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INCENTIVE MANAGEMENT

STIMULATING WORKER PRODUCTIVITY THROUGH REWARDS-FOR-PERFORMANCE

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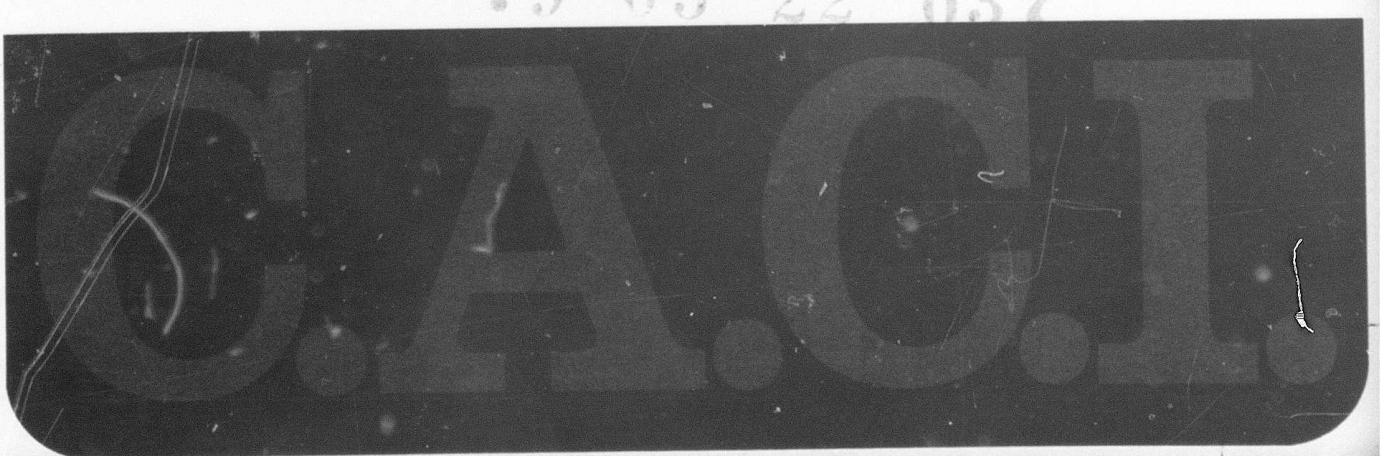
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This interim technical report defines and identifies incentive management (rewards-for-performance) strategies that have been and can be employed to stimulate worker productivity. Recent theoretical and empirical studies are reviewed to evaluate the relative effectiveness of alternate incentive plans on performance. An inventory of popular incentive systems is compiled and a taxonomy that classifies incentives is designed. Finally, a computer-based demonstration package is developed to display how workforce supervisors and organizational development specialists can tailor incentive designs to the needs of

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specific organizations and job functions. The preliminary results indicate that incentive management is an effective tool to improve worker productivity and maximize manpower cost savings. However, tailored incentive strategies are required to meet the special contingencies of different organizations and tasks.

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EXECUTIVE SUMMARY

PROBLEM. Rapidly escalating manpower costs in Department of Defense (DoD) logistics operations have stimulated a search for management methods by which workforce motivation can be improved, worker productivity increased, and cost savings maximized.

OBJECTIVES. The goals of this interim technical report are:

1. To define and identify incentive management (rewards-for-performance) strategies that have been designed and implemented in the DoD, U.S. Government, private industry, and in foreign countries.

2. To develop a qualitative taxonomy that classifies incentive management approaches.

3. To describe the relative effectiveness of various incentive management plans in improving worker motivation and productivity.

TECHNICAL APPROACH

1. Recent theoretical and empirical studies were reviewed that evaluate the effectiveness of incentive programs on worker productivity.

2. An inventory of popular incentive systems that have been implemented in government and industry was compiled and an incentive taxonomy was designed that classifies incentive plans based on their principal characteristics.

3. Common threads among 54 separate evaluations of incentive programs were identified and described to provide preliminary results on the productivity improvements that can be anticipated when implementing various incentive systems.

4. A computer-based demonstration package has been developed to display how workforce supervisors and organizational development specialists can access productivity data on potential incentive strategies as well as tailor incentive designs to the needs of a specific organization or job function.

FINDINGS

1. Over all 54 cases, the implementation of an incentive strategy has been shown to yield an average increase in productivity of 22.8 percent. The maximum increase in productivity observed was 87 percent.

2. Incentive strategies can also be linked to an average increase in work quality of 8.8 percent. Quality improvements have been observed to climb as high as 55 percent over preincentive levels.

3. For technical training tasks, variable cash bonus incentives have been found to increase the speed of course completion by an average of 40 percent. Productivity in clerical tasks, as well as in nonmanufacturing corporate firms, has improved up to 87 percent when nonfinancial incentives, such as granting special recognition to employees or offering valued privileges, were introduced.

4. Quality improvement in military organizations increases only slightly (1.6 percent on the average) when a mixture of cash bonuses and noncash incentives are implemented.

5. Incentive strategies designed with variable (unpredictable) reward schedules were found to have high potential for improving worker productivity and quality, but have received inadequate attention by the research and practitioner communities in the past.

CONCLUSIONS. Incentive management is an effective tool by which workforce supervisors can increase motivation, improve productivity and quality, and yield substantial payoff in terms of manpower cost savings. However, different incentive strategies are required to meet the special contingencies of different organizations and job functions.

RECOMMENDATIONS

1. The preliminary incentives database should be expanded to uncover trends of incentive effectiveness under a variety of conditions.

2. A contingency-based and computer-operated "incentive management aid" should be implemented to help workforce supervisors and organizational development specialists design and tailor incentive plans for particular job functions and organizations.

3. Workforce incentives based on variable reward schedules should be designed and tested.

4. Controlled laboratory experiments and field tests should be designed and conducted to evaluate the validity of the aid's recommendations.

5. A handbook and users' manual should be written to describe the practical results of the field tests for potential future reference and facilitate usage of the incentive management aid.

6. An incentive management training program for workforce managers should be developed and administered to promote the use of motivational management tools, such as incentive programs, to enhance manpower productivity and cost control.

CHAPTER 1. OBJECTIVES AND METHODS

INTRODUCTION

This is an interim technical report on the results of the first six months effort on one important aspect of the Logistics Systems Technology Program of the Defense Advanced Research Projects Agency (DARPA). It describes a study of the behavioral management implications of using extrinsic incentives as a means of improving performance and productivity in a variety of work situations and in a number of organizations in both the public and private sectors.

Incentives are generally accepted as being a favorable stimulus to actions, but this acceptance has been established more by tradition, lore, or trial and error than fundamental research. The present efforts attempt to identify the kinds of incentives that have been applied and measured to some degree in various organizations or in laboratory or field tests. Our goals are to develop a taxonomy of positive incentives that divides them into appropriate groups depending on their characteristics, and to analyze measurement data that can be secured on the results of cases where such incentives have been applied.

BACKGROUND

In 1977, DARPA began to lay the groundwork for research in various aspects of logistics functions within the Department of Defense (DoD) in its Logistics Systems Technology Program. This program had as its goals:

- Reducing costs of logistics operations while maintaining high levels of unit performance across DoD logistics functions,
- Developing incentives for increasing human motivation and unit effectiveness,

- Developing and improving advanced methodologies for measuring logistics effectiveness, and
- Ensuring service-wide transfer of systems technologies for modernizing and advancing DoD logistics functions.

As a first step toward meeting these objectives, DARPA conducted a case study to evaluate the impact of monetary incentives on maintenance. That study suggested organizational incentives that might quickly and significantly improve maintenance cost effectiveness. It was a limited project, however, and did not cover the wide and varied area of human motivation through incentives. DARPA, therefore, decided to carry out a specific study on incentives for improving logistics performance.

OBJECTIVES

The specific objectives of this research effort are as follows:

- Identify, review, and assemble information on past and current incentive programs applied to motivate personnel in public and private organizations.
- Develop a general qualitative taxonomy of past and current incentives applications.
- Construct a database that can be used for statistical analysis.
- Develop a detailed empirical taxonomy of incentives programs by attributes and functions.
- Prepare a comprehensive briefing for presentation to appropriate DoD personnel.
- Design a prototype executive aid for incentive program design and management.

APPROACH TO THE INITIAL PHASE

The efforts expended to date have been involved in accomplishing a comprehensive review of available documented cases of the use of extrinsic

incentives to motivate personnel to improved performance and productivity. An exhaustive search has been made of the literature, reference sources, and abstract services to identify incentive programs that qualify for inclusion in the study. In addition, numerous contacts have been made through personal interview with individuals both in and out of the Government who are interested in, knowledgeable of, and qualified in evaluating motivational efforts aimed at increasing productivity in the public and private sectors. The information thus collected has been tabulated, coded, and preliminarily evaluated from a qualititative point of view.

In addition, work is underway on the tentative design of the prototype executive aid to be developed more fully in the latter half of the contract period. Details of the findings to date, the tentative structure of the qualitative taxonomy, preliminary evaluation of the cases on which data have been accumulated, and a description of the characteristics and potential capabilities of the executive aid are covered in the following chapters.

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CHAPTER 2. INCENTIVES AND PRODUCTIVITY: SOME DEFINITIONAL AND THEORETICAL FOUNDATIONS

WHAT IS AN INCENTIVE?

Definition

In general, an incentive is an inducement that attempts to direct the performance of an employee or supervisor toward management-desired goals. It can take many forms including a monetary bonus for superior performance on the job, nonmonetary supervisory recognition of outstanding work, or time off with pay for above-standard performance. In the work situation, incentives are usually of a positive and rewarding nature. However, they can be designed as penalties for poor work, for example, a reduction in pay or withholding of salary increase may be imposed for below-standard performance.

Incentive strategies are motivating tools used to enhance management control over human resources, and, thus, gear performance toward predetermined results (Patten, 1977). The most important characteristic of incentives is the contingent relation between reward and performance. Before-the-fact knowledge by workers or supervisors that a valued object will be granted contingent on a certain level of specified performance is essential for incentives to have a real pull on behavior (Haworth, 1972). Research shows that apparent rewards lack motivational pull when they are not valued by workers or are not tied directly and explicitly to performance achievement (Lawler, 1973). Upon attainment of the performance goal, presentation of the valued object acts as a positive reinforcer of the extra effort expended by the worker and motivates continued extra effort to obtain additional rewards.

Many types of rewards or satisfactions received at the workplace are not incentives by this definition (Haworth, 1972). A guaranteed hourly wage is a basic commitment to compensate workers despite performance level and therefore is not considered an incentive. Typical fringe benefit programs, such as life and health insurance, retirement and pension plans, disability income programs, and savings plans are also granted regardless of worker effort or performance and are not incentives that reinforce achievement or specific output goals. Too, perquisities and working conditions provided by management, such as paid vacations, holidays, recreational facilities, dining facilities, company cars, and office furnishings, are rewards just for participating in an organization when offered to everyone equally, and generally are not incentives.

Applicability

Incentives can aim at workers as well as managers, and at individuals as well as groups. They can focus on the entire organization, particular divisions or departments, or specific job functions. However, no incentive plan is likely to be universally applicable. Different employees are likely to be motivated by different reward types. Different job functions may operate on different production schedules and have differing types of output that require tailoring of incentive plans. Especially when applying incentives in the military services or in other agencies of the government, legal regulations and guidelines must be consulted to adapt incentive plans to fit these special conditions.

Other Work Reinforcers

Certainly, incentives that stimulate worker performance through promised rewards are not the only form of work reinforcer. Organizational researchers often categorize work reinforcers into extrinsic and intrinsic motivational types (P. Moore, 1977; L. Moore, 1976; Newstrom, Reif, and Monczka, 1976; Rand, 1977; Deci, 1972, 1976).

Extrinsic motivators are those tangible rewards offered by the workplace that reinforce superior performance. They include incentives, as defined in this report, other monetary compensation, job security, job status and recognition, interpersonal relationships, and supportive physical aspects of the work environment.

Intrinsic motivators are those internal satisfactions that one gets from working, including a sense of accomplishment, responsibility, control, self-esteem, opportunity for growth, self-actualization, and a sense of belonging. All together, Pritchard and Shaw (1978) have inventoried 157 categories of intrinsic and extrinsic job rewards. However, this report limits its attention only to extrinsic incentive strategies that are tied explicitly to performance.

WHAT IS PRODUCTIVITY?

Definition

Improved productivity is the principal desired result of implementing incentive strategies. Productivity is defined as the volume of output that a manager or worker can produce in a fixed period of time of labor output (Zollitsch, 1975). As such, productivity is the ratio between results (outputs) and resources expended (inputs).

Effectiveness and Efficiency

Often, productivity is viewed solely from a quantitative perspective. Efficiency or quantitative measures tap the productivity rate: output per manhour. However, a second productivity dimension encompasses the qualitative aspects of the product or outputs, namely, effectiveness (U.S. Civil Service Commission, 1978). Although the quantity dimension is certainly more amenable to objective measurement than the quality dimension, the latter is especially sensitive when assessing productivity

in public sector services. The amount of a service rendered offers information only about the efficiency of workers and not about how well those services are being performed (accuracy, completeness, distribution), or whether they are performed in a timely fashion. In this report, both the quantity and quality dimensions of productivity are viewed as principal targets of incentive strategies.

Cost Savings

Productivity is also closely related to cost effectiveness analyses of workforces. Such studies evaluate how costs are allocated to obtain desired outputs and how costs can be minimized without undermining the quantity or quality of productivity. The degree of cost savings that can accrue due to implementation of incentive strategies is an additional goal that will be addressed in this report.

Other Productivity Maximizers

Incentive plans are not the only means of increasing productivity. Many work place factors can also help to maximize it: improved personnel selection and placement; job development and promotion; new training and instruction; work appraisal and feedback; management by objectives; goal setting; job redesign; work team redesign for responsibility, authority, and activity distribution; changes in supervisory methods; changes in overall organization structure; changes in physical working conditions; changes in work schedule; and changes in sociotechnical systems, including new technology (Katzell, Bienstock, and Faerstein, 1977; Fein, 1975). While noting the potential influence of these factors on productivity, this report focuses solely on the impact of incentive strategies on productivity improvement. In Chapter 4, where empirical studies of incentives and productivity are examined, careful attention is paid to controlling for the intervening effects of these rival hypotheses.

THE CONSEQUENCES OF INCENTIVE MANAGEMENT

Incentive management combines the use of incentive strategies and a concern for obtaining improved productivity. It can be defined as a management strategy to achieve increased control over human resources and maximize productivity and cost savings by granting rewards to workers and/or managers contingent upon achievement of prespecifed performance goals. Figure 1 displays the intended consequences of incentive management.

Implementation of an incentive management strategy is aimed at increasing worker motivation toward achieving management's prespecified performance targets. The anticipated behavioral outcome is increased worker effort toward attaining these ends. The productivity outcomes consist of increased quantity and quality of productivity and increased cost savings.

While not an element of productivity per se, a related outcome of incentive management is an improvement in the quality of work life (National Commission on Productivity and Work Quality, 1975b). This outcome includes improved morale, job security, personal growth, sense of accomplishment and control, and opportunities to exercise craftsmanship. Although changes in the quality of work life are important from a job satisfaction and human relations perspective, they will not be examined in this report.

