



FINAL TECHNICAL REPORT
SEPTEMBER 1979

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PRODUCTIVITY IMPROVEMENT THROUGH INCENTIVE MANAGEMENT

PROGRESS TOWARD DEVELOPING A NEW MANAGEMENT RESOURCE

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FINAL TECHNICAL REPORT

BY
DR. BERTRAM I. SPECTOR
MG JOHN J. HAYES, USA (RET)

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PREFACE

This report documents research undertaken by CACI, Inc.-Federal to analyze the effectiveness of worker incentive programs and develop new management resources for promoting productivity improvement in industry and Government. The project team principals are MG John J. Hayes, USA (Ret) and Dr. Bertram I. Spector.

Dr. Janice Fain implemented the Incentive Management Demonstration Package on a stand-alone microcomputer. James McClave transferred the Demo Package to the Demonstration and Development Facility making the program more accessible to potential users. Chilton Rogers contributed to the data coding and analysis tasks. James Schlotter and Patricia Conrad edited this report and Karen Pownall and Paula Womble typed it.

We would especially like to acknowledge the guidance and suggestions received from Dr. Judith A. Daly and Dr. Stephen J. Andriole of the Cybernetics Technology Office, Defense Advanced Research Projects Agency, who monitored this project. Although the list of names is too lengthy to present here, we owe special thanks to the many Government officials in productivity, personnel, and research areas who provided constructive criticism of our work as we proceeded. Finally, we are grateful to Col. Claude Donovan, USA, who cooperated fully in our investigation of the pilot productivity study at Red River Army Depot.

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TABLE OF CONTENTS

	<u>Page</u>
CHAPTER 1. BACKGROUND.....	1-1
The Problem.....	1-1
Study Objectives.....	1-4
Interim Results.....	1-6
Effects of Civil Service Reform Act of 1978 on Public Employee Incentives.....	1-8
Organization of this Report.....	1-10
 CHAPTER 2. INCENTIVE MANAGEMENT: TAXONOMY DEVELOPMENT AND SUCCESSFUL TECHNIQUES.....	 2-1
Incentive Management Taxonomy.....	2-3
When Incentives Succeed.....	2-10
When Incentives Fail.....	2-14
Conclusions.....	2-16
 CHAPTER 3. RED RIVER ARMY DEPOT -- A CASE STUDY.....	 3-1
Background.....	3-1
Organization and Objectives.....	3-1
Major Conclusions.....	3-2
Subjects.....	3-2
Organizational Environment.....	3-2
Techniques Employed.....	3-3
Productivity Performance Results.....	3-4
Limitations of Results.....	3-5

TABLE OF CONTENTS (Cont'd)

	<u>Page</u>
CHAPTER 4. A MODEL OF THE INCENTIVE MANAGEMENT DECISION PROCESS....	4-1
Principal Determining Factors in the Decision Process.....	4-1
Types of Incentive Plans to be Considered.....	4-2
Possible Constraints on the Use of a Selected Incentive Plan...	4-3
Cost Considerations.....	4-4
Value of Expected Productivity Increase.....	4-5
The Workforce and the Environment in Which it Operates.....	4-6
Consideration of Employee Union Attitudes.....	4-6
Employee Reaction to the Incentive Strategy.....	4-6
Capabilities for Administrative Support.....	4-7
Productivity Measurement.....	4-7
A Model of the Incentive Management Decision Process.....	4-7
 CHAPTER 5. DESIGN OF AN INCENTIVE MANAGEMENT AID.....	 5-1
Database Modules.....	5-1
Demonstration Package.....	5-6
 CHAPTER 6. CONCLUSIONS, RECOMMENDATIONS, AND IMPLICATIONS.....	 6-1
Recommendations.....	6-1
Implications.....	6-3
 BIBLIOGRAPHY.....	 BI-1
 APPENDIX A. QUANTITATIVE CASES OF PRODUCTIVITY THROUGH INCENTIVE PROGRAMS: 1975-1978.....	 A-1

TABLE OF CONTENTS (Cont'd)

