors which affect construction productivity. Circle the "rating" that best expresses your opinion or observations. If a question does not apply to you, then circle "N/A."

A. The following questions relate to your supervisor/crew leader. Think of your supervisor or crew leader for a minute before answering the following questions.

	TO A VERY LITTLE EXTENT	TO A LITTLE EXTENT	TO SOME EXTENT	TO A GREAT EXTENT	TO A VERY GREAT EXTENT	
1. Is willing to help workers with personal problems?	1	2	3	4	5	N/A
2. Is friendly and easy to approach?	1	2	3	4	5	N/A
3. Sets a good example on and off the job?	1	2	3	4	5	N/A
4. Encourages teamwork?	1	2	3	4	5	N/A
5. Praises and recognizes workers for good performance?	1	2	3	4	5	N/A
6. Properly disciplines workers when necessary?	1	2	3	4	5	N/A
7. Shows favoritism to certain crew members?	1	2	3	4	5	N/A
8. Is respected by workers?	1	2	3	4	5	N/A
9. Is competent in day to day duties?	1	2	3	4	5	N/A
10. Would you like to work for him again?	1	2	3	4	5	N/A
11. Considers suggestions from crew?	1	2	3	4	5	N/A
12. Do you consider him a good leader?	1	2	3	4	5	N/A

B. The following questions relate to the members of your crew or fellow workers.

1. They are friendly and easy to approach?	1	2	3	4	5	N/A
2. They work well together as a team?	1	2	3	4	5	N/A
3. Everyone pulls his own weight?	1	2	3	4	5	N/A
4. Does one worker's negative attitude affect the entire crew's performance?	1	2	3	4	5	N/A
5. Is there a lack of cooperation between your crew and other crews (subs) on your project?	1	2	3	4	5	N/A
6. Are your crew members competent in their ratings?	1	2	3	4	5	N/A

C. The following questions relate to the type of work you perform on a daily basis.

1. Do you generally work within your rating?   1 2 3 4 5 N/A
2. Are you happy with your rating?   1 2 3 4 5 N/A
3. Have you ever done work that you knew could be done better by another method?   1 2 3 4 5 N/A
4. Are you comfortable in your present work environment? 1 2 3 4 5 N/A
5. Are you satisfied with the quality of your work?   1 2 3 4 5 N/A
6. Does your work give you a sense of accomplishment? 1 2 3 4 5 N/A
7. What percent of your work time do you perform at your fullest potential? _____ percent of the time.
8. How many hours do you work each week? _____ hrs

D. To the best of your ability, please provide your personal opinions and observations to the following questions. If a question does not apply to you, then circle "N/A."

1. Does the location of your assignment (deployment site, duty station...) effect your productivity? 1 2 3 4 5 N/A
2. Are the proper tools for the job always available? 1 2 3 4 5 N/A
3. Are the available tools in adequate condition? 1 2 3 4 5 N/A
4. Are the available tools old fashioned or obsolete? 1 2 3 4 5 N/A
5. Are the construction materials of good quality? 1 2 3 4 5 N/A
6. Has your or your crew's performance been affected by poor quality materials? 1 2 3 4 5 N/A
7. Does the formal training (ie. schools) adequately prepare you for your assigned duties? 1 2 3 4 5 N/A
8. Do your current duties provide adequate on-the-job training? 1 2 3 4 5 N/A
9. Does the inspection program ensure quality work? 1 2 3 4 5 N/A
10. Has the performance of your crew ever been affected by a crew members substance abuse (drugs or alcohol)? 1 2 3 4 5 N/A
11. Has your performance ever been affected by substance abuse? 1 2 3 4 5 N/A
12. Is the proper equipment for the job available? 1 2 3 4 5 N/A
13. Is the available equipment in adequate condition? 1 2 3 4 5 N/A
14. Is the available equipment old fashioned or obsolete? 1 2 3 4 5 N/A
15. Has the use of poor quality equipment affected your crew's performance? 1 2 3 4 5 N/A
16. Has the use of computers had any affect on your performance? 1 2 3 4 5 N/A
17. Are computers effectively used within your unit/command? 1 2 3 4 5 N/A
18. Is adequate time set aside for planning and estimating of projects? 1 2 3 4 5 N/A
19. Are schedules usually followed? 1 2 3 4 5 N/A
20. Is it worth the time and effort to plan and estimate? 1 2 3 4 5 N/A
21. Are computers effectively used in the planning and estimating effort? 1 2 3 4 5 N/A
22. Are computers effectively used for project management during construction? 1 2 3 4 5 N/A
23. Should computers be used more in project planning and managing of projects? 1 2 3 4 5 N/A
24. Do safety regulations restrict your ability to work effectively? 1 2 3 4 5 N/A
25. Do you understand the need for safety awareness on the projects? 1 2 3 4 5 N/A
26. Do you feel that you work in a safety conscious work environment? 1 2 3 4 5 N/A
27. Are daily safety lectures affective? 1 2 3 4 5 N/A
28. Have you observed any major safety violations that were unreported? 1 2 3 4 5 N/A