Incentive management is applicable in many diverse organizational contexts. In the military command and control (C^2) area, incentive management can be used to tighten effective control over human resources and improve performance reliability. In the DoD logistics community, incentive management can be employed to contain costs and maintain military readiness through improved material acquisition, supply, and maintenance. Several successful, though isolated, experiments in the use of

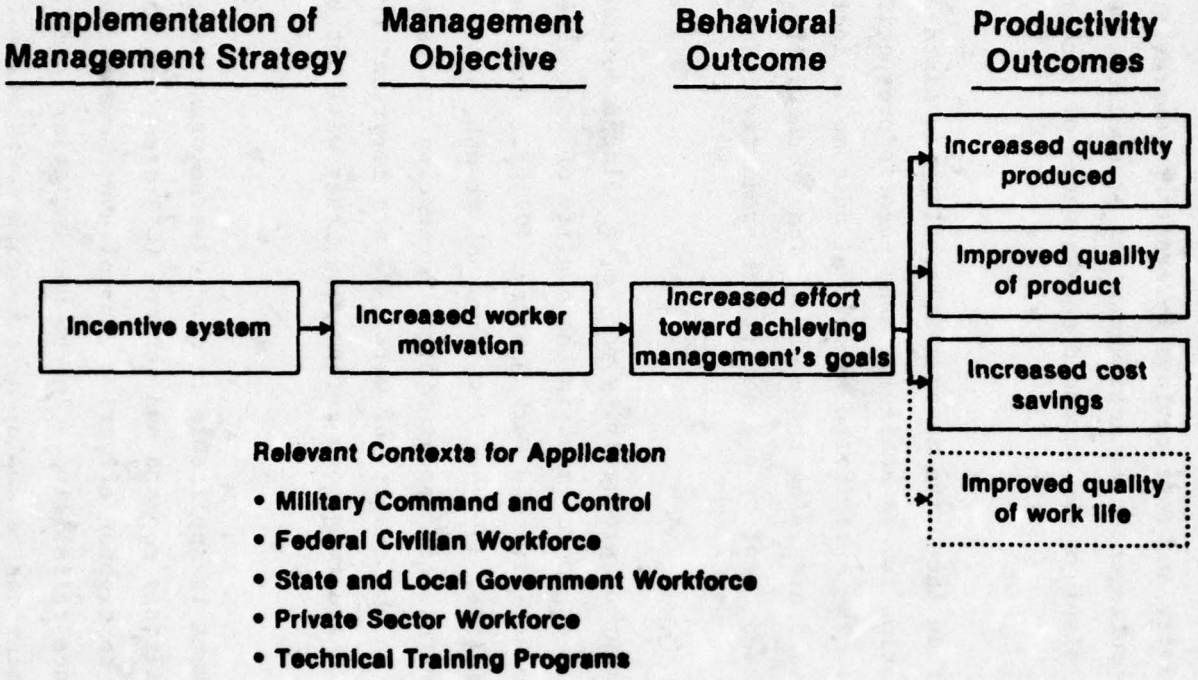


Figure 1. The Consequences of Incentive Management

incentive strategies have been documented within the Federal, state, and local civilian workforces (National Commission on Productivity and Work Quality, 1975b). The application of incentive management in technical training programs has received some attention in recent years (see Appendix A for some examples), with the objectives of improving student grades, retention, and speed of course completion. Finally, incentive management has received the most attention within the private sector workforce, and, in particular, in production line and manufacturing industries.

AN INVENTORY OF INCENTIVE PLANS

Table 1 presents an inventory of 39 popular incentive systems that are currently being used in industry and government. These incentive plans are characterized by:

- Rewards contingent on achieving a prespecified performance goal.
- Positive, rather than negative reinforcement.
- Monetary or nonmonetary motivators.
- Worker or managerial rewards.
- Group or individual rewards.

Nonmonetary rewards are somewhat underrepresented in this inventory, because particular nonmonetary plans tend to be unique to each organizational context. For example, an Air Force technical training center experimented recently with the following nonmonetary incentives to motivate higher grades (Pritchard, DeLeo, and Von Bergen, 1976):

- Special award for outstanding performance sent to the new commander.

TABLE 1

Inventory of Popular Incentive Systems
(in alphabetical order)

Bedaux Point Premium Plan	Time savings plan. Standard time (points) for completion is set by dividing job into tasks. If work is completed in shorter time, worker is paid for 75 percent of time saved. Completion at standard time also yields extra bonus. Below standard time, workers get guaranteed wage.
Competition and Contests	Competitive spirit is used to motivate improved performance.
Cost/Budgetary Performance Plan	Management incentive. Managers are paid bonus based on appraisal of cost savings in department.
Differential Distribution Group Incentive Plan	Total bonus paid to work group is set by piece rate system and divided among team members based on individual performance.
80-20 Incentive Plan	Eighty percent of wages are considered base pay. Twenty percent is paid based on performance (overfulfillment of quotas). Used in People's Republic of China.
Emerson Efficiency Bonus	A high standard is set with workers being guaranteed an hourly wage up to 67 percent of the standard. Between 67 percent and 100 percent of standard, small bonuses are paid equaling 20 percent of the standard. Above standard, straight piece work rates apply.
Employees Supervised Plan	Management incentive where managers are paid bonus based on appraisal of performance of employees supervised.
Equal Distribution Group Incentive Plan	Total bonus paid to work group is determined by piece rate system and distributed equally among team members.
Fein Productivity Sharing Plan	A group incentive where weekly productivity increases of work group are shared

Continued

Table 1
Inventory of Popular Incentive Systems
Continued

	by employees and management equally if costs decrease as productivity rises.
French System	Group incentive aimed at reducing production costs. Bonuses paid proportional to salary level based on yearly calculation of ratio of total output to total input costs (not only labor costs).
Gantt Task and Bonus Plan	A high standard is set for average performance with guaranteed hourly wages paid to that point. Worker usually receives payment of 120 percent of time saved.
Halsey Premium Plan	A time saving plan; actual hours worked are subtracted from standard time. Time wages are paid for production up to a stipulated percentage of the standard. Value of hours saved is split between employee and management, usually 50-50.
High Performer Group Plan	Bonus is paid to all group members based on productivity of highest performer in group.
Lincoln Electric Plan	Includes (a) profit sharing based on individually appraised merit; (b) payment on straight piece work basis; (c) promotions emanate from within the firm only and on basis of merit; (d) guaranteed employment for 49 weeks each year.
Low Performer Group Plan	Bonus payment to all group members is based on productivity of lowest performer in group.
Lump Sum Merit Increase	Employees granted salary increases based on meritorious performance in a lump sum at the time of award, rather than in smaller increments over the succeeding year.

Continued

Table 1
Inventory of Popular Incentive Systems
Continued

Measured Day Work Plan	Task standards and pay rates are established on the basis of job analyses. Hourly incentive rates are adjusted for each worker individually based on frequent evaluations of work quality and productivity.
Merit Performance Pay Plan	Permanent salary increases are given until employee reaches midpoint of salary range for position. Then, for meritorious performance, one time, nonpermanent merit increases within the top one-half of the pay range should be given.
Merrick Multiple Piece Rate Plan	Same as the Taylor Plan except a medium piece rate for levels of output between 83 percent and 100 percent of standard is set to encourage new or average performers.
Organizational Recognition	Outstanding performance is rewarded with nonmonetary rewards.
Output-Oriented Merit Increase Plan	Above standard performance results in a permanent nonpromotional increase in salary.
Performance Bonus	One-time monetary awards given in recognition of specific accomplishments.
Performance Target Plan	Target output is set and employees are rewarded for meeting or exceeding target goals.
Priestman Plan	A bonus is paid that amounts to 1 percent of workers' wage for each 1 percent increase in output over standard in addition to the initial 10 percent.
Profit Sharing Plan	Regular employees are paid special or deferred sums of money based on profits of business.

Continued

Table 1
Inventory of Popular Incentive Systems
Continued

Promotion	Good workers are promoted over poorer workers.
Rowan Plan	Workers and employer share in savings of direct costs. Level of bonus at every level of output is determined by percentage of time saved out of total time allowed for task.
Rucker Plan	Group incentive where increase in production value (sales value minus cost of incoming materials and supplies) is basis of collective bonus. Incentive is to lower labor costs. Bonus paid to each worker based on wage and total working hours.
Safety Incentive Plan	Monetary or nonmonetary awards given contingent on improved safety records or reduced equipment, man-hour, and financial losses due to accidents.
Scanlon Plan	A company-wide incentive where bonus is paid on increased productivity based on a ratio of labor cost to sales revenue of goods and services produced. The plan also includes a formal suggestion system for cost savings and a labor-management teamwork philosophy. Bonus paid to each worker is proportional to salary. Encourages cost savings initiated by workers.
Shared Savings Plan	Financial rewards are offered due to cost savings generated by employees.
Special Benefits	Special benefits are provided based on prior superior performance. Benefits include prior claim on health benefits, superior sickness benefits (all costs paid), full wages paid for 6 months while sick, full invalid wages, higher death benefits, and higher pension to better performers. Used in People's Republic of China.

Continued

Table 1
Inventory of Popular Incentive Systems
Continued

Standard Hour Plan	Standard time for job completion is set. Within standard time, worker is paid 100 percent of standard time multiplied by hourly wage. Otherwise, worker is guaranteed an hourly wage for actual time. An extra bonus may be added for completion within standard time.
Straight Piece Rate Plan	Employee is paid a fixed rate for each unit of work performed. Below standard, worker is usually given a guaranteed minimum salary.
Stock Purchase Plan	Employees become "owners" and are thereby motivated to improve production.
Suggestion Awards Plan	Monetary or nonmonetary rewards for ideas contributed towards decreasing costs, increasing quality of service, reducing accidents, etc. If monetary, reward can be fixed amount or based on proportion of cost savings.
Supervisory Recognition	Outstanding performance is praised by supervisor.
Taylor Differential Piece Work Plan	Two piece work rates are established. A high rate is paid for reaching or surpassing a high standard output level. A lower rate is paid for output below standard.
Time Off For Performance Plan	Time off with pay is granted for above standard performance.

- Special award for outstanding performance sent to parents.
- Being excused from squadron details for one week.
- Getting a three day pass over a weekend.
- Getting a walker's pass (excuse from marching) for one week.
- Being able to leave class one hour early.
- Not having to go to class for one day.
- Wearing any uniform desired for one week.

Certainly, most of these incentives, while highly valued by the servicemen at the technical training center, are inapplicable to most other organizations. However, the major categories of nonmonetary incentives: recognition, valued privileges, and promotion, are included in the inventory. Readers are referred to several sources for more detailed information on each of these incentive plans (Belcher, 1975; Patten, 1977; Hoffmann, 1967; Louden and Deegan, 1959; Kennedy, 1945; Schwinger, 1975; Zollitsch, 1975; Marriott, 1961).

POTENTIAL ADVANTAGES AND DISADVANTAGES OF INCENTIVE PLANS

There are potential advantages and disadvantages to pursuing incentive management strategies that must be evaluated in light of the targeted organizational environment and labor-management relations. They include (Marriott, 1961; Zollitsch, 1975; Lawler, 1973):

Potential Advantages

- May increase productivity.
- May lower costs.
- May increase profits.
- May increase earnings for workers.

Potential Disadvantages

- Can be expensive to administer.
- Quality may deteriorate if supervision is inadequate.
- May cause resistance to new methods and technology.

Potential Advantages	Potential Disadvantages
• Can motivate workers to achieve their top capacity.	• May cause workers to press for higher minimum wage.
• Require less direct supervision.	• May cause some workers to overwork and undermine health.
• Provide a fair day's pay for a fair day's work.	• Can result in production restriction in reaction to social pressures against fast workers.
• Often viewed as equitable by workers.	• May cause excessive competition among workers.
• Give objective data on worker ability and qualifications for promotion.	
• Give accurate control and cost data.	

THE PREREQUISITES FOR SUCCESSFUL INCENTIVE SYSTEMS

Several practitioners have itemized the requirements for effective incentive systems from their professional experiences (Hesse, 1977; Lawler and Bullock, 1978; Lawler, 1971; Lawler and Olsen, 1977; Daly, 1975; Pritchard, DeLeo, and Von Bergen, 1976; Haworth, 1972; Zollitsch, 1975). These prescriptions include:

1. Incentives should be attractive and valued by employees.
2. Rewards should be large enough to motivate.
3. Equitable and fair rewards for performance should be designed.
4. Clear and measurable performance goals for employees should be defined.
5. Reasonable and attainable performance goals should be developed.
6. Employees should perceive that required behaviors are possible to achieve.

7. Required behaviors should be within employees' spans of control.

8. Employee expectations that achievement of performance goals will result in incentive rewards should be reinforced.

9. Interdependence among tasks, individuals or groups should be taken into consideration in rewarding performance.

10. Management's commitment to fairness in administering and consistency in paying incentives should be reinforced.

11. Employee participation in incentive decisions should be encouraged.

12. Management's commitment to productivity goals and a high quality of worklife should be reinforced.

13. Goals, incentives, or the environment should be adjusted to minimize conflicting or negative outcomes for employees that reduce the probability of goal attainment.

14. The time gap between employee goal attainment and reward should be minimized.

15. A menu of incentives for employees to choose from should be provided to take individual differences into account.

16. Additional reinforcement for superior performance should be available from significant authorities in the organization.

17. Caution should be taken in changing the magnitude of incentives for a given behavior or changing the standards of performance required to receive rewards.

18. In large organizations, local measures of performance (such as work team performance) should be linked to rewards.

19. Incentive implementors should attempt to "sell" the program to both supervisors and employees.

20. Production supervisors should be included in employees' incentive systems.

21. Incentive systems should be evaluated continuously and systematically once implemented.

RELEVANT THEORIES OF WORK MOTIVATION AND PRODUCTIVITY

Much of the research that has been conducted concerning the impact of incentive management on performance and productivity emanates from two theoretical foundations. One is expectancy theory and the other is operant conditioning theory.

Expectancy Theory

Expectancy theory views work motivation as a hedonistic or need satisfaction process (Deci, 1976). People behave in the workplace to maximize what they perceive to be the greatest satisfactions that can be obtained by pursuing alternative courses of action. This school of thought relies heavily on several perceptions and expectations of the work environment to predict the behaviors a person is likely to engage in (Vroom, 1964; Lawler, 1973). A person's motivation to achieve a performance goal is said to depend on (Nadler and Lawler, 1977; Deci, 1976; Heneman and Schwab, 1975):

a. Valence: The perceived attractiveness of the reward outcome that may follow from goal-oriented behavior.

b. Effort-Performance Expectancy: The perceived probability that changes in worker effort will facilitate attainment of the performance goal.

c. Performance-Outcome Expectancy: The perceived probability that performance will indeed lead to certain rewarding outcomes.

Thus, the strength of a person's motivation to perform effectively and in the prescribed direction is influenced by:

- The person's belief that effort can be translated successfully into performance, and
- The attractiveness of rewarding outcomes that are expected to follow from superior performance.

For example, let us suppose management has committed itself to using an incentive strategy to yield higher productivity. A worker's behavior will depend on:

- The worker's expectation that by increasing effort, it is possible to improve productivity rates.
- The attractiveness of the reward promised for achieving high productivity rates.
- The relative attractiveness or repulsiveness of other conflicting outcomes resulting from higher performance, such as fatigue, less time for family, recognition by supervisors, and a sense of self-esteem.
- The worker's expectation that high productivity will result in obtaining the incentive reward as well as the other outcomes.
- The net attraction or repulsion of all possible outcomes, discounted by the perceived likelihood of such outcomes.

Overall, expectancy theory stresses the linkage between performance and reward. Performance will be maximized if workers perceive that a predictable reward will be granted for <u>each</u> instance of acceptable or superior behavior.

Operant Conditioning Theory

As opposed to expectancy theory, operant conditioning is founded on observable behavior and responses, rather than on perceptions and expectations. It deals with developing the contingencies of reinforcement that will increase the probability that certain desired behaviors will result (Gullett and Reisen, 1975). One of the fundamental assumptions of operant conditioning identifies the type of reinforcement and the schedule of reinforcement as the major factors responsible for the achievement of desired behaviors, such as higher productivity.

According to this school of thought, behavior can be modified by (Latham and Dossett, 1978; Ford and Couture, 1978):

a. Identifying rewards that are truly reinforcing.

b. Making the reinforcer a consequence of desired job behaviors.

c. Determining the optimum schedule for administering the reinforcer.

The optimum reinforcement schedule is a major source of disagreement within the operant conditioning field, as well as between this school and expectancy theory. Expectancy theory implies that continuous reinforcement (where all desired responses are reinforced) will yield the best performance. In operant conditioning, continuous schedules are viewed as best to promote initial learning of job behaviors, but variable schedules (where only a certain proportion of responses are reinforced) are seen as more effective for maintaining desired behaviors (Latham and Dossett, 1978; Gullett and Reisen, 1975). Thus, by making the timing of reward presentation somewhat unpredictable and uncertain, the worker is likely to perform at high standards all the time, and this superior behavior is less vulnerable to extinction or decline due to the uncertainty.

CHAPTER 3. QUALITATIVE TAXONOMY OF INCENTIVE SYSTEMS

One method for analytically organizing the large number of incentive plans that are in effect or are yet to be designed is to develop a taxonomy that classifies these plans by their common characteristics. Such a structuring device enables taxonomy users to compare incentives and the relative merits and disadvantages of particular plans in categories that appear appropriate for a specific targeted job function or organization. As an important byproduct, taxonomies can serve as a stimulus in the creativity process and can help managers and organizational development (OD) experts uncover new incentive designs based on previously uncorrelated combinations of incentive characteristics.

PREVIOUS ATTEMPTS AT TAXONOMY BUILDING

The major task in developing a meaningful taxonomy is to identify the common dimensions and values by which all incentive plans can be categorized. Past attempts at identifying these common dimensions have resulted in several taxonomies:

- Financial/nonfinancial incentives (National Commission on Productivity and Work Quality, 1975),
- Group/individual incentives (Zollitsch, 1975),
- Executive (managerial)/worker incentives (Patten, 1977),
- Purposeful (time saved/efficiency) incentives (Marriott, 1961, Schwinger, 1975),
- Time/volume incentives (Marriott, 1961),
- Payment method (employer takes all gain or loss/ employee takes all gain or loss/gains shared/ accelerating premium) incentives (Marriott, 1961),

- Earnings based on output (earnings vary proportionally with output/less than output/more than output) incentives (Marriott, 1961),
- Behavioral modification (predictability of reinforcement/time interval/underlying need appeal) incentives (Ford and Couture, 1978),
- Monetary reward/performance measure/level of analysis incentives (Lawler, 1971).