	<u>Page</u>
APPENDIX B. AVERAGE PRODUCTIVITY IMPROVEMENTS ACCOUNTED FOR BY INCENTIVE PLANS.....	B-1
APPENDIX C. DEMONSTRATION PACKAGE SAMPLE OUTPUT.....	C-1
APPENDIX D. INCENTIVE MANAGEMENT DEMONSTRATION PACKAGE: USER'S MANUAL.....	D-1

LIST OF TABLES AND FIGURES

Page

CHAPTER 2

Figure 1. Incentive Management Taxonomy.....2-3

Table 1. Dimensions and Detailed Attributes in the Incentives Taxonomy.....2-5

Table 2. Quantitative Taxonomy of Incentive Plans.....2-10

Table 3. The Most Effective Incentive Strategies in Various Contexts.....2-14

Table 4. The Least Effective Incentive Strategies in Various Contexts.....2-17

CHAPTER 4

Figure 1. Adoption of an Incentive Plan -- The Decision Process....4-7

CHAPTER 5

Figure 1. Incentive Management Aid.....5-1

EXECUTIVE SUMMARY

PROBLEM. As the rate of productivity has declined in the United States during a period of rapidly escalating labor costs, interest has grown among public and private sector workforce managers to identify effective and cost efficient techniques that enhance productivity outcomes. Presidential concern has been aroused and the 1978 Civil Service Reform Act mandates increased efforts toward stimulating productivity growth.

OBJECTIVES. The principal goals of this research effort are:

1. To develop a detailed taxonomy that classifies incentive approaches.
2. To identify, review, assemble, and analyze statistically quantitative data on 54 past and current extrinsic incentive programs to motivate productivity among personnel in public and private organizations.
3. To describe the workplace conditions under which incentive management is likely to succeed and fail.
4. To model the decision process of workforce supervisors in applying an incentive management approach.
5. To design a computer-based Incentive Management Aid that can serve workforce supervisors as a practical management resource.

FINDINGS

1. Over all 54 cases studied, incentive management techniques elicited gains in productivity of 23.1 percent and in performance quality of 11.0 percent.
2. The variable cash bonus appears to be effective under more varied circumstances than any other incentive strategy. This technique significantly improved performance quality 48.3 percent over all cases. It was the most effective technique in improving quality performance when applied to stimulate individual workers.
3. When immediate feedback on a worker's performance is provided, noncash recognition or special privileges are the most effective motivators. However, when performance feedback is delayed, variable cash bonuses yield significant quality and quantity gains,

while cash-noncash incentive mixes yield high productivity improvement.

4. Blue collar workers are motivated to significantly higher performance levels by recognition, privileges, and by disciplinary actions.
5. In training tasks, variable bonuses are most effective in assuring high quality.
6. When tasks are inherently interesting, variable bonuses yield significantly more effective qualitative results. With boring tasks, however, workers are stimulated by cash-noncash mixes and by recognition or privileges.

CONCLUSIONS. The results of this research effort confirm that incentive management techniques constitute a sound and effective methodology for improving productivity through workforce motivation. However, different incentive strategies should be chosen for optimal effectiveness depending on the varied contingencies of the particular work situation.

RECOMMENDATIONS.

1. The existing incentives database should be expanded and a contingency model that predicts productivity outcomes should be designed and validated.
2. The computer-based Incentive Management Aid should be implemented and a practical handbook of incentive techniques developed for practical use by public and private workforce supervisors.
3. Demonstration projects should be conducted to test incentive management effectiveness in the field and practical guidelines should be developed to assure the most efficient implementation and administration of incentive plans. Moreover, an incentive management training program for managers should be designed and conducted.
4. Innovative productivity standards and measures for common job functions, as well as executive level positions, should be identified.

THE PROBLEM

Requirements for Improvement in Public Sector Productivity

At a time when the Department of Defense (DoD) and other Government agencies face tight budgets, reduced availability of manpower and resources, persistent inflation, and public demands for greater efficiency in the delivery of services, increased national productivity efforts are required in the public sector. President Carter's establishment of the National Productivity Council in October 1978 symbolizes a new national impetus to overcome obstacles that have reduced productivity growth rates in the United States over the last two decades.