29. Since you have been in your present unit/command, how many injuries have you received that:
    a. Required first aid treatment only? _____
    b. Required a doctor's attention? _____
    c. Were lost time accidents? _____

30. Has personal problems ever affected your crew's work?   1 2 3 4 5 N/A

31. If you had a personal problem, would you know where to go to seek help to resolve the problem?   1 2 3 4 5 N/A

32. Is adequate assistance provided by your command to resolve a member's personal problem?   1 2 3 4 5 N/A

33. Do you feel that your superiors are concerned about your personal problems?   1 2 3 4 5 N/A

34. Do you feel that the communication within your chain of command is effective?   1 2 3 4 5 N/A

35. Have you or your crew ever performed rework due to poor communications between crew and supervisor?   1 2 3 4 5 N/A

36. Is morale generally good in your work environment?   1 2 3 4 5 N/A

37. Has low morale ever affected your crew's work performance negatively?   1 2 3 4 5 N/A

38. Does family separation of your job affect your productivity?   1 2 3 4 5 N/A

39. Are you under a lot of stress in your work environment?   1 2 3 4 5 N/A

40. Is the productivity of your crew reduced due to stress?   1 2 3 4 5 N/A

41. Do you feel that the some constructions methods that are being used are outdated?   1 2 3 4 5 N/A

42. Are the quality of your project plans of good quality and are easy to understand?   1 2 3 4 5 N/A

43. Do the project plans have few errors (interferences, missing information...) that require major revisions?   1 2 3 4 5 N/A

44. Does a crew member's substandard physical fitness affect your crew's productivity?   1 2 3 4 5 N/A

45. Do any discriminatory remarks or actions by crew members affect your crew's productivity?   1 2 3 4 5 N/A

46. Would you like to increase your participation in the decision making process concerning your project?   1 2 3 4 5 N/A

E. The following is a list of factors that affect construction productivity. Please select the top _five factors_ that most influence your work performance in a _positive_ way, and rank in order of importance, (1-highest; 5-lowest).

[ ] Supervisor	[ ] Planning and scheduling
[ ] Type of work	[ ] Safety
[ ] Weather	[ ] Personal problems
[ ] Location	[ ] Chain of command communication
[ ] Tools	[ ] Morale
[ ] Materials	[ ] Family Separation
[ ] Training	[ ] Stress
[ ] Substance abuse	[ ] Construction Methods
[ ] Equipment	[ ] Plans
[ ] Computers	[ ] Discrimination
[ ] Physical Fitness	[ ] Other, please specify : _____

MOTIVATION: The following questions relate to factors which affect a construction worker's motivation. Motivation is the desire to satisfy your physical and emotional needs, by stimulating an active interest in your assigned task.

A. To the best of your ability, please provide your personal opinions and observations to the following questions. If a question does not apply to you, then circle "N/A."

1. Does the opportunity for rewards (Letters of appreciation/commendation, medals, special liberty, etc...) improve your performance?   1 2 3 4 5 N/A