These taxonomies are either:

- Too broad gauged -- Too many specific incentive types fit into each category to make the taxonomy very useful as a categorizing device,
- Oriented exclusively toward monetary incentives for production line workers, or
- Atheoretical -- There is no reason why another conceptual taxonomy would not be superior.

A BEHAVIORAL TAXONOMY OF INCENTIVES

The chosen solution was to develop a three-dimensional behavioral taxonomy of incentive systems that reward increased worker productivity (Figure 1). This taxonomy is characterized by:

- Thirty cells within which specific incentive systems can be classified.
- Monetary, as well as nonmonetary incentive categories.
- A conceptual base that attempts to link the essential characteristics of expectancy theory (the contingency between performance and reward) and operant conditioning theory (the reinforcement schedules by which the performance-reward contingency can be maximized).

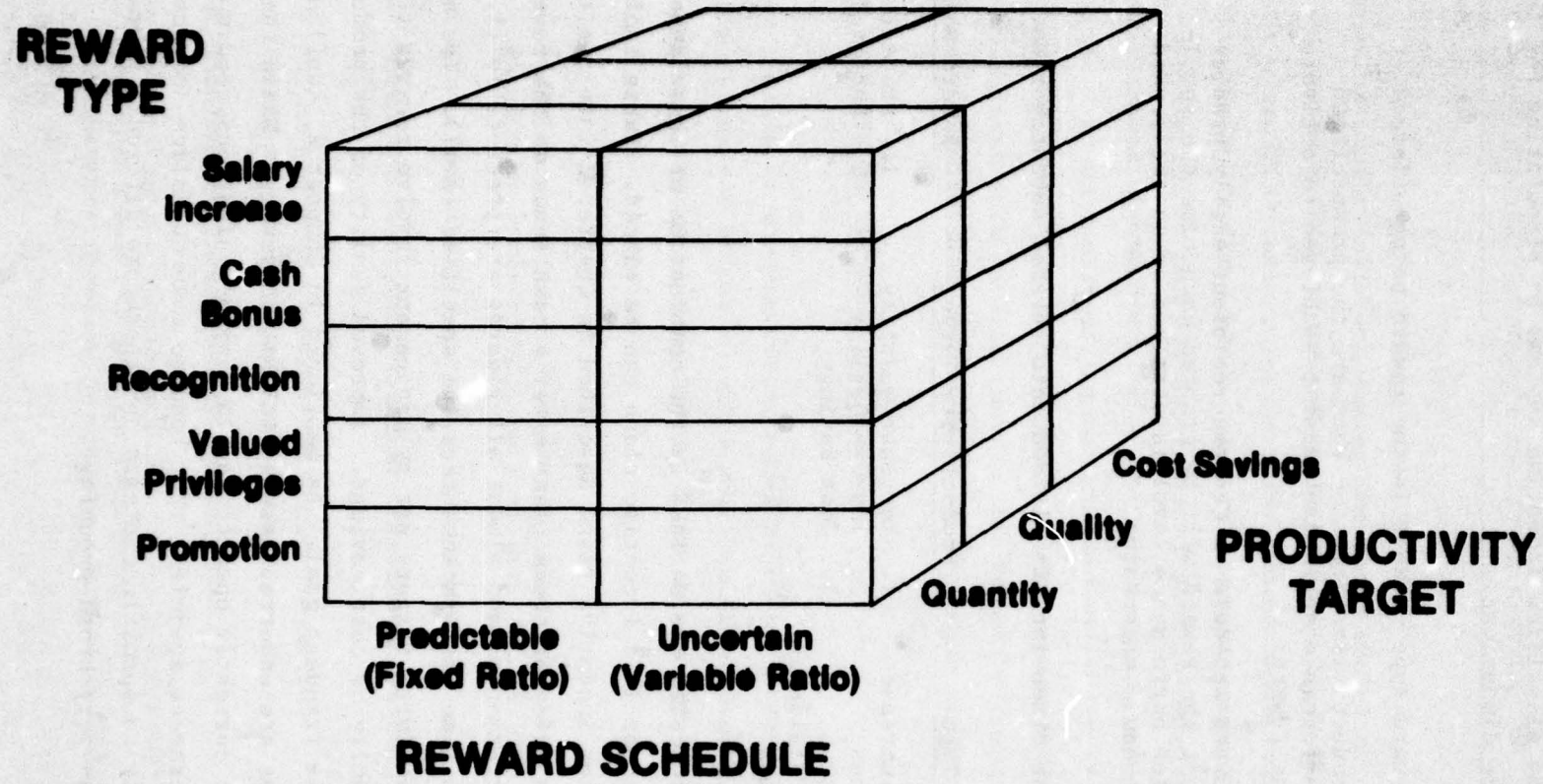


Figure 1. Incentives Taxonomy

This taxonomy classifies incentive systems by pinpointing the intersection of three dimensions:

- Reward type -- What is the reward being offered?
- Productivity target -- What are the prespecified performance goals that must be achieved to activate the reward?
- Reward schedule -- Can the recipient easily predict that the reward will be granted each time the specified performance level is attained or is the reward schedule uncertain?

Each of these dimensions is divided into several subcategories:

Reward Type	Productivity Target	Reward Schedule
1. Salary increase	1. Increase Quantity	1. Predictable
2. Cash bonus	2. Improve Quality	2. Uncertain
3. Recognition	3. Cost Savings	
4. Valued Privileges		
5. Promotions		

A total of 30 cells are defined by the combination of these subcategories within which specific incentive plans can be placed. Table 1 classifies the 39 popular incentive plans described in Chapter 2 into the taxonomy. The large majority of these plans offer a cash bonus as the reward for superior performance, and almost all rewards are predictable (i.e., granted each time performance meets the specified level). The most prevalent productivity targets set by management involve rewards for increased quantity or cost savings. Improved quality of the product is a somewhat less frequent goal. As mentioned in Chapter 2, nonfinancial incentive plans are underrepresented in this inventory. While these types of plans are currently operational in many organizations, and notably present in government agencies, they tend to take on unique characteristics relevant only to specific contexts and therefore difficult to reference in other than very broad groupings.

UTILITY OF THE TAXONOMY

The taxonomy should have utility for work force supervisors and OD experts by identifying and sorting the universe of possible incentive systems into logical categories. Due to its behavioral perspective -- the taxonomy classifies plans by type of reward, performance-reward contingencies, and reinforcement schedule -- the taxonomy is a well defined reference source for practical incentive applications.

The taxonomy also uncovers gaps in incentive design. Certain categories may have significant effects on productivity but have yet to receive sufficient attention or application. To rectify this situation, the taxonomy can be used as a catalyst for creative thinking to expore how certain reward types might be designed to enhance performance in target organizations.

The most striking gap displayed in Table 1 is the absence of incentive plans involving uncertain reward schedules. The 39 incentive plans in the inventory occupy a total of 21 cells in the taxonomy. The remaining empty cells, all characterized by uncertain reward schedules, have yet to be examined sufficiently in field tests or controlled laboratory settings, despite preliminary evidence that suggests greater potency. Most plans currently reward every instance that performance meets or exceeds prespecified standards. While the operant conditioning literature agrees that such continuous and predictable schedules of reinforcement are best to promote initial learning of job behaviors, it argues that variable and uncertain schedules are more effective to maintain desired behaviors once learned.

If this is true, it is anomalous that there have been few serious efforts to confirm it through application in significant work situations. Such an application could be a fruitful area for research involving selection of an appropriate organization, the conduct of an incentive program

TABLE 1

Taxonomic Classification of Popular Incentive Systems

Popular Incentive Plans	REWARD TYPE					REWARD SCHEDULE		PRODUCTIVITY TARGET		
	Salary Increase	Cash Bonus	Recog-nition	Valued Privilege	Promotion	Predictable	Uncertain	Increase Quantity	Improve Quality	Cost Savings
Bedaux Point Premium Plan		X				X				X
Competition and Contests			X			X		X	X	X
Cost/Budgetary Performance Plan		X				X				X
Differential Distribution Group Incentive Plan		X				X		X		
Eighty-Twenty Incentive Plan		X				X		X		
Emerson Efficiency Bonus		X				X		X		
Employees Supervised Plan		X				X		X	X	X
Equal Distribution Group Incentive Plan		X				X		X		
Fein Productivity Sharing Plan		X				X		X		X
"French" System		X				X				X
Gantt Task and Bonus Plan		X				X				X
Halsey Premium Plan		X				X				X
High Performer Group Plan		X				X		X		
Lincoln Electric Plan		X			X	X		X	X	X
Low Performer Group Plan		X				X		X		
Lump Sum Merit Increase	X					X		X	X	X
Measured Day Work Plan		X				X		X		
Merit Performance Pay Plan	X					X		X	X	X
Merrick Multiple Piece Rate Plan		X				X		X		

Continued

Table 1
Taxonomic Classification of Popular Incentive Systems
Continued

	REWARD TYPE					REWARD SCHEDULE		PRODUCTIVITY TARGET		
Popular Incentive Plans	Salary Increase	Cash Bonus	Recog-nition	Valued Privilege	Promotion	Predictable	Uncertain	Increase Quantity	Improve Quality	Cost Savings
Organizational Recognition			X				X	X	X	X
Output-Oriented Merit Increase Plan	X					X		X	X	X
Performance Bonus		X				X		X	X	X
Performance Target Plan		X				X		X	X	
Priestman Plan		X				X		X		
Profit Sharing Plan		X				X				X
Promotion					X		X	X	X	X
Rowan Plan		X				X				X
Rucker Plan		X				X				X
Safety Incentive Plan		X	X			X			X	
Scanlon Plan		X				X				X
Shared Savings Plan		X				X				X
Special Benefits				X		X		X	X	X
Standard Hour Plan		X				X				X
Straight Piece Rate Plan		X				X		X		
Stock Purchase Plan		X				X		X	X	X
Suggestion Awards Plan		X	X			X		X	X	X
Supervisory Recog-nition			X				X	X	X	X
Taylor Differential Piece Work Plan		X				X		X		
Time Off for Per-formance Plan				X		X		X	X	X

using a variable or uncertain schedule of reinforcement, and careful measurement of the results in terms of increased performance or productivity.

CHAPTER 4. EMPIRICAL EVIDENCE OF THE IMPACT OF INCENTIVE MANAGEMENT ON PRODUCTIVITY

Industrial engineers estimate that incentive plans yield substantial productivity improvements among production line workers in manufacturing plants (Rice, 1977; Hesse, 1977; Fein, 1976). On the basis of largely impressionistic data, they conclude that the average increase in productivity traceable directly to incentives:

- Is 53.9 percent in plants with no engineered work standards, and
- Is 42.7 percent in plants with engineered work measurement already installed.

This chapter will expand the scope and reliability of these conclusions by including empirical evidence on the impact of incentive programs in military, government, nonmanufacturing, and training situations.

The purpose of this chapter is to identify and describe some characteristics frequently shared by incentive plans, as well as their impact on productivity outcomes. The discussion is based on data collected in a comprehensive search of the available literature for the years 1975-1978. Data were gathered from each of thirty studies that qualified for inclusion because it:

- Tested the impact of an incentive program on worker performance, and
- Provided systematically-derived quantitative data evaluating an incentive's impact on performance in comparison to a control condition.

Appendix A provides a detailed description of the data collection process and contains the abstracts developed for each study.

DATABASE DESCRIPTION

These thirty studies provide a database of 54 separate cases in which the impact of incentives was evaluated in industrial, governmental, military, educational, or laboratory settings. Table 1 offers a general description of the database.

Organizational Type

Most of the evaluations (37.0 percent) took place in educational institutions, which accounts for laboratory experiments as well as field tests in training situations. Manufacturing firms continue to be extremely active in conducting incentive evaluations (27.8 percent), while non-manufacturing industries, the military services, and the Federal, state, and local governments are beginning to get significantly involved in incentive management studies.

Task Type

Since observable productivity measures are most amenable to repetitive and hard-ended tasks, it is not surprising to find that most of the studies (37.0 percent) focused on increasing worker productivity in repetitive clerical tasks, including questionnaire coding, EDP keypunching, card sorting, and matching tasks. Almost an equal number of studies attempted to affect performance in repetitive production tasks (22.2 percent -- largely in manufacturing plants) and in training tasks (20.4 percent).

Study Type

The majority of studies (55.6 percent) were field tests of incentive programs in place in an actual organization. The remainder were laboratory experiments administered in contrived situations.

TABLE 1

Database Description (N=54)

	Frequency	Percentage
Organizational Type		
Military organizations	7	13.0
Federal, state, or local governments	5	9.2
Manufacturing firms	15	27.8
Nonmanufacturing firms	7	13.0
Educational institutions	20	37.0
Task Type		
Repetitive production tasks	12	22.2
Repetitive clerical tasks	20	37.0
Logistics tasks	4	7.4
Training/learning tasks	11	20.4
Intrinsically interesting perceptual tasks	5	9.3
Professional/supervisory tasks	2	3.7
Study Type		
Field tests	30	55.6
Laboratory experiments	24	44.4
Incentive Type		
Salary increase	1	1.9
Predictable cash bonus	28	51.8
Variable (uncertain) cash bonus	7	13.0
Recognition and/or valued privileges	5	9.2
Mixture of cash bonus and nonmonetary incentive	12	22.2
Disciplinary action	1	1.9
Incentive Target		
Individuals	43	79.6
Groups	11	20.4
Percentage Improvement in Productivity -- Quantity	$\bar{x}$ = 22.8% (N=51)	Minimum value = -9.7% Maximum value = 87.0%
Percentage Improvement in Productivity -- Quality	$\bar{x}$ = 8.8% (N=20)	Minimum value = -6.4% Maximum value = 55.0%

Incentive Type

The majority of incentives tested (51.8 percent) were predictable cash bonuses, that is, some form of monetary payment was made for performance superior to a specified criterion. A mixture of cash bonus incentives and nonmonentary recognition, privileges, or feedback was employed in a large number of cases (22.2 percent); a variable or unpredictable cash bonus schedule was used in 13.0 percent of the studies; and recognition and/or valued privileges were tested in 9.2 percent. Incentives involving permanent salary increases or negative disciplinary action were employed in only 3.8 percent of the studies.

Incentive Target

Individual incentives constituted the large majority (79.6 percent) of those tested.

Percentage Improvement in Productivity -- Quantity

Productivity improvement was measured as the increase in the rate of output after an incentive was implemented relative to a preincentive baseline condition or a simultaneous control group operating without an incentive. Forty-six of the 51 cases in which the quantitative aspects of productivity were measured (90.2 percent) show gains in quantity attributable to incentives. Over all the cases, a 22.8 percent average improvement in the quantity of productivity was registered. The lowest value recorded was a 9.7 percent decrease in productivity and the highest value was an 87.0 percent increase. These results suggest that incentive management can have a significant impact on improving worker productivity over a wide range of work situations and tasks.

Percentage Improvement in Productivity -- Quality

Only nine of the 20 cases in which qualitative aspects of productivity were measured (45.0 percent) indicate favorable effects due to incentives. The majority of cases registered a very small decrease in quality or no significant improvement in quality attributable to an incentive plan. On the average, quality improved by 8.8 percent when incentive plans were implemented. While these results indicate that incentive management has had only a limited impact on improving the quality of workers' products and services in the past, it suggests the need for more intensive research into designing incentive strategies that can improve quality as well as quantity.

CAUTIONARY NOTES

While these across-the-board productivity statistics suggest that incentive management systems can be used effectively to improve worker performance, several cautionary notes should be sounded:

1. The database upon which these statistics are calculated is comparatively small and is artifically bounded by a narrow range of publication dates (1975-1978). The sample of incentive evaluation tests that constitute the database must be expanded in future research to increase its representativeness of different incentive types as well as organizational and task contexts. This will improve the generalizability of the results.

2. The average productivity improvement statistics presented above are aggregated over all incentive types, all organizational types, and all job functions or tasks. Because measurement criteria often differed from test to test and from organization to organization, these aggregate findings should be viewed as only a very general indicator of potential productivity improvement attainable by using incentive management. The remaining sections of this chapter partition the sample by organizational type and job function to provide more sensitive and comparable indicators of the

improvement in productivity that can be anticipated in each organizational environment.