While productivity levels in the United States are high in comparison to many other industrial nations, our rate of productivity growth has fallen behind that of Japan, West Germany, and other countries. Latest available data indicate that productivity in the second quarter of 1979 suffered the sharpest rate of decline in the last five years. This decreasing rate of growth in U.S. productivity can be traced to many economic, energy-related, environmental, safety, and workforce-related obstacles (Task Force on Productivity and Workforce Effectiveness, 1978a). Public sector performance is rapidly becoming a crucial element in the equation to improve national productivity efforts. Government is a major employer and accounts for a third of the Gross National Product. Moreover, interdependencies between Government and the private sector through taxes, subsidies, regulations, monetary policies, and public services, stress the importance of enhanced public sector productivity. Finally, requirements for more and improved services from Government agencies already straining under reduced budgets and manpower constraints demand renewed public productivity efforts.

These needs can be well illustrated at the local level. Red River Army Depot in Texarkana, Texas conducted a Pilot Productivity Study in 1978 at the instruction of the U.S. Army Depot Systems Command (DESCOM). This Depot experienced a significant reduction in maintenance and supply personnel authorizations over the last few years as well as a simultaneous increase in workload levels. In combination, these factors necessitated dramatic improvements in depot efficiency and productivity in terms of lowered costs and more efficient use of manpower and other resources. The Depot study engaged many diverse techniques to increase efficiency and productivity tailored to that particular installation (Red River Army Depot, 1978). As a result, productivity in some operations improved as much as 44 percent.

Candidate Methods for Improving Productivity

There are several basic methods that can be used to stimulate productivity improvement. Each technique is often focused on influencing several major productivity outcome variables:

- Increasing cost effectiveness (a cost/benefit measure).
- Improving the correlation between goods and services produced and organizational goals (an effectiveness measure).
- Reducing the time spent producing a good or service (an efficiency measure).
- Increasing the quantity of a good or service (an efficiency measure).
- Improving the quality of a good or service (an effectiveness measure).
- Improving the quality of worklife for the workers involved (a job satisfaction measure).

Four basic categories of productivity improvement techniques can be employed by management. While the private sector has pioneered each of them, many variants have been applied in the public sector. Restrictive

regulations at one time would have hampered many such experiments. However, the 1978 Civil Service Reform Act has helped to ease these restrictions.

1. Capital Investment. The introduction of new or improved technology and capital goods, such as buildings, equipment, tools, and supplies, can contribute to productivity increases. In the private sector, capital investment contributes up to 60 percent of productivity increases according to one source (Task Force on Productivity and Workforce Effectiveness, 1978a). However, Federal agencies rarely have capital investment programs or budgets and are often averse to investing money in capital that may have long-term rather than short term benefit.
2. Work Measurement and Work Standards. The capability to measure work activities and collect longitudinal data on performance offers managers improved methods of control and techniques for establishing performance standards and baselines in given functional areas. Moreover, work measurement and standards, by themselves, can provide feedback to workers and thereby increase productivity by as much as 80 to 85 percent according to one source (Hesse, 1977).
3. Quality of Worklife Improvements. Research has indicated that improving the quality of worklife in such ways as redesigning jobs, providing more opportunity for worker participation, improving work conditions, and providing job enrichment, can also enhance productivity outcomes.
4. Motivation and Measurement. Effective utilization of workforce resources through scientific management and motivational techniques can improve productivity. Recent innovations in the Federal sector, such as the development of the Senior Executive Service and upgraded performance appraisal techniques, are likely to support increased productivity growth rates. Moreover, the current Civil Service Reform Act provides Federal workforce supervisors a more flexible hand at motivating high- and mid-level managers as well as lower level employees, through work incentives that are linked to superior work performance. Financial as well as nonfinancial incentives are now encouraged. The removal of structural or organizational disincentives to perform more productively would also stimulate greater motivation to exert more productive effort. Several researchers have estimated that incentive plans can improve productivity by 50 to 60 percent (Hesse, 1977; Fein, 1976; Rice, 1977).