2. Do you feel that you are adequately recognized for contributions:
   a. By your superiors   1 2 3 4 5 N/A
   b. By your peers?   1 2 3 4 5 N/A
   c. By your subordinates?   1 2 3 4 5 N/A
3. Do your evaluations accurately reflect your performance?   1 2 3 4 5 N/A
4. If you received a less than average evaluation, would you try to improve your performance?   1 2 3 4 5 N/A
5. If you received an above average evaluation, would you work harder to maintain your performance level?   1 2 3 4 5 N/A
6. Is your supervisor a good motivator of personnel?   1 2 3 4 5 N/A
7. Do you tend to be a self-motivator?   1 2 3 4 5 N/A
7. Do you set personal goals for yourself?   1 2 3 4 5 N/A
8. Do you achieve your personal goals?   1 2 3 4 5 N/A
9. Do you know what your superiors expect of you?   1 2 3 4 5 N/A
10. Are you satisfied with your contribution to the command?   1 2 3 4 5 N/A
11. Are you learning a useful career skill at your present position?   1 2 3 4 5 N/A
12. Since you have been in the Naval Construction Force, have the duty assignments, training and experience that you received, been what you expected?   1 2 3 4 5 N/A
13. Do you consider the pay and benefits that you receive to be adequate compensation for your duties?   1 2 3 4 5 N/A
14. Do you enjoy your work?   1 2 3 4 5 N/A
15. Do you try to do a better job on some types of construction work than other types?   1 2 3 4 5 N/A
16. Is the type of work you perform meaningful?   1 2 3 4 5 N/A
17. Do you have pride in yourself as a member of the Navy?   1 2 3 4 5 N/A
18. Are you proud to be a member of your present command?   1 2 3 4 5 N/A
19. Are you proud to be a Seabee?   1 2 3 4 5 N/A
20. Are you satisfied with the advancement procedures?   1 2 3 4 5 N/A
21. Do you prefer to stay at your present paygrade?   1 2 3 4 5 N/A
22. Does the potential for advancement influence your performance?   1 2 3 4 5 N/A
23. Does the job security of being in the Navy influence your performance?   1 2 3 4 5 N/A
24. Do you feel that you have earned the respect from your:
   a. Superiors   1 2 3 4 5 N/A
   b. Peers   1 2 3 4 5 N/A
   c. Subordinates   1 2 3 4 5 N/A
25. Is the respect from others an influence on your performance?   1 2 3 4 5 N/A
26. How much longer do you expect to stay in the Navy? _____ yrs

B. The following is a list of factors that affect the motivation of construction workers. Please select the top five factors that most influence your work performance in a positive way, and rank in order of importance, (1-highest; 5-lowest).

| | Money | | Travel
| | Rewards | | Job satisfaction
| | Benefits | | Patriotism/camaraderie
| | Recognition | | Advancement
| | Personal goals | | Job security
| | Training and education programs available | | Respect
| | Meaningful work
| | On-the-Job Training | | Other, please specify: _____

Thank you for the time and effort in answering these questions!

4

APPENDIX B

SAMPLE COVER LETTER

Date

Name
Commanding Officer/Officer in Charge
Naval Mobile Construction Battalion/Naval Construction Battalion Unit
Address
City, State Zip Code

Dear Title/Name:

I am presently a student at the University of Washington pursuing a
Master of Science in Civil Engineering. As partial fulfillment of my
academic requirements, I am developing a study (thesis) of
productivity and motivational factors that influence Seabees in the
Naval Construction Force. To achieve my research goals, the enclosed
questionnaire has been developed to isolate and identify various
factors.

I respectfully request your assistance in gathering data for my study.
I would like these questionnaires to be filled out by a "typical cross-
section" of Seabees in your command, (various paygrades and rates in
the OF-13 field). There are a few points that should be stressed to
your Seabees:

    1. These questionnaires are set up to find out just what are the
important factors that motivate a Seabee to be productive. All
responses will be regarded as being <u>strictly confidential</u>.

    2. These questionnaires are not a test; there is no "right" or
"wrong" answers. Each answer is simply an expression of their
individual opinions and observations.

Upon completion of the questionnaires please return them in the
enclosed envelope. I appreciate your cooperation and participation in
this study.