3. Many of the studies comprising the database reported methodological limitations and shortcomings that raise questions about their generalizability. These problems are described in detail in Appendix A. While reported limitations have been taken into account where possible in preparing the data, it is possible that some methodological problems have remained unreported, thus impairing the validity of the final results. Little can be done now to rectify this situation. However, where suspicions run high, future research should include new experiments and field tests to control for these shortcomings.

4. Finally, it is uncertain as to how many incentive systems have been tried but failed. Success invites publicity, but failures are often hidden. So, it is likely that incentives that have proven unsuccessful have never been written up for publication. Future research can attempt to correct for this bias through onsite interviews with compensation and incentive administrators in the public and private sectors.

THE MOST EFFECTIVE INCENTIVE STRATEGIES

Of the six incentive categories identified in the database, which had the greatest effect on worker productivity? The following discussion is based on the average percentage of productivity improvement attributable to each incentive type. First, this statistic is computed for the aggregate of all cases in the database. Then, the data are partitioned by organization type, task type, study type, and incentive target to identify the specific organizational environment in which particular incentive plans are most effective.

Effective Incentives to Improve Quantity

Table 2 focuses on productivity improvements registered in the quantitative dimension. All percentages are listed, and those rows in which

TABLE 2

The Impact of Incentive Plans on Productivity Improvement --Quantitative Dimension (in mean percentage improvement; underlined percentages identify the most effective and statistically significant incentives)

		INCENTIVE PLANS						
	Frequency	Salary Increase	Predictable Cash Bonus	Variable Cash Bonus	Recognition and/or Valued Privileges	Mix of Cash Bonus and Non-cash Incentives	Disciplinary Action	Overall Average
All cases	51	10.0	19.8	17.1	25.7	33.7	46.0	22.8
By Organizational Type								
Military	4	-	-	-	5.9	17.8	-	8.9
Government	5	10.0	48.1	-	-	-	46.0	40.1
Manufacturing	15	-	29.0	8.0	-	21.7	-	20.5
Nonmanufacturing[c]	7	-	17.4	40.0	87.0	60.0	-	46.0
Educational[b]	20	-	10.7	-	23.5	33.5	-	14.8
By Task Type								
Production	12	-	28.3	8.0	-	21.7	-	18.2
Clerical[a]	20	-	13.4	-	87.0	39.7	-	25.0
Logistics	4	-	28.7	-	-	-	46.0	33.0
Training[c]	8	-	17.4	40.0	10.3	-	-	19.5
Perceptual	5	-	17.1	-	-	-	-	17.1
Supervisory	2	10.0	60.7	-	-	-	-	35.4
By Study Type								
Field test	27	10.0	34.8	8.0	26.2	33.8	46.0	27.8
Lab test[a]	24	-	11.5	40.0	23.5	33.5	-	17.1
By Incentive Target								
Individuals	40	-	21.1	17.1	25.7	39.7	-	23.8
Groups	11	10.0	15.0	-	-	21.7	46.0	19.2

[a] $p < .01$

[b] $p < .05$

[c] $p < .10$

certain incentive strategies are shown to be more effective statistically than others are identified.[1]

Despite numerical differences in worker productivity, no statistically significant differences were found among incentive plans tested in the military, government, or manufacturing firms. This means that while all tested incentives yielded improved worker quantity, no one incentive plan was found to be more effective than any other in these types of organizations. However, in nonmanufacturing firms, incentives that include recognition and/or valued privileges, or a mixture of cash bonuses and noncash incentives may be more effective statistically than other incentives in increasing the quantity of worker output. In educational institutions, the mix of cash payments and nonmonetary incentives also appears to yield more effective results.

Incentive evaluations in production, logistics, perceptual, and supervisory tasks indicate that, again, while all tested incentives produced increased worker productivity in these job functions, no one incentive plan appears to be significantly better than any other. However, in performing clerical tasks, incentive plans that offer recognition and/or valued privileges are more potent than other incentives in increasing worker productivity. In training tasks, variable cash bonuses appear to stimulate the greatest productivity. When examining only the laboratory experiments in the sample, variable cash bonuses again stand out as the most effective incentive category among all tested.

Effective Incentives to Improve Quality

Table 3 displays the average percentage in productivity improvement for the qualitative dimension. Over all cases, variable cash bonuses and

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[1] A one way analysis of variance was performed for each partition in Tables 2 and 3 to determine if there were significant differences in the levels of productivity improvement recorded for each incentive type. Significant differences are underlined in the tables.

TABLE 3

The Impact of Incentive Plans on Productivity Improvement — *Qualitative Dimension*
(in mean percentage improvement; underlined percentages identify the most effective and statistically significant incentives)

		INCENTIVE PLANS						
	Frequency	Salary Increase	Predictable Cash Bonus	Variable Cash Bonus	Recognition and/or Valued Privileges	Mix of Cash Bonus and Non-cash Incentives	Disciplinary Action	Overall Average
All cases[b]	20	-	5.3	<u>48.3</u>	1.4	1.6	31.0	8.8
By Organizational Type								
Military	6	-	-	-	-5.4	<u>1.6</u>	-	-1.9
Government	1	-	-	-	-	-	31.0	31.0
Manufacturing	1	-	-	-	-	6.5	-	6.5
Nonmanufacturing	4	-	21.0	48.3	-	-	-	34.6
Educational[a]	8	-	-2.5	-	<u>21.9</u>	0	-	1.5
By Task Type								
Production	1	-	-	-	-	6.5	-	6.5
Clerical	5	-	-1.8	-	-	0	-	-0.7
Logistics	1	-	-	-	-	-	31.0	31.0
Training[c]	11	-	21.0	<u>48.3</u>	1.4	1.6	-	13.5
Perceptual	1	-	-3.2	-	-	-	-	-3.2
Supervisory	0	-	-	-	-	-	-	-
By Study Type								
Field test[a]	8	-	-	-	-5.4	2.8	<u>31.0</u>	3.3
Lab test[c]	12	-	5.3	<u>48.3</u>	21.9	0	-	12.5
By Incentive Target								
Individuals[b]	18	-	5.3	<u>48.3</u>	1.4	0.8	-	7.7
Groups	2	-	-	-	-	6.5	31.0	18.8

[a] $p < .001$

[b] $p < .01$

[c] $p < .05$

disciplinary action offer the greatest improvement in quality. However, among military organizations in particular, a mixture of cash bonuses and noncash incentives is most effective for ensuring improved quality. Among educational institutions, nonfinancial incentives, such as gaining recognition and/or valued privileges, yielded the greatest quality improvements.

In the training context, variable cash bonuses produced significantly higher quality than other incentive plans. However, in field tests, the threats of negative sanctions contained in disciplinary actions yielded the highest improvement in quality, while in lab tests, cash bonuses offered on a variable schedule produced the highest quality performance. Finally, among all tests in which incentives were targeted at individual performance, variable cash bonuses had the greatest impact on quality.

CONCLUSIONS

Taking the precautionary notes stated earlier into consideration, these preliminary findings indicate one thing clearly: under different circumstances, certain incentive plans are more effective than others in improving worker productivity and quality. Thus, incentive management must be tailored to the needs, requirements, and constraints of the targeted organization and job function.

Moreover, preliminary results suggest the degree to which the quantity and quality of worker output may be improved if the organizational environment is matched with the appropriate incentive plan. Table 4 summarizes these results. Only those incentive plans that were identified as making a statistically significant impact on a particular type of organization or task are presented. Additional research to expand the database is required to determine the reliability of these results, as well as to identify effective incentive management strategies for those organizations and tasks in which too few cases have been found to draw conclusions.

TABLE 4

Summary of Findings: Effective Incentives in Various Organizational Contexts

Organizational Context	INCENTIVE PLANS					
	Salary Increase	Predictable Cash Bonus	Variable Cash Bonus	Recognition and/or Valued Privileges	Mix of Cash Bonus and Non-cash Incentives	Disciplinary Actions
Military organizations					Quality = 1.6%	
Government agencies						
Manufacturing firms						
Nonmanufacturing firms				Quantity = 87%	Quantity = 60%	
Educational institutions				Quality = 21.9%	Quantity = 33.5%	
Production tasks						
Clerical tasks				Quantity = 87%	Quantity = 39.7%	
Logistics tasks						
Training tasks			Quantity = 40% Quality = 48.3%			
Perceptual tasks						
Supervisory tasks						

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CHAPTER 5. INCENTIVE MANAGEMENT DEMONSTRATION PACKAGE

A computer-based demonstration package has been developed to display the benefits of a prototype incentive management aid for military commanders, civilian DoD supervisors, organizational development (OD) specialists, and other work force managers. This demonstration package offers users a brief overview of the project and a preview of a possible executive aid that can draw upon previous empirical evaluations of incentive systems in order to design incentive management strategies that are tailored specifically to users' organizational requirements.

The aid is not conceived as providing the final answer on the many details involved in incentive management design and implementation. Rather, it can direct managers and OD specialists toward effective incentive management decisions by:

- Providing integrated quantitative information on previously evaluated incentive plans, and
- Providing contingency-based analyses of organizational conditions that are matched to appropriate incentive plans.

As currently designed, the prototype aid can assist managers and OD experts via three interactive modules:

- Module 1 describes and characterizes specific incentive strategies for users in terms of the three-dimensional incentives taxonomy. Users can display descriptions of specific incentives in the current inventory of incentive systems for each cell of the taxonomy.
- Module 2 enables users to examine productivity data that relate to the potential effectiveness of specific incentive systems. If users identify specific incentives or categories of incentives that appear appropriate

to their organization, the aid can display productivity data for those incentives based on prior empirical evaluations. The percentage of productivity improvement that can be anticipated due to implementation of an incentive plan can be displayed in terms of the quantity or volume of output, the quality of output, or cost savings.

- Module 3 enables users to design effective incentive strategies tailored to increase productivity or reduce cost in a particular task, job function, or organization. Users input a structured description of the task, job function, or organization that they wish to affect. The aid responds by:

  - Recommending alternate incentive management strategies that are appropriate for the described organization.
  - Identifying the degree of productivity improvement that can be expected based on past experience.
  - Listing the types of organizations in which the incentive strategies have been evaluated previously.
  - Describing limitations and cautionary notes in implementing the recommended incentives.

  This module operates on the basis of a contingency model algorithm.

The demonstration package is currently available in a stand-alone Tektronix 4051 microcomputer version written in BASIC. It will be transferred to DARPA's Demonstration and Development Facility (DDF) and implemented on the PDP 11/70 at that site. The demonstration package currently operates on the limited database described in Chapter 4 of this report. This database will have to be expanded to produce reliable and stable recommendations. Sample output from the package appears in Appendix B of this report.

CHAPTER 6. NEXT RESEARCH STEPS

REMAINDER OF FISCAL YEAR 1979

The remainder of the research scheduled for FY79 is based on the qualitative taxonomy, incentives database, and computer-based demonstration package described in this interim report. Specifically the following tasks and subtasks will be accomplished:

- Develop a detailed empirical taxonomy of incentives for human motivation:
  - Identify attributes of incentive programs.
  - Produce a quantitative database on U.S. and non-U.S. governmental and nongovernmental incentives.
  - Using statistical methods, analyze the incentives database.
  - Develop a detailed empirical taxonomy of incentive programs by attributes and function.
- Prepare a comprehensive briefing of research findings for DoD logistics personnel.
- Design a preliminary prototype for an executive aid to deal with incentive design and management.

A final technical report will be written at the conclusion of the fiscal year.

RECOMMENDATIONS FOR CONTINUED RESEARCH

Findings to date suggest that this exercise in "integrative cumulation" of the incentive management field can have important payoffs in terms of

improving worker performance and productivity and reducing costs. Figure 1 indicates some possible directions for continued research in the incentive management field to produce these payoffs.

To start with, the incentives database should be expanded and further analytical probes conducted to synthesize the findings of prior evaluation studies and uncover trends of incentive effectiveness under a variety of conditions. This would lay the groundwork for development and implementation of a contingency-based incentive management aid that could help work force managers and OD specialists design and tailor incentive plans for particular job functions and organizations.

In the next phase, two parallel evaluation studies are recommended. A series of controlled laboratory experiments can be designed and administered in which worker productivity is measured under incentive and nonincentive conditions. The purpose of these experiments would be to test the validity of incentive management recommendations derived from the contingency-based aid. In a parallel vein, several organizational field tests can be designed and conducted to evaluate the validity of the aid's recommendations in a real world context. Special attention should be paid to incentive strategies designed with variable (unpredictable) reward schedules, since they have not been sufficiently tested in the literature, but appear to be extremely potent reinforcers of work behavior.

The conclusions of these experiments can be assessed to refine the contingency parameters of the aid and improve its reliability. A handbook that describes the practical results of the experiments can be produced to assist incentive implementation and management in similar job functions and organizations in the future. In addition, a users' manual for the incentive management aid can be developed to facilitate usage. Finally, an incentive management training program for work force managers can be designed and administered with the purpose of promoting the use of

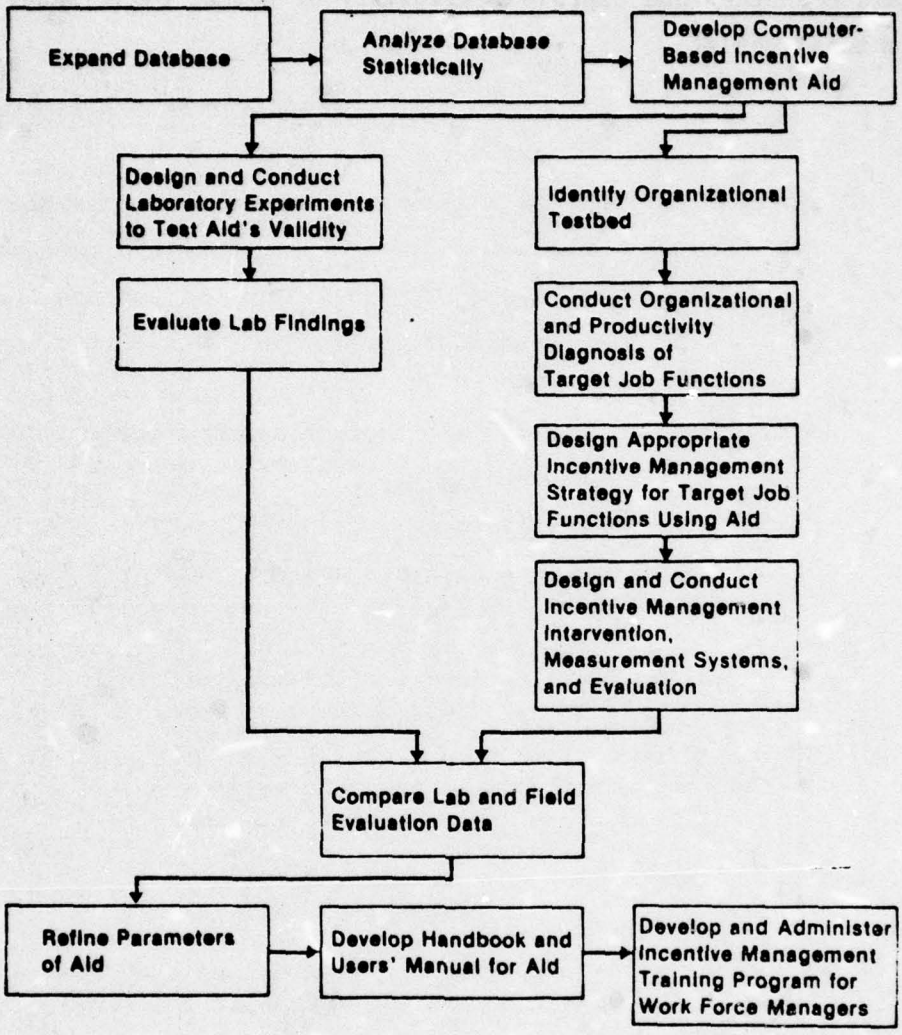


Figure 1. Recommendations for Continued Research

motivational tools, such as incentive plans, to enhance effective control over human resources and improve reliability of worker performance toward organizational goals.

APPENDIX A. QUANTITATIVE EVALUATIONS OF REWARDS-FOR-PERFORMANCE PROGRAMS, 1975-1978

This appendix contains abstracts for 30 quantitative evaluation studies of rewards-for-performance programs. These abstracts represent the findings of an exhaustive search of the literature in the fields of organizational behavior, management, personnel, compensation administration, applied psychology, and industrial engineering for the years 1975-1978.

As part of the search process, a comprehensive listing of technical and business journal articles, books, and monographs was drawn from the following index and abstract services:

- Psychological Abstracts,
- Personnel Literature Index,
- Management Contents,
- Defense Documentation Center,
- Defense Logistics Studies Information Exchange,
- Smithsonian Science Information Exchange.

To qualify for inclusion, each study had to:

- Test the impact of an incentive program on worker performance, and
- Provide systematically derived quantitative data evaluating the incentive's impact on performance in comparison to a no-incentive condition.

The abstracts include both field studies of incentive systems in place in industry, government, and the military, and laboratory experiments in which the impact of incentives is evaluated in an artificial context.

The abstracts are written in a uniform manner to facilitate cross-reference and comparison. The order of presentation is alphabetical by last name of the principal author. The content of each abstract includes:

1. Bibliographic Reference.

2. Conclusions. A brief statement of the principal implications of the findings.

3. Organization. The name, type, and size of the organization in which the study was conducted. In the case of laboratory experiments, no organization is listed.

4. Subjects. The number, personal backgrounds, occupations, and attributes of the workers or experimental subjects evaluated.

5. Organizational Environment. Salient facts about the organizational setting and the nature of the work task involved in the study.

6. Incentive Program. Description of the incentive system evaluated, performance standards involved, reward structure and contingency, and reward timing.

7. Incentive Method. Salient features of incentive system implementation.

8. Experimental Design. Nature of the experimental design involved in the study. Indication of how performance is measured.

9. Productivity/Performance Results. Quantitative data on the percentage of improvement or decrement in the performance measure traceable directly to the implementation of the incentive system under evaluation. The percentage differential is the ratio of performance under the incentive system to equivalent performance under a no-incentive condition. While the task and performance measurement scale differ from one study to another, the percentage of improvement or decrement in performance is somewhat more comparable within similar organizations or job functions.

10. Other Results. Additional conclusions, such as attitudinal reactions, job satisfaction, morale, absenteeism, turnover, etc.

11. Intervening Factors. Reported changes that occurred simultaneously to the implementation of the incentive system that might also have an impact on productivity/performance results. For example,

new technology or work processes, improved training, new recruitment policies, etc.

12. Limitations of Results. Methodological weaknesses in the study that limit validity or applicability of the results. For example, absence of control groups, nonequivalence of comparison groups, peculiarities of measurement, peculiarities of the incentive system, peculiarities of the sample, or statistical inadequacies.

1. Reference. BEBEAU, M. and H. SULLIVAN (1978) "Effects of Student-Preferred Incentives in University Courses," Williams AFB, Arizona: Flying Training Division, Air Force Human Resources Laboratory. Report AFHRL-TR-78-17.

2. Conclusions. Incentive effects in technical training are most evident for memory tasks. Incentives have a negative effect on tasks involved in learning new applications of rules or concepts.

3. Organization. None.

4. Subjects. Same sixty-four college students in Experiments 1 and 2. Fifty-nine students in Experiment 3.

5. Organizational Environment. In Experiments 1 and 2, subjects were tested on self-paced programmed learning. In Experiment 3 (2-week duration), subjects were tested on self-instructional materials in a field experimental context.

6. Incentive Program. In Experiment 1, subjects could receive 10 points toward their course grade if they did well (score of 80 percent or above) on their final exam (instructor-selected incentive). In Experiment 2, subjects could choose from among 5 incentives if they scored 80 percent or above on their final exam (student-preferred incentive). They included (a) release from an assignment, (b) an option to substitute the current exam score for a previous test score, (c) an invitation to participate in a discussion group with a well-known learning specialist, (d) a positive letter of reference for the student's placement file, or (e) an opportunity to assist the instructor in grading. In Experiment 3, subjects could earn release from the course final exam by receiving 80 percent or above on a unit exam.

7. Incentive Method. Students were assigned to control and experimental conditions at random.

8. Experimental Design. Controlled lab experiments (Experiment 1 and 2). Field experiment (Experiment 3). Quality of performance was measured by exam scores and errors committed. Quantity of performance was measured by the amount of time spent studying.

9. Productivity/Performance Results. Productivity differences between incentive and no-incentive conditions (positive results indicate improvement due to incentive):

	Exp. 1	Exp. 2	Exp. 3
Exam Scores (Quality)	+9.3%[a]	+21.9% (+4.6%[a])[b]	-2.1%[a]
Program Errors (Quality)	-20.7%[a]	- -	-15.8%[a]
Speed (Quantity)	-1.6%[a]	+23.5% (+2.5%[a])[b]	-26.8%[a]

[a] Difference is not statistically significant.

[b] Percentages in parentheses are findings from a second programmed learning task.

In two memory task subscores on the exam, quality improved by 64.2 percent and 25.0 percent respectively with the incentive conditon (Experiment 2). In Experiment 3, concept and rule application task subscores declined 7.0 percent with the incentive condition.

10. Other Results. Grade-related incentives were most preferred.

11. Intervening Factors. None reported.

12. Limitations of Results. Insignificant statistical differences found for most measures of productivity between the incentive and no-incentive conditions.

1. Reference. CHUNG, K. and W. VICKERY (1976) "Relative Effectiveness and Joint Effects of Three Selected Reinforcements in a Repetitive Task Situation," Organizational Behavior and Human Performance 16, 1: 114-142.

2. Conclusions. The combination of piece rate, bonus, and feedback incentive systems produced the highest performance levels. While the additive impact of bonus incentives was significant, the additive impact of feedback had a greater effect on improved performance.

3. Organization. None.

4. Subjects. Eighty college students (male and female) in business administration courses.

5. Organizational Environment. Repetitive task performed on individual basis involved transferring responses from one standardized answer sheet to another (limited intrinsic satisfaction).

6. Incentive Program. (a) Piece rate incentive system; (b) Partial reinforcement (bonus) schedule (variable ratio); and (c) knowledge of results feedback (nonfinancial reward).

7. Incentive Method. Each subject worked in the 2 1/2 hour session under only one of eight incentive conditions (each of the three incentive schedules independently and in combination).

8. Experimental Design. Controlled laboratory experiment. Performance output is measured by the number of responses transferred or answer sheets processed.

9. Productivity/Performance Results. Piece rate incentives elicited a 20.2 percent improvement in performance quantity over hourly pay, nonincentive conditions. Piece rate plus bonus incentives elicited a 16.7 percent improvement over the control condition. Piece rate plus feedback incentives elicited a 26.6 percent improvement over the control. Finally, combining piece rate, bonus, and feedback incentives produced a 57.2 percent improvement in performance quantity over the control condition. There were no statistically significant differences on quality of performance among the experimental conditions.

10. Other Results. Feedback offers extrinsic and intrinsic stimulation and goal-setting standards to a dull task, thereby improving performance.

11. Intervening Factors. None reported.

12. Limitations of Results. None reported.

1. Reference. The Conference Board (1977) "Case Study - Donnelly Mirrors Inc.: Data-based OD in a Moderate-Sized Firm," in D. Jones, (ed.) Horizons of Industrial Productivity. Ann Arbor, Michigan: Institute of Science and Technology, Industrial Development Division.

2. Conclusions. The Scanlon Plan and other participative management and OD interventions can result in higher productivity, higher product quality, and a higher quality of work life.

3. Organization. Donnelly Mirrors, Inc.; manufacturer of rearview mirrors for auto industry.

4. Subjects. All employees (350) in U.S. plant.

5. Organizational Environment. Company employs about 350 workers in its U.S. plants.

6. Incentive Program. Scanlon Plan (adopted in 1952); bonuses are calculated on productivity increases and cost reductions. Formula includes direct labor costs as well as indirect costs such as purchase of machines and tooling.

7. Incentive Method. Plan has evolved and changed over the years fostering increased worker participation.

8. Experimental Design. Field study. Productivity measured by production per unit of direct labor.

9. Productivity/Performance Results. Since 1952, the company's compounded growth rate has averaged 14 percent. Between 1964 and 1971, production per unit of direct labor increased 40 percent. Quality levels climbed 6.5 percent. The price of the company's major product dropped 25 percent from its 1952 price. If only half the productivity gains are attributed to OD efforts, there was a return of 220 percent on OD costs.

10. Other Results. Employee bonuses averaged 12 percent over base pay.

11. Intervening Factors. Other OD strategies have been introduced since the mid-1960's, including the managerial grid, team development, career counseling, productivity bargaining, and employment guarantee.

12. Limitations of Results. No control group.

1. Reference. DEVLIN, J. (1976) "Improving Productivity: One Company's Wage Incentive Program," Supervisory Management 21, 3: 7-16.

2. Conclusions. An incentive plan, similar to a standard hour plan, results in higher productivity than no incentive system with work standards in place.

3. Organization. Aetna Life and Casualty Co., Hartford, Conn.

4. Subjects. Ten employees in home office unit performing clerical tasks.

5. Organizational Environment. Low employee morale, poor work procedures, and frustration due to continual work backlog was evident. Absenteeism and turnover were high.

6. Incentive Program. Employees producing at work standard level (based on prior measurement baselines -- time standards, production counts, etc.) receive 25 percent bonus. Increased supervisor-worker feedback and communication was also involved. Similar to Standard Hour Plan.

7. Incentive Method. First, work standards were established without an incentive program. After 9 months, the incentive program was added and feedback and management interest were increased.

8. Experimental Design. Field study. Productivity is measured as the ratio between standard (premeasured) time and actual time to complete a task.

9. Productivity/Performance Results. Productivity improved 72 percent over the no incentive condition (with work standards in place) once the incentive program was introduced. On the average, of Aetna's 7,500 employees on the incentive plan, productivity is 62 percent higher than among employees not on the plan.

10. Other Results. Approximately 7,500 field and home office employees were covered by the incentive plan as of 1976.

11. Intervening Factors. Feedback, additional management interest, and additional communication about work standards.

12. Limitations of Results. No controls for intervening variables. It is impossible to identify whether intervening factors or incentive plan improved productivity.

1. Reference. FARR, J. (1976) "Incentive Schedules, Productivity, and Satisfaction in Work Groups: A Laboratory Study," Organizational Behavior and Human Performance 17, 1: 159-170.

2. Conclusions. Both individual and group incentives significantly increase task performance. The combination of both individual and group incentives (condition d below) resulted in the highest level of performance.

3. Organization. None.

4. Subjects. One hundred forty-four introductory psychology students working in three-person groups.

5. Organizational Environment. Subjects were paid for their participation in a card-sorting task.

6. Incentive Program. Four incentive conditions tested: (a) Hourly Pay Condition -- no incentive; subjects paid on hourly basis; (b) Piece Rate Condition -- subjects paid piece rate incentive based on performance on task; (c) Equal Distribution/Group Condition -- the total productivity of group was summed, the total pay for group was then determined by the piece rate system, and then the total pay was divided equally among members; (d) Differential Distribution/ Group Condition -- same as (c) except pay was differentially divided according to individual performance; subject with highest productivity received one half of total group pay, subject with second highest productivity received one third, and remaining subject received one sixth of total.

7. Incentive Method. Piece rate and hourly total pay was generally comparable; subjects were aware of their pay condition prior to the experiment; individual performance was measured twice with feedback given.

8. Experimental Design. Laboratory experiment with controls. Productivity was measured by the number of cards sorted properly.

9. Productivity/Performance Results. Highest productivity resulted under condition (d). On average, individual incentives (b) produced a 10.7 percent improvement in productivity over no incentive conditions; group incentives (c and d) produced a 7.7 percent improvement. When pay was distributed based on performance (b and d), there was higher productivity than under equal pay conditions (a and c).

10. Other Results. Condition d, which resulted in the highest productivity, was perceived as being the least fair or equitable pay system.

11. Intervening Factors. None reported.

12. Limitations of Results. Group size was small and there is evidence that the effectiveness of group incentives decreases as group size increases.

1. Reference. FARR, J. (1976) "Task Characteristics, Reward Contingency, and Intrinsic Motivation," Organizational Behavior and Human Performance 16, 2: 294-307.

2. Conclusions. Pay for performance results in higher levels of productivity than hourly, nonincentive pay systems.

3. Organization. None.

4. Subjects. Ninety college students working individually.

5. Organizational Environment. Subjects were paid for their participation in assembling Erector set puzzles.

6. Incentive Program. Contingent pay in which subjects were paid on a piece rate rather than hourly (nonincentive) basis.

7. Incentive Method. Subjects were placed into either contingent or noncontingent pay conditions prior to experiment.

8. Experimental Design. Controlled laboratory experiment. Productivity was measured by counting the total nut and bolt connections made.

9. Productivity/Performance Results. More subjects in the contingent pay condition (11.1 percent more) volunteered for additional nonrewarded problem-solving than subjects not receiving incentives (this difference, however, was not statistically significant.) Mean production for the contingent pay condition was 29 percent higher than for the nonincentive condition.

10. Other Results. Task characteristics were found to affect performance motivation and satisfaction.

11. Intervening Factors. None reported.

12. Limitations of Results. Statistical insignificance of difference between volunteer-nonvolunteer groups.

1. Reference. HAMNER, W. and L. FOSTER (1975) "Are Intrinsic and Extrinsic Rewards Additive: A Test of Deci's Cognitive Evaluation Theory of Task Motivation," Organizational Behavior and Human Performance 14, 3: 398-415.

2. Conclusions. To obtain higher quantity and quality of output, managers should design a work setting that is both intrinsically interesting and extrinsically rewarding.

3. Organization. None.

4. Subjects. Ninety-eight college students.

5. Organizational Environment. Two tasks: Boring (code and transfer math exam scores to a computer work sheet) and interesting (code and transfer sex survey responses to a computer work sheet).

6. Incentive Program. Three conditions: (a) no pay (control group), (b) noncontingent pay (subjects paid 75¢ for 20 minutes) (control group), (c) contingent pay (subjects paid 5¢ for each questionnaire completed).

7. Incentive Method. None reported.

8. Experimental Design. Controlled laboratory experiment. Performance measured by number of items scored (quantity) and number of error items (quality).

9. Productivity/Performance Results.

	Percent Difference of contingent pay from noncontingent pay group
Boring Task (No. Items Scored)	-9.7%
Interesting Task (No. Items Scored)	+21.3%
Boring Task (No. Error Items)	-3.5%
Interesting Task (No. Error Items)	-6.4%

10. Other Results. Disputes Deci's theory and findings that contingent pay reduces intrinsic motivation in an interesting task.

11. Intervening Factors. None reported.

12. Limitations of Results. Small sample (15 to 20) in each experimental condition.

1. Reference. HESSE, L. (1977) "Wage Incentives Eliminate 'Zombie Time,'" Industrial Engineering 9, 10 (October): 26-27.

2. Conclusions. A premium plan incentive improved productivity over a no-incentive condition among workers in a manufacturing plant.

3. Organization. Huffman Manufacturing Company, California Bicycle Division, Azusa, California.

4. Subjects. Four hundred workers at plant.

5. Organizational Environment. Wage incentive plan covers all direct labor operations in manufacturing bicycles.

6. Incentive Program. One hundred percent premium plan. Workers earn 1 percent for every 1 percent above the standard rate in addition to guaranteed hourly pay.

7. Incentive Method. Reward is in direct proportion to amount of work output exceeding established standard of performance.

8. Experimental Design. Field study. Performance was measured by changes in the quantity of production.

9. Productivity/Performance Results. Average performance improvement under the incentive system was 27 percent over standard performance with no incentive.

10. Other Results. The slowest worker under the incentive produced 10 percent below the standard and the fastest worker produced 125 percent above the standard.

11. Intervening Factors. None reported.

12. Limitations of Results. None reported.

1. Reference. KELLEHER, D. (1977) "A Different Approach to Measuring Maintenance Work," in 1977 Spring Annual Conference Proceedings of the American Institute of Industrial Engineers. Norcross, GA: AIIE.

2. Conclusions. A time-saved incentive plan among maintenance employees significantly increases productivity over a no-incentive condition.

3. Organization. Bethlehem Steel Corporation -- Lebanon, Pennsylvania plant.

4. Subjects. Two hundred seventy-one maintenance employees (in mechanical, electrical, and repair shops).

5. Organizational Environment. Pressure to include maintenance employees in an incentive plan stemming from union-management agreement in 1969.

6. Incentive Program. Time saved plan. Ratio of time saved in completing tasks to total time on the job is multiplied by a standard incentive rate.

7. Incentive Method. Work and time studies were conducted to identify standards for each job to be placed on incentives. The incentive plan was then "sold" and explained to supervisors and affected workers.

8. Experimental Design. Field study. Productivity was measured in tons of production per maintenance man-hour.

9. Productivity/Performance Results. Based on productivity averages for the first three years under the incentive (1972-1974), productivity improved by 48 percent when compared to preincentive average production.

10. Other Results. None reported.

11. Intervening Factors. Potential confounding effects of prior work and time study (Hawthorne effect).

12. Limitations of Results. No control group.

1. Reference. KOMAKI, J., W. WADDELL, and M. PEARCE (1977) "The Applied Behavior Analysis Approach and Individual Employees: Improving Performance in Two Small Businesses," Organizational Behavior and Human Performance 19, 2: 337-352.