                              Very Respectfully,

                              T.W. BURNS
                              LT, CEC, USN
                              Department of Civil Engineering
                              University of Washington
                              121 More Hall, FX-10
                              Seattle, WA 98195

Enclosures

APPENDIX C

RESEARCH DATA

(Coded for Analysis)

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154444321423331169 999999999999999999999999
543146544555444241445541544444119 999999999999999
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333334433334333433243444142333215 949599192939999
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444434342233343234 999999999999999999999999
433434444444434364443434313344440 999999999999999
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160161620084082 4444444144444222522251141020605666666231666655111223353331000000
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63333354433324433333333333333301 199999923994959
160172404063362 333444232333322322239439052351113233433121122132213455511000101
51331535232534113 91394999599999999992999
51111512511219314529141151333300 999999999999999
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333333334334313334344421223339999 999999951949239
160191505092242 5554531445553233235523551004022353134311334416135466154310 10000
35432314131524134 12459999999939999999999
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122223433333333333335154243333305 999599992139499
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34323443343333434 3999495999921999999999
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9999999999999999 99999999999999999999999
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160245201123122 333334333343444323444444070403333343436612336633366624453000000
33333333222336222 99999999999999999999999
3333333333333432333333323333399 999999999999999
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APPENDIX D

DEFINITION FILE

DATA LIST FILE= "c:\spss\the\thesis.dat" /Sampgrp 1-2 Number 3-5 Rate 6 Rank 7
Timenavy 8-9 Timeunit 10-11 Position 12 Timepos 13-14 Orgtype 15 Sperprob 17
Sfrneasy 18 Sexamjob 19 Sencteam 20 Spraise 21 Sdispl 22 Sfavor 23 Srespect 24
Scomp 25 Swork 26 Ssuggest 27 Sgoodldr 28 Cfrneasy 29 Cteam 30 Cpullwt 31
Cnegatt 32 Ccoop 33 Ccomp 34 Wrate 35 Whpyrate 36 Wmethod 37 Wworkenv 38
Wqual 39 Waccomp 40 Wperc 41-43 Whrsweek 44-45 assnmt 46 toolavl 47 tooladeq 48
toolold 49 matlgood 50 matlpoor 51 trnforml 52 trnojt 53 winspect 54 crwsubab 55
persubab 56 eqavail 57 eqadeq 58 eqold 59 eqcrew 60 compperf 61 compeff 62
petime 63 schfoll 64 peeff 65 pecomp 66 pmcomp 67 compuse 68 saferegs 69
safeawar 70 safeenv 71 safelect 72 safeviol 73 firstaid 74-75 doctor 76-77
losttime 78-79 / probcrew 1 probhelp 2 probasst 3 probsupr 4 commeff 5
commrewk 6 morgood 7 morcrew 8 famsep 9 stressen 10 stresscr 11 contmeth 12
plangood 13 planerr 14 physfit 15 discrim 16 decision 17 super 19 typework 20
weather 21 location 22 tools 23 material 24 training 25 subabuse 26 equip 27
computr 28 physfitn 29 plansch 30 safety 31 persprob 32 coccomm 33 morale 34
famsepr 35 stress 36 conmeth 37 plans 38 dscrim 39 other 40 / rewards 1
recsuper 2 recpeers 3 recsubor 4 evalperf 5 evalpoor 6 evalgood 7 supermot 8
selfmot 9 goalset 10 goalach 11 glexpect 12 satcontr 13 learnskl 14 trainexp 15
payben 16 enjoywrk 17 worktype 18 workmean 19 prdnavy 20 prdunit 21 prdseab 22
advsat 23 advstay 24 advpot 25 secjob 26 respsupr 27 resppeer 28 respsub 29
respothr 30 nvylgr 31-32 money 34 reward 35 benefits 36 recog 37 persgoal 38
train 39 ojtrain 40 travel 41 jobsat 42 patriot 43 advance 44 jobsec 45
respect 46 meanwork 47 otherm 48.
VARIABLE LABELS Sampgrp "Sample Group" / Number "Questionnaire Number"
/ Rate "Rate" / Rank "Paygrade" / Timenavy "Time in navy, yrs"
/ Timeunit "Time in unit, mos" / Position "Job title"
/ Timepos "Time in present position, mos" /Orgtype "Organization type"
/Sperprob "Supervisor helps with personal problems"
/Sfrneasy "Supervisor is friendly and easy to approach"
/Sexamjob "Supervisor sets a good example on and off the job"
/Sencteam "Supervisor encourages teamwork"
/Spraise "Supervisor praises workers"
/Sdispl "Supervisor properly disciplines workers"
/Sfavor "Supervisor shows favoritism to certain workers"
/Srespect "Supervisor is respected by workers"
/Scomp "Supervisor is competent in duties"
/Swork "Would like to work for supervisor again"
/Ssuggest "Supervisor considers suggestions from crew"
/Sgoodldr "Consider supervisor a good leader"
/Cfrneasy "Crew members are friendly and easy to approach"