2. Conclusions. Goal clarification and reinforcing incentives can improve performance.

3. Organization. Neighborhood grocery store (in Experiment I) and pinball/game room (in Experiment II).

4. Subjects. Two male clerks ages 25 and 36 (in Experiment I) and 1 male attendant age 26 (in Experiment II).

5. Organizational Environment. In Experiment I, the two clerks interacted only with the store owner.

6. Incentive Program. In Experiment I, time off with pay if subjects attained at least 90 percent of desired behaviors. Feedback and self-recording of performance were also administered. In Experiment II, feedback and pay contingent on performance were administered together.

7. Incentive Method. In addition to introduction of incentives, subjects were given instructions on performance goals to be attained.

8. Experimental Design. Field experiment. Performance measured through observation in terms of (a) being in store (b) assisting customers and (c) keeping shelves filled (in Experiment I). Performance in Experiment II was measured by time spent working on-the-job.

9. Productivity/Performance Results. Experiment I: Behavior (a) improved 62 percent; behavior (b) 149 percent; and behavior (c) 51 percent over the baseline performance measure when the incentive was introduced. This degree of improvement was maintained for at least 6 weeks subsequent to the initial intervention. Experiment II: Performance improved 48 percent over the baseline when the incentive was introduced. When the subject was put on a nonincentive hourly wage for one week, his performance dropped to the pre-incentive baseline level.

10. Other Results. None reported.

11. Intervening Factors. Employer-employee interactions changed as well during intervention.

12. Limitations of Results. Insufficient sample to make generalizations. No control for impact of experimental intervention itself (Hawthorne

effect). Goal clarification by itself should have served as the control condition. Experiments as they stand cannot distinguish between effects of goal clarification and incentive introduction.

1. Reference. KOOP, J. (1977) "Indirect Labor Incentives Pay Off," Industrial Engineering 9, 1 (January): 26-30.

2. Conclusions. A ratio type cost control and incentive plan was successful in reducing the overall cost of material handling in a manufacturing plant.

3. Organization. Material handling operations at Sperry's New Holland plant (a farm equipment manufacturing plant in Pennsylvania).

4. Subjects. Several groups of material handlers working throughout the plant.

5. Organizational Environment. Nonunion plant. Material handler groups work with fork trucks and overhead cranes to receive and store raw material, move and store in-process parts, and move finished parts to storage.

6. Incentive Program. Group incentive program. To obtain a standard of work performance, a ratio was established of definite number of hours of material handling labor required to service direct labor earning a definite number of standard hours. A bonus is paid as the ratio changes due to an increase in total direct labor effort or a decrease in material handling hours (thus, a gain in productivity).

7. Incentive Method. Bonus earning opportunities are 25 percent. Bonuses begin at a certain level of effectiveness. The bonus is calculated weekly.

8. Experimental Design. Field study. Performance was measured in terms of time and cost savings.

9. Productivity/Performance Results. A 15 percent time savings in the material handling operation was recorded over a period of years under the incentive system in comparison to the preincentive situation.

10. Other Results. None reported.

11. Intervening Factors. Industrial engineers conducted an organizational and effectiveness study of operations in the material handling operation just prior to implementing an incentive plan (resulting in possible Hawthorne effects when measuring the impact of the incentive plan). This study resulted in changes in work process.

12. Limitations of Results. (a) Confounding factors as a result of prior study of material handling function. (b) No control group.

1. Reference. LATHAM, G. and D. DOSSETT (1978) "Designing Incentive Plans for Unionized Employees: A Comparison of Continuous and Variable Ratio Reinforcement Schedules," Personnel Psychology 31, 1: 47-61.

2. Conclusions. Continuous reinforcement schedules yield higher productivity from workers than variable ratio schedules. Both types of incentive schedules yielded higher productivity than a no-incentive condition. Experienced workers performed better under a variable ratio schedule, while inexperienced workers performed best under a continuous reinforcement schedule. This finding agrees with laboratory experiments showing that continuous reinforcement results in more rapid learning acquisition while variable ratio schedules are useful in maintaining desired behaviors.

3. Organization. Company in northwestern U.S.

4. Subjects. Fourteen mountain beaver trappers in the northwestern United States. All had high school educations and several had attended or graduated from college. All were permanent full-time employees and all belonged to a strong national union.

5. Organizational Environment. The job involved catching mountain beavers. The subjects were paid $5.00 per hour prior to and during the study.

6. Incentive Program. Group A: Trappers were put on a continuous reinforcement schedule in which they received $1.00 for every beaver caught. At the end of 4 weeks, they switched to a variable ratio schedule (VR-4) in which they received $4.00 contingent upon trapping a beaver and correctly specifying the color of one of 4 marbles prior to drawing it. Group B: The same procedure, but reversed. Trappers started on a VR-4 schedule and after 4 weeks switched to a continuous schedule. In both groups, the trappers were paid a regular salary ($5.00 per hour), with the above incentive paid in addition. For both groups, the incentive system is a variant of piece rate systems.

7. Incentive Method. Involved union discussion and acceptance of incentive plan. Trappers were randomly assigned to continuous or variable ratio schedules.

8. Experimental Design. Field experiment. The actual money earned in Groups A and B were very close. Pre-experimental baseline measures were collected. Productivity was measured by the number of beavers caught per man-hour.

9. Productivity/Performance Results. There was a 23 percent reduction in cost (taking into account all factors including the incentive system). The number of acres covered per man-day increased by 11

percent and the beavers caught per acre increased by 23 percent. In terms of the number of beavers caught per man-hour, there was an overall 41 percent increase in productivity in both groups over the pre-experimental baseline. The continuous schedule yielded 16 percent higher productivity than the variable ratio schedule. The continuous schedule yielded a 52.3 percent productivity improvement over the baseline, and the VR-4 schedule yielded only a 31.8 percent improvement. Moreover, inexperienced workers under a continuous schedule showed an 11 percent improvement in productivity over the VR-4 schedule. Experienced workers under a VR-4 schedule show a 50 percent improvement in productivity over the continuous schedule.

10. Other Results. Both the experienced and inexperienced workers preferred the VR-4 schedule over the continuous schedule because of the added interest and excitement.

11. Intervening Factors. None reported.

12. Limitations of Results. (a) The magnitude of the reward in the variable ratio schedule appeared larger and more worthwhile to the workers, possibly acting as a stronger incentive to perform. (b) The marble game in the VR-4 schedule was treated as a game by the workers which added greater interest and, perhaps, effort. (c) Small number of observations. (d) Note that productivity comparisons between degrees of worker experience juxtapose two different types of incentive systems. However, no statistics are given that relate experience to the nonincentive baseline period.

1. Reference. LONDON, M. and G. OLDHAM (1977) "A Comparison of Group and Individual Incentive Plans," Academy of Management Journal 20, 1 (March): 34-41.

2. Conclusions. The goals and performance are highest under individual, piece rate, and high performer-based group incentives. The effectiveness of group incentives depends on their design and perceptions of other team members.

3. Organization. None.

4. Subjects. Seventy male college students.

5. Organizational Environment. Task is a perceptual motor task (computer card sort). Subjects worked individually, although they were told that their bonuses would be affected by another subject on their team (for the group incentives only).

6. Incentive Program. Five incentive conditions: (a) Bonus payment to the group based on the highest performer in the group; (b) Bonus payment to the group based on the lowest performer in the group; (c) Bonus payment to the group based on the average performance in the group; (d) Individual piece rate bonus; and (e) Fixed rate (no incentive) condition.

7. Incentive Method. Subjects were assigned randomly to the five incentive conditions.

8. Experimental Design. Lab experiment. Performance was measured by the number of cards sorted properly.

9. Productivity/Performance Results. Productivity improvement over the fixed rate (no-incentive) condition were: (a) High performer-based group incentive -- 13.1 percent increase; (b) Low performer-based group incentive -- 9.5 percent decrease; (c) Average performance group incentive -- 3.1 percent increase; (d) Individual piece rate incentive -- 15.1 percent increase.

10. Other Results. Higher goals were set by subjects under conditions (a) and (d).

11. Intervening Factors. None reported.

12. Limitations of Results. Small number of subjects in each condition.

1. Reference. LONDON, M. and G. OLDHAM (1976) "Effects of Varying Goal Types and Incentive Systems on Performance and Satisfaction," Academy of Management Journal 19, 4 (December): 537-546.

2. Conclusions. Both piece rate and no payment conditions produce higher productivity than fixed pay (no-incentive) conditions.

3. Organization. None.

4. Subjects. One hundred and eighty college students.

5. Organizational Environment. The task involved sorting computer cards (a perceptual motor task). Experiment lasted 40 minutes.

6. Incentive Program. Three conditions: (a) No pay (control group); (b) Piece rate incentive (1¢ paid per card sorted); (c) Fixed rate ($2.00 paid for participating in experiment -- no-incentive group).

7. Incentive Method. Subjects were given performance goals as well as incentives, but it is possible to isolate the effects of goal setting from incentive implementation.

8. Experimental Design. Lab experiment. Minimum and high performance goals were set and communicated to each subject. Performance was measured as the number of cards sorted properly.

9. Productivity/Performance Results. Productivity under the piece rate condition was 10 percent higher than under the fixed-rate condition. There was no significant difference between productivity under the piece rate and no pay conditions.

10. Other Results. Performance increases as the difficulty of the goal increases. Goal setting procedures should not replace incentives as a means of enhancing productivity.

11. Intervening Factors. None reported.

12. Limitations of Results. None reported.

1. Reference. National Commission on Productivity and Work Quality (1975) Employee Incentives to Improve State and Local Government Productivity. Washington, D.C.: GPO.

2. Conclusions. Establishing specific work standards and disciplinary actions for failure to meet them improve productivity and speed of work.

3. Organization. New York City's Sanitation Department.

4. Subjects. Workers in the department's vehicle repair shop.

5. Organizational Environment. Not reported.

6. Incentive Program. Disciplinary action (unspecified) would be taken for failure to meet the commercial work standards for repairing vehicles. There is no provision for rewarding employees for exceeding the standard.

7. Incentive Method. The work standards and consequences for failure were accepted by the union after collective bargaining.

8. Experimental Design. Field study evaluation. Productivity measures were based on the commercial work standards set for vehicle repair, including time and quality standards.

9. Productivity/Performance Results. Repair operations have speeded up about 46 percent since the plan has been instituted. After 1 year in which the work standards and incentive have been instituted, the number of vehicles down for repair has been reduced by 31 percent.

10. Other Results. None reported

11. Intervening Factors. None reported.

12. Limitation of Results. No control group.

1. Reference. National Commission on Productivity and Work Quality (1975) Employee Incentives to Improve State and Local Government Productivity. Washington, D.C.: GPO.

2. Conclusions. The impact on productivity of performance-based wage increases for police has been uncertain: some indicators rose and some fell.

3. Organization. City of Orange, California government.

4. Subjects. One hundred forty-eight policemen.

5. Organizational Environment. Focus on reducing certain categories of "repressible" crimes.

6. Incentive Program. Across-the-board wage increases (2 percent) are provided at certain times for all covered personnel if the total number of repressible crimes (rapes, robberies, burglaries, and auto thefts) reported since July 1973 has fallen by specified levels against a historical baseline. There is no penalty if crime rates rise. Incentive method is organization-wide and the reward is distributed to all at the same rate. The reward results in a permanent salary increase.

7. Incentive Method. Program introduced in July 1973 as a result of productivity bargaining.

8. Experimental Design. Field study evaluation. Number of reported crimes (productivity measure) is obtained from radio callslips, citizen telephone calls, and officer logbooks.

9. Productivity/Performance Results. During the first 7 months of the program, the total of repressible crimes was reduced by 10.0 percent over the previous year. Felony arrests (not covered by incentive) were also up 14.4 percent. However, other serious crimes (some not included in the incentive program) increased by 7.9 percent. Of the covered crimes, only burglaries were reduced; the other 3 crimes increased, but not enough to offset the burglary reductions.

10. Other Results. Increased cooperation among police units. Only burglaries have shown a decrease; other crimes have increased.

11. Intervening Factors. A new position of "crime prevention officer" has been established. Other police units have intensified efforts to prevent burglaries.

12. Limitations of Results. No control group. Unreported crimes are not included. External factors often play a major role in the perpetration of crime and are beyond the control of policemen.

1. Reference. National Commission on Productivity and Work Quality (1975) Employee Incentives to Improve State and Local Government Productivity. Washington, D.C.: GPO.

2. Conclusions. Initial results indicate that city auto mechanics have higher output under a high standard hour-type incentive system.

3. Organization. Fort Worth, Texas city government.

4. Subjects. Seventy-five auto mechanics working for a city department.

5. Organizational Environment. The incentive plan was instituted, in part, to create parity between city and commercial auto mechanics.

6. Incentive Program. Five percent bonus is awarded to each worker whose output in a given month exceeds the flat rate standards for auto repair by at least 10 percent. To control for quality, time to redo previously completed jobs is added to the worker's time. Similar to high standard hour method for individual incentives.

7. Incentive Method. Program commenced October 1973. The bonus is paid by giving workers a one-step increase in pay level for the month (to accord with civil service guidelines). Awards are paid in special checks to emphasize the exceptional nature of the bonus. If, in subsequent months, performance fails to exceed the goal, the employee is returned to the previous salary step.

8. Experimental Design. Field study evaluation. Productivity is measured by degree to which workers exceed standard time for task minus time required for quality rejects.

9. Productivity/Performance Results. After the first 7 months, output averaged a 23 percent improvement.

10. Other Results. None reported.

11. Intervening Factors. Workers assumed increased responsibility as a result of management interest (Hawthorne effect).

12. Limitations of Results. Productivity statistics do not include quality adjustments. No control group.

1. Reference. National Commission on Productivity and Work Quality (1975) Employee Incentives to Improve State and Local Government Productivity. Washington, D.C.: GPO.

2. Conclusions. Piecework incentives appear to improve productivity among EDP operators.

3. Organization. Electronic Data Processing Unit of the State of Pennsylvania's Bureau of Employment Security.

4. Subjects. Eighty-five nonsupervisory employees and 5 supervisors.

5. Organizational Environment. The unit enters over 4 million wage records into a tape file each quarter, usually within an 8 to 10 week period. The unit was experiencing a shrinking supply of job applicants and a high turnover of personnel. There were extremely limited opportunities for advancement in the unit and a favorable local job market in the private sector.

6. Incentive Program. Piecework plan. A quota of 115,000 wage records per quarter per employee was established. For production in excess of the standard, a bonus of 32 cents per 100 wage records is awarded. Quality is controlled through a penalty for errors. Low error rates result in an additional 10 percent bonus. Supervisors receive bonuses based on the average incentive rate for all employees in each work group. This bonus rises in proportion to the number of units produced and therefore is similar to a piecework program as well.

7. Incentive Method. Plan instituted in 1970. Weekly printouts of each employee's record are posted as feedback and to induce competition.

8. Experimental Design. Field study evaluation. Productivity is measured automatically as a byproduct of entering records. Errors are also measured in this way. Before and after statistics were collected.

9. Productivity/Performance Results. Output of wage records per hour averaged an increase of 60.7 percent after 2 years under the piecework system. The per unit cost was reduced by 37.2 percent.

10. Other Results. Turnover has been reduced to a bare minimum, absenteeism is practically nonexistent, training has been reduced, more highly qualified trainees have been attracted, and there has been an increase in the capacity to absorb more work. After 2 years with the piecework program, the unit realized a savings of 10 operators at a salary of $5,200 each per year. Total savings amounted to $10,544 per month as compared to conditions before the plan. Employee morale also improved.

11. Intervening Factors. None reported.

12. Limitations of Results. No control group.

1. Reference. NELSON, J. (1977) "Improving Productivity With Performance Measures and a Group Incentive Plan: A Case Study," in 1977 Spring Annual Conference Proceedings of the American Institute of Industrial Engineers. Norcross, Georgia: AIIE.

2. Conclusions. A group incentive plan for factory workers yielded higher productivity than an outdated individual incentive, was easier to administer, and produced greater confidence among workers.

3. Organization. Factory manufacturing heavy wire-rope and electro-mechanical cable.

4. Subjects. Approximately seventy-five workers in the rope mill and electro-mechanical cable departments.

5. Organizational Environment. Prior individual incentive plan became obsolete due to technological change and vague standards and performance measures. It rewarded machine shutdown time and slow machine speed.

6. Incentive Program. Group plan. Work team performance above standard time to produce a unit pound of rope or cable is rewarded. Also, day-to-day feedback on performance and employee suggestion system established.