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/Cteam "Crew works as a team"
/Cpullwt "Crew members pull their own weight"
/Cnegatt "Negative attitude of one worker affects entire crew"
/Ccoop "Lack of cooperation between crews"
/Ccomp "Crew members are competent in their duties"
/Wrate "Work within your rate"
/Whpyrate "Happy with your rating"
/Wmethod "Complete any work which could have been done differently"
/Wworkenv "Comfortable in work environment"
/Wqual "Satisfied with your quality of work"
/Waccomp "Sense of accomplishment from work"
/Wperc "Percent of work done at your fullest potential"
/Whrsweek "Hours per week of work"
/assnmt "Work location effect your productivity"
/toolavl "Proper tools available"
/tooladeq "Tools in adequate condition"
/toolold "Tools old fashioned or obsolete"
/matlgood "Materials of good quality"
/matlpoor "Crew performance ever affected by poor quality materials"
/trnforml "Does formal training adequately prepare you for your duties"
/trnojt "Duties provide adequate on the job training"
/Winspect "Does inspection program ensure quality work"
/crwsubab "Crew performance ever affected by substance abuse"
/persubab "Your performance ever affected by substance abuse"
/eqavail "Proper equipment for the job available"
/eqadeq "Equipment in adequate condition"
/eqold "Equipment old fashioned or obsolete"
/eqcrew "Crew performance ever affected by poor quality equipment"
/compperf "Performance affected by use of computers"
/compeff "Computers are used effectively in unit"
/petime "Adequate time set aside for planning and estimating"
/schfoll "Schedules are usually followed"
/peeff "It is worth the time & effort to plan and estimate projects"
/pecomp "Computers are effectively used in planning and estimating"
/pmcomp "Computers are used effectively in project management"
/compuse "Use more computers in the P & E and proj mgt process"
/saferegs "Safety regs restrict ability to work effectively"
/safeawar "Understand the need for safety regs"
/safeenv "Work in a safe environment"
/safelect "Daily safety lectures are effective"
/safeviol "Observed safety violations that were unreported"
/firstaid "Number of first aid injuries in past 3 years"
/doctor "Number of injuries needing doctor attention in past 3 years"
/losttime "Number of lost time injuries in past 3 years"
/probcrew "Personal problems have affected crew performance"
/probhelp "Know where to go for help with personal problems"
/probasst "Adeq assistance is provided by unit for personal problems"
/probsupr "Superiors are concerned with your personal problems"
/commeff "Effective chain of command communication"
/commrewk "Rework has been performed due to poor communication"
/morgood "Morale is generally good in work environment"
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/morcrew "Low morale has affected crew performance negatively"
/famsep "Family separation affects your performance"
/stressen "Under alot of stress in work environment"
/stresscr "Crew productivity has been reduced due to stress"
/contmeth "Outdated construction methods are being used"
/plangood "Project plans are of good quality"
/planerr "Project plans contain few errors that require revisions"
/physfit "Workers poor physical fitness affects crew productivity"
/discrim "Discriminatory remarks affect crew productivity"
/decision "Improve participation in decision making"
/super "Supervisor"
/typework "Type of work"
/weather "Weather"
/location "Location"
/tools " Tools"
/material "Material"
/training "Training"
/subabuse "Substance abuse"
/equip "Equipment"
/computr "Computer"
/physfitn "Physical Fitness"
/plansch "Planning and scheduling"
/safety "Safety"
/persprob "Personal problems"
/coccomm "Chain of command communications"
/morale "Morale"
/famsepr "Family separation"
/stress "Stress"
/conmeth "Construction methods"
/plans "Project plans"
/dscrim "Discrimination"
/other "Other productivity factors"
/rewards "Rewards influence performance"
/recsuper "Performance recognized by superiors"
/recpeers "Performance recognized by peers"
/recsubor "Performance recognized by subordinates"
/evalperf "Evals accurately reflect performance"
/evalpoor "Strive for improved performance due to a poor eval"
/evalgood "Strive to maintain or improve performance due to good eval"
/supermot "Supervisor is a good motivator"
/selfmot "Self motivating individual"
/goalset "Set personal goals"
/goalach "Achieve personal goals"
/glexpect "Know what is expected of your performance from superiors"
/satcontr "Satisfied with contributions to unit"
/learnskl "Learning a useful skill at present position"
/trainexp "Satisfied with skills developed"
/payben "Pay and benefits are adequate for work performed"
/enjoywrk "Enjoy your work"
/worktype "Work harder on some types of work than others"
/workmean "Perform meaningful work"