7. Incentive Method. Workers participated in designing new incentive system.

8. Experimental Design. Field study. Performance was measured as pounds produced per man-hour.

9. Productivity/Performance Results. Over the first 6 months of the group incentive plan, the average direct-labor productivity increased 9 percent over the old incentive plan.

10. Other Results. Increased cooperation among workers and between workers and supervisors. Considerable reduction in paperwork to administer incentive system.

11. Intervening Factors. Potential effect on performance of involving workers in incentive design.

12. Limitations of Results. (a) No control group. (b) No comparable measure under prior no-incentive condition reported.

1. Reference. PINDER, C. (1976) "Additivity versus Nonadditivity of Intrinsic and Extrinsic Incentives: Implications for Work Motivation, Performance and Attitudes," Journal of Applied Psychology 61, 6 (December): 693-700.

2. Conclusions. Subjects receiving a piece rate incentive on a boring task produce more than subjects receiving the same incentive on an appealing task, who, in turn, produce more than subjects receiving fixed (no-incentive) compensation.

3. Organization. None.

4. Subjects. Eighty male high school and college students. The mean age was 17.3 years and the mean number of years of schooling was 11.8.

5. Organizational Environment. Appealing task condition involved construction of a large model car using Erector set pieces. Nonappealing task condition involved assembling pairs of identical parts (similar to production line). Both tasks took over one hour.

6. Incentive Program. A token (worth 5 cents) was given to subjects immediately upon fitting two pieces together correctly (piece rate system).

7. Incentive Method. Subjects were randomly assigned to the contingent/noncontingent pay, and appealing/nonappealing task conditions.

8. Experimental Design. Lab experiment. 2x2 design with (1) an intrinsically/nonintrinsically motivating task, and (2) a contingent/noncontingent payment system based on performance. A control (noncontingent pay) condition involved paying subjects a flat rate of $2.75 for participation in the experiment. Performance was measured by the number of Erector set pieces correctly fitted together.

9. Productivity/Performance Results. On the average, subjects who were involved in an intrinsically motivating task and received a reward contingent on performance yielded 6.4 percent higher performance than the noncontingent groups. Subjects who were involved in a boring task and received contingent rewards produced 17.7 percent higher performance than the average noncontingent groups.

10. Other Results. Subjects paid under a noncontingent schedule appear to maintain a more intrinsic orientation toward work and greater satisfaction than those paid on an incentive-based schedule.

11. Intervening Factors. None reported.

12. Limitations of Results. None reported.

1. Reference. PRITCHARD, R., P. DeLEO, and C. VON BERGEN (1976) "A Field Experimental Test of Expectancy-Valence Incentive Motivation Techniques," Organizational Behavior and Human Performance 15, 2: 355-406.

2. Conclusions. Financial incentives resulted in more significant quantitative performance improvements than nonfinancial incentives. However, neither type of incentive had major impacts on improving qualitative performance.

3. Organization. Chanute AFB, Rantoul, Illinois. Airman technical training.

4. Subjects. One thousand four hundred and thirty-nine first term airmen in Aircraft Electrical Repair (AER) and 1301 airmen in Weather Observer (WO) courses. Subjects between 17-20 years old. Most had just completed basic training. Most had finished high school and a small number had some college. For the AER course, the entrance qualifications based on ability were low. The qualifying abilities for the WO course were quite a bit higher.

5. Organizational Environment. AER course was self-paced and scheduled for 16 weeks. The WO course was taught conventionally for 16 weeks.

6. Incentive Program. Three incentive systems tested: (a) Subject could choose one of eight desirable nonfinancial rewards based on level of objective performance achievement in course (points were earned based on test and speed of completion scores which could be turned in for incentive rewards); (b) Subjects could choose among the same eight nonfinancial rewards based on an objective measure of effort expended toward performance (points earned based on effort measure); (c) Same incentive system as in (b) but subjects had the additional opportunity to choose from among 5 financial rewards. (Eight nonfinancial rewards: Commendation sent to Commanding Officer, commendation sent to parents, being able to walk rather than march to class for 1 week, leaving class 1 hour early, a day off, a 3 day pass, wearing any uniform to class for a week, being excused from squadron detail for 1 week; 5 financial rewards: chits for BX facility, U.S. savings bonds, Sears gift certificate, chit at Airmen's Club, roundtrip bus transportation).

7. Incentive Method. Incentive system was described in detail and a manual was distributed to all students and instructors.

8. Experimental Design. Field experiment. Controls for cyclical trends in course performance, Hawthorne effects, and fluctuations in student ability. Performance was measured by exam scores, grades and length of time to complete course. "Effort" calculated by partialing out ability from performance, thus giving low ability subjects an equal

chance of earning incentives. All three incentive systems were run sequentially over a period of approximately 8 months.

9. Productivity/Performance Results.

Percent Difference from Pre-Experimental Baseline	Incentives a	b	c	Postexperimental
AER Exam Scores	-4.7%	-6.1%	-5.4%	-8.5%
WO Exam Scores	+1.9%	+1.5%	+1.4%	+2.6%
Course Completion Speed (AER)	+1.0%	+3.2%	+13.6%	+20.7%

Incentives may have had little effect on WO course due to high ability performers in that course even before incentives were introduced. Incentives (a), (b), and (c) resulted in net cost savings per week of $300, $1,200, and $4,500, respectively, due to time savings.

10. Other Results. Airmen rated incentives for attractiveness. Subjects saw incentives as increasing performance-reward instrumentalities. Remedial instruction decreased. Students had very positive attitudes toward the incentives, while instructors were slightly negative.

11. Intervening Factors. Changes in exams and procedures during post-experimental measurement (unreliable). Changes in AF recruiting resulting in higher student ability for the postexperimental measurement (unreliable).

12. Limitations of Results. Since each student was in a course during at least 2 incentive conditions, the final course grade may be contaminated. To minimize this effect, mean performance was stressed in the analysis.

1. Reference. PRITCHARD, R., D. LEONARD, C. VON BERGEN, and R. KIRK (1976) "The Effects of Varying Schedules of Reinforcement on Human Task Performance," Organizational Behavior and Human Performance 16, 2: 205-230.

2. Conclusions. Performance and the amount of earnings was lower under a noncontingent hourly pay system than under various pay for performance systems.

3. Organization. None

4. Subjects. Sixteen subjects with mean age of 18 years and with low prior knowledge of electronics.

5. Organizational Environment. Subjects hired for 4 weeks to learn self-paced programmed material on electricity, electronics, and transistors. Task performed independently.

6. Incentive Program. (a) Fixed Interval (FI) schedule -- hourly, nonincentive system; (b) Fixed Ratio (FR) schedule -- piece rate incentive system; (c) Variable Ratio (VR) schedule -- a variable number of responses are needed to obtain the fixed reward; (d) Variable Ratio-Variable Amount (VR-VA) schedule -- a variable number of responses are needed to obtain a reward that varies in size.

7. Incentive Method. Each subject worked for 1 week under each of the four reinforcement schedules and was informed of the operation of each schedule prior to each session.

8. Experimental Design. Controlled experiment. Performance was measured by how many work units in self-paced texts were completed.

9. Productivity/Performance Results. Productivity improvement due to incentive systems as compared to FI schedule (all differences are statistically significant):

	FR	VR	VR-VA
No. tests passed (quality)	41.9%	41.6%	55.0%
No. work units completed (quantity)	30.6%	37.7%	42.3%

10. Other Results. Attitudes were most favorable to the FR schedule of incentives.

11. Intervening Factors. None reported.

12. Limitations of Results. None reported.

1. Reference. SCHWINGER, P. (1975) Wage Incentive Systems. New York: John Wiley and Sons and Israel Universities Press.

2. Conclusions. Incentives offered on a piece rate basis to production line workers can result in significant productivity increases.

3. Organization. Three industrial firms in Israel using incentive plans.

4. Subjects. Workers at particular work stations in the participating plants.

5. Organizational Environment. Wage incentives are targeted only at the production line workers, not the managers (who may receive bonuses on criteria other than productivity). The three plants all produce the same product.

6. Incentive Program. Individual incentives based on individual output determined by traditional stopwatch methods. The norm for the task is 100 percent and the premium as a percent of the basic wage is directly proportional to the percent increase in output above the norm (like straight piece rate method).

7. Incentive Method. Incentive methods had not been used previously at chosen work stations.

8. Experimental Design. Surveys of individuals in wide range of manufacturing plants, plus observations of output per manhour before and after introduction of the incentive. Performance measure is aggregate averaged output for crews at each targeted work station.

9. Productivity/Performance Results. Introduction of a wage incentive system resulted in average increases in labor productivity of about 25 percent. Increase in labor productivity is a continual trend; although there was high variation in productivity from month to month after incentive introduction, productivity was generally higher after the incentive than before.

10. Other Results. Survey of workers in 71 industrial firms using incentives and 12 not using incentives in Israel concluded that most workers not on an incentive plan produce well below the standard output.

11. Intervening Factors. Attempt to control for changes in capital or methods based on survey questionnaires may be faulty.

12. Limitations of Results. No control group was measured to determine whether incentive was in fact the cause of productivity changes. Measures of productivity were averaged for work crews although incentives were given individually; averaging may obscure true relationships.

1. Reference. SHERMAN, G. (1976) "The Scanlon Concept: Its Capabilities for Productivity Improvement." The Personnel Administrator 21, 5: 17-20.

2. Conclusions. Scanlon plan improved productivity and labor efficiency in an electrical products plant.

3. Organization. Midland-Ross Corporation's Athens, Tennessee Electrical Products plant.

4. Subjects. Five hundred plant workers involved.

5. Organizational Environment. No prior existing incentives in plant.

6. Incentive Program. Scanlon Plan instituted in 1974.

7. Incentive Method. Workers voted for a 1 year trial period initially.

8. Experimental Design. Before and after field study. Bonus formula and productivity standards not available.

9. Productivity/Performance Results. Direct labor efficiency has improved 10 percent in one area of the plant and 8.5 percent in the other. Using the same equipment, productivity has increased 16 percent, and $250,000 has been realized in cost savings. There have also been work force savings amounting to 6 percent of the total work force.

10. Other Results. Grievances have been cut 50 percent, absenteeism has dropped 50 percent, and turnover has dropped 92 percent. After a year and a half, the plan is yielding monthly bonuses averaging 10 percent.

11. Intervening Factors. None reported.

12. Limitations of Results. No control group.

1. Reference. SHUMATE, E., S. DOCKSTADER, and D. NEBEKER (1978) "Performance Contingent Reward System: A Field Study of Effects on Worker Productivity." San Diego, California: Navy Personnel Research and Development Center. NPRDC-TR-78-20 (May).

2. Conclusions. A piece rate incentive system with a guaranteed salary for minimum performance was implemented within a naval shipyard. The incentive increased production efficiency in terms of performance rate and productive time, and virtually eliminated backlog and overtime.

3. Organization. Card Punch section at Long Beach Naval Shipyard.

4. Subjects. Seventeen civilian data transcribers.

5. Organizational Environment. Task involved a key entry function (repetitive, self-paced, and objectively measured). Preincentive period was characterized by supervisor as having low productivity. There was expressed concern over performance rates, leave abuse, and morale.

6. Incentive Program. Implemented January 1977. Transcribers rewarded independently in direct proportion to the amount of work exceeding standard. They continued to receive hourly salary. The reward amounted to 11 percent of the amount saved through high performance.

7. Incentive Method. Researchers interviewed workers to gather preincentive information; then baseline data were collected. Union cooperation was enlisted. Workers were briefed on how incentive money could be earned. Incentives accounting was automated enabling immediate feedback to workers on their incentive money accounts. Bonus checks could be drawn once a month.

8. Experimental Design. Field experiment. Performance rate was measured by keystrokes per hour (quantity). Productive time was measured as the ratio of time spent working at a machine to the time assigned to do so (quantity). The number of overtime hours was also recorded as a performance measure (cost savings).

9. Productivity/Performance Results. Productivity measurement during the initial 12-month incentive period indicated the following improvement over the preincentive period:

   - Average performance rate increased 17.8 percent.
   - Average productive time increased 5.6 percent.
   - Average overtime hours decreased 92.2 percent.

Estimates of cost savings for 1, 3, and 5 years are $66,000, $221,000, and $412,000, respectively. If generalized to similar key entry work centers in the remaining seven shipyards and the rest of the Navy Materiel Command, the incentive program could save $17.2 million in 5 years.

10. Other Results. Preincentive intervention providing feedback to the workers resulted in increased and sustained productivity.

11. Intervening Factors. Potential Hawthorne effects due to attention shown to workers by research team prior to incentive implementation.

12. Limitations of Results. (a) Small number of subjects. (b) Controls on effects of performance feedback, goal setting, and improved systems design were inadequate.

1. Reference. TERBORG, J. (1976) "The Motivational Components of Goal Setting," Journal of Applied Psychology 61, 5 (October): 613-621.

2. Conclusions. Incentives and goal setting can independently influence performance.

3. Organization. Fictitious company established for this experiment.

4. Subjects. Fifty-five subjects (male and female) hired through newspaper ads. The average age was 17.4 years and the average education level was 11.6 years. The sample was judged to be similar to Air Force trainees in terms of background characteristics.

5. Organizational Environment. One week job (5 hours per day) involving evaluation of written training material. Task involved studying programmed text on introductory principles of electricity at own pace, passing short tests on each section completed, and then taking a comprehensive exam on all the material studied.

6. Incentive Program. Pay contingent on how fast subjects could complete task. Control group consisted of subjects paid on a fixed hourly wage (noncontingent).

7. Incentive Method. Subjects were assigned to conditions at random.

8. Experimental Design. Lab experiment. Speed of completion (quantity measure) was measured as the total number of minutes required to complete the task. A quality measure dealt with the percentage of correct answers on the comprehensive exam. Finally, a composite criterion measure combined speed and quality by weighting speed twice that of the test score.

9. Productivity/Performance Results. Subjects in the contingent pay condition completed the task 20.9 percent faster than those in the noncontingent condition. Moreover, subjects in the contingent pay group had a 4.1 percent higher composite score than those in the control group. However, there was no significant statistical difference between the quality of performance under either condition.

10. Other Results. Incentives have no impact on whether or not subjects set performance goals.

11. Intervening Factors. None reported.

12. Limitations of Results. None reported.

1. Reference. TERBORG, J. and H. MILLER (1978) "Motivation, Behavior, and Performance: A Closer Examination of Goal Setting and Monetary Incentives," Journal of Applied Psychology 63, 1 (February): 29-39.

2. Conclusions. Piece rate bonus systems are effective for increasing the quantity of production over nonincentive conditions, but do not impact significantly on the quality of production.

3. Organization. None.

4. Subjects. Sixty college students. Average age -- 19.8 years.

5. Organizational Environment. One hour tasks performed individually involving assembly of a complex model given the necessary parts.

6. Incentive Program. Piece rate incentive (40¢ per model and $2.50 hourly rate for pre- and postexperimental interviews). A control group receiving hourly compensation (no incentive) only were paid $2.50 per hour.

7. Incentive Method. Subjects were assigned to experimental conditions on a random basis.

8. Experimental Design. Lab experiment. In addition to the incentive payment conditions, subjects were assigned to one of 3 goal conditions: (a) quantity goal condition (to build 9 models per hour); (b) quality goal condition (to achieve at least 10 out of 12 possible quality points); and (c) no goal condition. Quantity was measured by counting the number of completed models. Quality was measured by supervisor ratings of the completed models.

9. Productivity/Performance Results. Subjects receiving piece rate bonuses produced 11.1 percent more models than those receiving hourly payment. There were no statistically significant differences between piece rate subjects and hourly pay subjects on the quality of production increase.

10. Other Results. Goal setting for quality and quantity of production affected actual goal achievement positively.

11. Intervening Factors. None reported.

12. Limitations of Results. Small number of subjects in each condition.

1. Reference. TURNAGE, J. and P. MUCHINSKY (1976) "The Effects of Reward Contingency and Participative Decision-Making on Intrinsically and Extrinsically Motivating Tasks," Academy of Management Journal 19, 3 (September): 482-489.

2. Conclusions. The amount of improvement in productivity that can be expected due to an incentive system depends on whether the task is intrinsically or extrinsically motivating.

3. Organization. None.

4. Subjects. Eighty male college students.

5. Organizational Environment. Subjects randomly assigned to intrinsically motivating task (stencil design -- perceptual motor task) or to extrinsically motivating task (card sorting).

6. Incentive Program. Two conditions: (a) Contingent reward (subjects given 50¢ or 15 minutes of experimental credit for each task completed); (b) Noncontingent (no incentive) condition (subjects paid $2.00 or given 1 hour of experimental credit for participating in the total experiment).

7. Incentive Method. Subjects were randomly assigned to choice or no choice groups concerning type of payment for performance.