/prdnavy "Proud to be in the navy"
/prdunit "Proud to be in present unit"
/prdseab "Proud to be a Seabee"
/advsat "Satisfied with advancement procedures"
/advstay "Prefer to stay at present paygrade"
/advpot "Potential for advancement improves work performance"
/secjob "Job security influences performance"
/respsupr "Earned the respect of superiors"
/resppeer "Earned the respect of peers"
/respsub "Earned the respect of subordinates"
/respothr "Respect from other persons influence performance"
/nvylgr "How much longer do you expect to remain in the navy, yrs"
/money "Money"
/reward "Rewards"
/benefits "Benefits"
/recog "Recognition"
/persgoal "Personal goals"
/train "Training"
/ojtrain "On the job training"
/travel "Travel"
/jobsat "Job satisfaction"
/patriot "Patriotism and camaraderie"
/advance "Advancement"
/jobsec "Job security"
/respect "Respect"
/meanwork "Meaningful work"
/otherm "Other motivational factors".
VALUE LABELS Rate 1 "BU" 2 "SW" 3 "CE" 4 "UT" 5 "EO" 6 "CM" 7 "EA" 8 "Other"
/ Rank 1 "E1" 2 "E2" 3 "E3" 4 "E4" 5 "E5" 6 "E6" 7 "E7" 8 "E8" 9 "E9"
/ Position 1 "Project Manager" 2 "Crew Leader" 3 "Crew Member"
4 "Staff or Support" 5 "Other"
/ Orgtype 1 "NMCB" 2 "CBU" 3 "Public Works" 4 "Staff" 5 "Other"
/ Sperprob to Waccomp 1 "Very Little extent" 2 "Little Extent" 3 "Some extent"
4 "Great extent" 5 "Very great extent" 6 "N/A"
/ assnmt to safeviol 1 "Very little extent" 2 "Little extent" 3 "Some extent"
4 "Great extent" 5 "Very great extent" 6 "N/A"
/ probcrew to decision 1 "Very little extent" 2 "Little extent" 3 "Some extent"
4 "Great extent" 5 "Very great extent" 6 "N/A"
/ rewards to respothr 1 "Very little extent" 2 "Little extent" 3 "Some extent"
4 "Great extent" 5 "Very great extent" 6 "N/A".
MISSING VALUES Rank (0) / Rate Position Orgtype to Waccomp assnmt to safeviol
probcrew to respothr money to otherm (9) / Sampgrp Timenavy Timeunit Timepos
Whrsweek firstaid doctor losttime nvylgr (99) / Number Wperc (999).

* Productivity Efficiency Calculations.
IF (ORGTYPE EQ 1) AVGWK = 49.2.
IF (ORGTYPE EQ 2) AVGWK = 41.9.
COMPUTE PRODUCT = (WPERC * WHRSWEEK)/AVGWK.
IF (PRODUCT LT 55)   PRODEFF = 1.
IF (PRODUCT GE 55 AND PRODUCT LT 85) PRODEFF = 2.
IF (PRODUCT GE 85)   PRODEFF = 3.
VALUE LABELS PRODEFF 1 "LOW" 2 "AVERAGE" 3 "HIGH".

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* Safety Factor Calculations - No. Injuries per 1,000,000 hours of exposure.
* First Aid Injuries - SAFEFA.
COMPUTE SAFEFA = (FIRSTAID * 1000000)/((TIMEUNIT/12) * 48 * WHRSWEEK).
* Doctor Required Injuries - SAFEDR.
COMPUTE SAFEDR = (DOCTOR * 1000000)/((TIMEUNIT/12) * 48 * WHRSWEEK).
* Lost Time Injuries - SAFELT.
COMPUTE SAFELT = (LOSTTIME * 1000000)/((TIMEUNIT/12) * 48 * WHRSWEEK).
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