8. Experimental Design. Lab experiment. In addition to conditions (a) and (b), a no payment condition was established for extra control. Performance measured as number of seconds working on the task.

9. Productivity/Performance Results. On the average in the card-sorting task, performance speed under the contingent (incentive) condition improved 7.9 percent over performance speed for the noncontingent (no-incentive) condition. For the stencil design task, the contingent condition exhibited a 17.7 percent increase in performance speed over the noncontingent (no-incentive) condition.

10. Other Results. When the task is interesting, supervisors have some flexibility in terms of allowing worker participation and developing incentives to influence productivity.

11. Intervening Factors. None reported.

12. Limitations of Results. Small number of subjects in each condition.

1. Reference. YUKL, G. and G. LATHAM (1975) "Consequences of Reinforcement Schedules and Incentive Magnitudes for Employee Performance: Problems Encountered in an Industrial Setting," Journal of Applied Psychology 60, 3: 294-298.

2. Conclusions. Continuous reinforcement schedules yield higher productivity than variable ratio schedules of reward. Variable ratio schedules with longer intervals between response and reward are more effective than those using shorter intervals.

3. Organization. Weyerhauser Company.

4. Subjects. Thirty-eight tree planters in North Carolina between January and June. Workers were primarily young, uneducated, and black males and females who could be classified as marginal workers because their productivity, turnover, and absenteeism was considered low by management. The turnover rate over the course of the study was approximately 40 percent.

5. Organizational Environment. Tree planting is a tiring, repetitious, and monotonous task. Workers plant most of the time during an 8-hour work day.

6. Incentive Program. Three conditions: (a) Continuous reinforcement condition ($2 bonus for each bag of trees planted), (b) Variable ratio - 2 condition ($4 bonus for each bag planted and correctly guessing one coin toss), (c) Variable ratio - 4 condition ($8 bonus for each bag planted and correctly guessing two coin tosses). All bonuses were paid in addition to the regular hourly salary ($2/hour).

7. Incentive Method. Tokens were handed out to planters immediately after planting a bag. They could be redeemed for cash later.

8. Experimental Design. Field experiment. A control group, receiving no special incentive, was also measured to identify changes in productivity attributable to seasonal fluctuations. Productivity was measured as the number of bags planted divided by the man-hours worked. Sample consisted of 13 workers in condition (a), 14 in condition (b), and 11 in condition (c).

9. Productivity/Performance Results. Productivity under condition (a) increased by 33 percent over the control group. Under condition (c), productivity increased by 18 percent over the control. There was an 8 percent decline in performance for condition (b). Condition (a) was highly effective in terms of cost effectiveness, while the other 2 conditions were not effective in terms of direct labor cost per bag.

10. Other Results. Contradicts findings of reinforcement studies in animals and previous study by same principal author using student subjects.

11. Intervening Factors. (a) Switch in work procedures in VR4 group -- from individual planting to planting in pairs. (b) Sample mortality.

12. Limitations of Results. (a) Subjects may have found coin toss game intrinsically pleasing or a form of disapproved gambling. (b) Small sample size. (c) Experimenters unable to control for worker characteristics and leadership potential. (d) Some of the incentive procedures appeared too difficult for the workers to understand.

1. Reference. YUKL, G., G. LATHAM, and E. PURSELL (1976) "The Effectiveness of Performance Incentives Under Continuous and Variable Ratio Schedules of Reinforcement," Personnel Psychology 29, 2: 221-231.

2. Conclusions. Continuous reinforcement schedules yielded higher productivity than no-incentive or variable ratio schedules. Due to a sense of worker uncertainty evoked by a variable ratio schedule, productivity under this incentive condition decreased even below the no-incentive rate.

3. Organization. Tree planters in rural North Carolina. Weyerhauser Company.

4. Subjects. Twenty-eight employees (16 males and 12 females). They were semi-literate seasonal workers, and consisted of whites and blacks.

5. Organizational Environment. Management considered the productivity of these workers as adequate prior to the incentives intervention. All subjects worked for the same supervisor.

6. Incentive Program. Four conditions: (a) No-incentive baseline period (hourly pay); (b) Continuous reinforcement -- $2.00 bonus in addition to hourly pay contingent upon planting 1000 trees; (c) Variable ratio - 4 schedule -- $8.00 bonus for planting 1000 trees if color of chosen marble can be guessed correctly in 2 consecutive tries, all in addition to hourly pay; (d) Variable ratio - 2 schedule -- $4.00 bonus for planting 1000 trees if color of 1 chosen marble can be guessed, in addition to hourly pay.

7. Incentive Method. In initial interviews, money was identified as a valued reinforcer to the workers. Each incentive condition was introduced consecutively over a 14-week period.

8. Experimental Design. Field experiment. Productivity measured for each worker as the number of trees planted per man-hour worked.

9. Productivity/Performance Results. Overall productivity increases attributable to the continuous reinforcement schedule were 2.9 percent over the no-incentive condition. Overall productivity decreased by 2.0 percent over the no-incentive condition in the VR-4 schedule. Productivity was approximately identical under the VR-2 schedule and the no-incentive condition.

10. Other Results. Performance is higher for those working under a higher rate of reinforcement. Eighty-two percent of the planters preferred a no-incentive condition with a flat hourly increase in salary. Workers did not like the uncertainty of the variable ratio schedule.

11. Intervening Factors. During pre-experimental baseline measurement, subjects appeared to be more highly motivated than usual.

12. Limitations of Results. (a) Small number of cases. (b) Contamination of the data due to temporary workers being introduced during certain experimental conditions. (c) Variable reinforcement schedules were inaccurately administered. (d) Subject mortality from one condition to the next makes comparison more difficult. (e) Some subjects may have found the marble-choosing game intrinsically pleasing in itself, while others found its gambling aspects unpleasant.

APPENDIX B. DEMONSTRATION PACKAGE SAMPLE OUTPUT

CYBERNETICS TECHNOLOGY OFFICE, D A R P A



INCENTIVE MANAGEMENT AID

Demonstration Package
developed by
CACI, Inc.-Federal

Incentive Management

Stimulating Worker Productivity Through Rewards for Performance

Research Performed by

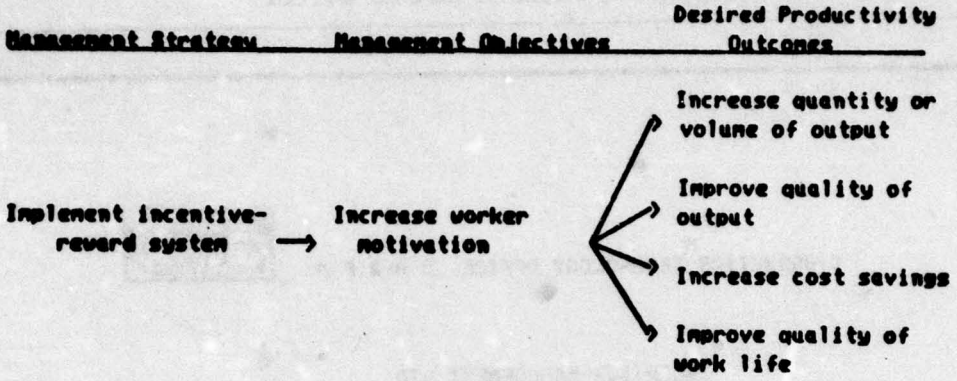
CACI, Inc.-Federal

Objectives

- Improve productivity in DoD by increasing worker motivation.
- Increase cost savings in DoD by improving individual and unit performance.
- Identify and design appropriate and effective incentive management strategies to achieve productivity and cost effectiveness goals in DoD.

Press CONTINUE

The Impact of Incentive Systems



Press CONTINUE

Relevant Application Areas for Incentive Management

- o DoD Logistics Community
- o Military Command and Control (C2)
- o Technical Training Programs
- o Federal, State, and Local Government
- o Private Sector Work Force

Press CONTINUE

MotivAid

A prototype automated executive aid for effective incentive strategy development and improved productivity.

You may examine the three prototype modules:

Module 1. Classifies and Displays Incentive Plans

Module 2. Displays Productivity Data on Incentives

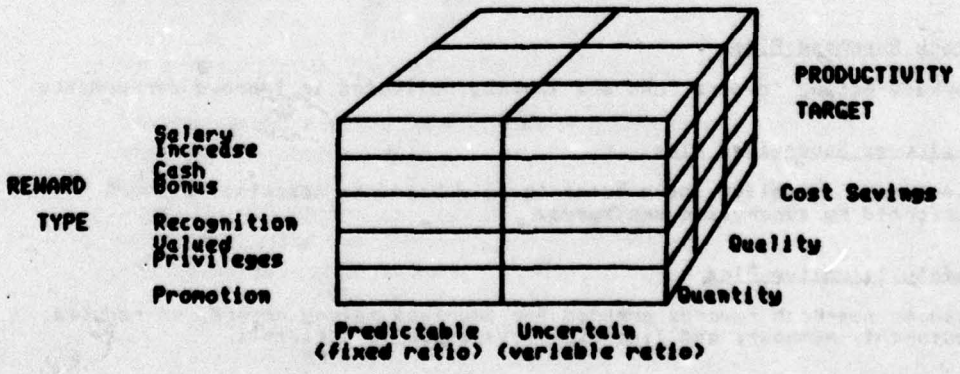
Module 3. Allows You to Design Job-Specific Incentive Plans

Enter a module number (1,2,or 3) or P to proceed to the final segment.

1

Module 1. Incentive Taxonomy and Examples

This module enables users to list and define specific incentive systems on the basis of a three-dimensional behavioral taxonomy of incentives.



Press CONTINUE

All reward systems can be classified by combining three dimensions:

REWARD TYPE	REWARD SCHEDULE	PRODUCTIVITY TARGET
1. Salary Increase	1. Predictable	1. Increase Quantity
2. Cash Bonus	2. Uncertain	2. Improve Quality
3. Recognition		3. Cost Savings
4. Valued Privileges		
5. Promotions		

To display specific examples of incentive systems, choose one index under each category.

For example :

'212' = 'Cash Bonus-Predictable-Quality Targeted Incentives'

212

Cash Bonus-Predictable-Improve Quality

Performance Target Plan

Employees are rewarded for meeting targeted goals.

Performance Bonus Plan

One-time monetary award in recognition of specific accomplishments.

Stock Purchase Plan

Workers become 'owners' and are thereby motivated to improve performance

Employees Supervised Plan

Management incentive where bonus is paid based on appraisal of work performed by supervised employees.

Safety Incentive Plan

Cash or non-cash rewards granted for improved safety record, or reduced equipment, manhour, and financial losses due to accidents.

Suggestion Awards Plan

Cash or noncash rewards for ideas that reduce cost and increase quality.

Press CONTINUE

Module 2. Incentive System Effectiveness

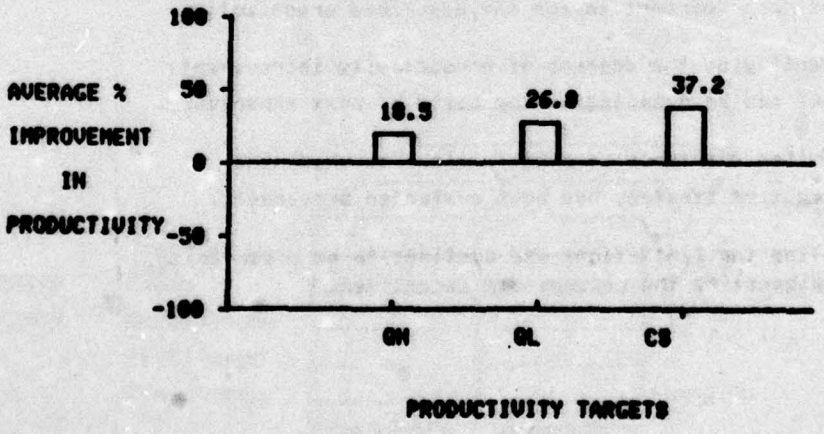
This module enables users to display productivity data on the effectiveness of specific incentive systems. The current generation of MotivAid is restricted to preliminary data on the effectiveness of five categories of incentives.

To obtain a bar graph of productivity data on the five incentive categories, enter the category type :

'1' = Salary Increase
'2' = Cash Bonus
'3' = Recognition
'4' = Valued Privileges
'5' = Promotion
'6' = Choose another module

2

REWARD TYPE : CASH BONUS



Press CONTINUE

MODULE 3. TAILORED INCENTIVE SYSTEM DESIGN

This module offers data to users on incentive management strategies that have proven effective for increasing productivity in tasks, job functions, or organizations that are similar to their own.

(The current generation of MotivAid operates on a limited data base.)

First, you must identify the characteristics of the personnel, task, organization, and job function for which you desire to design an incentive system.

Press CONTINUE

MotivAid will respond by:

- o Recommending alternative incentive strategies that are appropriate for the described organization.
- o Identifying the degrees of productivity improvement that can be expected on the basis of past experience.
- o Listing the types of organizations in which the incentive strategy has been evaluated previously.
- o Noting the limitations and cautions to be observed in implementing the recommended incentives.

Press CONTINUE

ORGANIZATIONAL DESCRIPTORS

Choose one answer for each descriptor. (Examples will be shown.)

Organizational Type

1. Military
2. Government
3. Manufacturing Firm
4. Nonmanufacturing Firm
5. Educational Institution

<3>

Targeted Job Function

1. Production Line
2. Clerical
3. Logistics (acquisition, supply, maintenance)
4. Training
5. Supervisory

<3>

Number of Workers Affected:

1. [1-50] 2. [51-150] 3. [>150]

<3>

Task Performance Can be Measured at:

1. Individual worker level
2. Work Team level
3. Organizational level

<1>

Work Standards Already in Effect for this Job Function ?

1. Yes 2. No

<2>

You have described a :

Manufacturing Firm
Logistics function
151 or more workers
Individual worker measurement level
No work standards in effect

Press CONTINUE

MotivAid Recommendations

Historical case in data base corresponding most closely to organizational description..... 2

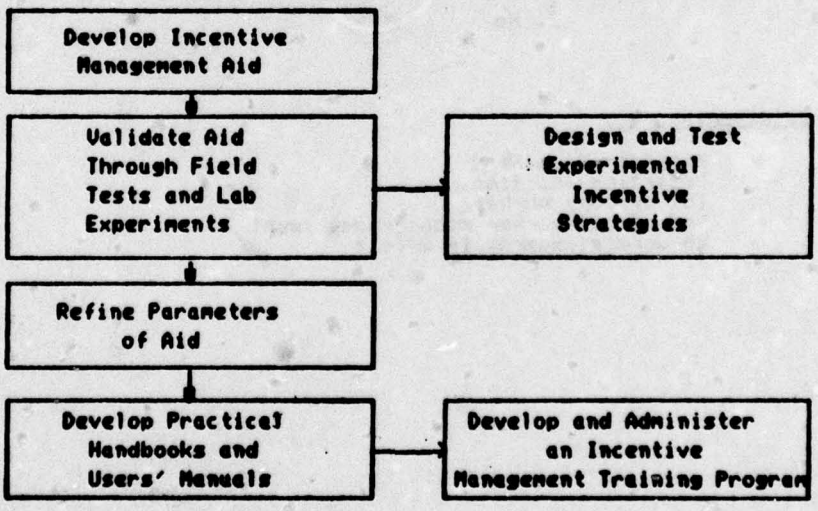
Number of recommended incentive strategies..... 2

Name of Incentive Plan	: Halsey Premium Plan
Description	: Timed saved plan
Productivity Improvement Expected	: 48% improvement in quantity
Type of Organization Tested	: Bethlehem Steel Corp. maintenance workers
Limitations	: o Requires extensive work and time studies o Need to 'sell' plan

Name of Incentive Plan	: Fein Productivity Sharing Plan
Description	: Group bonus paid as labor effort increases or hours decrease
Productivity Improvement Expected	: 15% improvement in quantity
Type of Organization Tested	: Sperry New Holland plant material handlers
Limitations	: Requires prior work measurement stu ies

Press CONTINUE

RECOMMENDATIONS FOR CONTINUED RESEARCH



END OF DEMONSTRATION

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Incentives	Manpower
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Rewards	Management Aid

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This interim technical report defines and identifies incentive management (rewards-for-performance) strategies that have been and can be employed to stimulate worker productivity. Recent theoretical and empirical studies are reviewed to evaluate the relative effectiveness of alternate incentive plans on performance. An inventory of popular incentive systems is compiled and a taxonomy that classifies incentives is designed. Finally, a computer-based demonstration package is developed to display how workforce supervisors and organizational development specialists can tailor incentive designs to the needs of

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specific organizations and job functions. The preliminary results indicate that incentive management is an effective tool to improve worker productivity and maximize manpower cost savings. However, tailored incentive strategies are required to meet the special contingencies of different organizations and tasks.