Each of these candidate techniques to improve productivity has been tested to varying degrees. The first two have received comparatively more attention than the last two, in part due to the greater ease in quantifying and observing the effects of capital investments and work measurement on productivity. As research has indicated, however, quality of worklife projects and motivation and management strategies can also dramatically improve productivity. Such improvement techniques require further definition, testing, and evaluation to validate their effectiveness.

STUDY OBJECTIVES

This study focuses on the fourth improvement strategy identified above -- motivation and management -- and, in particular, addresses the use of incentive management as a way of directly stimulating increased productivity at the worker level. Incentives can be defined as inducements that attempt to direct the performance of an employee or supervisor toward management-desired goals. These motivational management tools can take the form of monetary bonuses for above standard performance, nonmonetary supervisory recognition of outstanding work, or time off with pay as a reward for superior productivity. Only these types of positive extrinsic incentives are examined in this study since they are easier to identify, observe, implement, measure, and control than intrinsic work reward programs, such as job enrichment, participative goal setting, and feedback techniques. Extrinsic incentives are often successful motivators if they are granted contingent upon superior performance, valued by the workers, and tailored to the needs of the personnel, job function, and organization.

Incentive management is a fruitful approach to pursue at this time for various reasons:

- It has the potential to be a highly effective and efficient method to improve productivity on the basis of research conducted thus far.

- Incentive management and the linkage between compensation and superior performance are encouraged by the 1978 Civil Service Reform Act.
- This technique is potentially less expensive than a major capital investment program, and yet has considerable payoff potential.
- Government and DoD agencies have indicated great interest recently in the potential application of incentive strategies to improve productivity.
- Only separate, uncoordinated, and unsystematic efforts to link incentives and productivity have been pursued by other researchers.
- Many different types of incentives have been tested, but no reliable data comparing the effectiveness of each type are available.

Overall, this study identifies and analyzes the management consequences of using incentive techniques as a means of stimulating performance and productivity in a variety of work situations and in a number of organizations in both the public and private sectors. The present effort attempts to provide a systematic framework of the available empirical research that has been conducted on the productivity impacts of incentives. The basic question that underlies this study is to identify the workplace factors and conditions under which extrinsic incentive strategies are likely to succeed in improving worker productivity and when they are likely to fail.

The specific objectives of this research effort are as follows:

- Identify, review, and assemble quantitative information on past and current extrinsic incentive programs to motivate personnel in public and private organizations.
- Develop a general qualitative taxonomy of incentive 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 that can serve as a practical management resource.

INTERIM RESULTS

CACI's research effort on incentives and productivity through the middle of FY79 has indicated not only the reasonableness of the approach taken, but also the likely acceptance of the statistical conclusions and the proposed computer based Incentive Management Aid by DoD and other potential Government users.

Technical Approach

The technical approach consists of the following four steps:

1. Recent theoretical and empirical studies that evaluate the effectiveness of incentive programs on worker productivity were reviewed.
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 trends among 54 separate evaluations of incentive programs were identified and described to provide preliminary statistical 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 assess productivity data on potential incentive strategies as well as tailor incentive designs to the needs of a specific organization or job function.

Preliminary Conclusions

On the basis of a statistical analysis of the 54 cases in the sample database, it was concluded that incentive management programs have different impacts on productivity depending on the type of organization or job function in which they are implemented. Mixtures of cash and nonmonetary incentives improved quality only a small amount (1.6 percent) in military organizations. In service-oriented nonmanufacturing firms and in educational institutions, however, productivity improved by 60 percent and 33.5 percent, respectively, when a cash/noncash incentive mix was used. Productivity in clerical tasks improved 39.7 percent when this same incentive mixture was implemented.

Nonfinancial incentives that grant individual recognition or special privileges in exchange for superior performance also have significant effects on productivity. Again, productivity in nonmanufacturing companies and in clerical tasks increased an average of 87 percent when these relatively inexpensive incentives were used. The quality of performance in educational settings improved 21.9 percent when these socially-oriented incentives were implemented.

Finally, one category of very potent but inadequately researched incentives -- variable cash bonuses -- appears to have marked effects on improving both productivity (up 40 percent) and quality of performance (up 48.3 percent). These incentives typically are presented on an uncertain schedule -- workers are not rewarded for every instance of superior performance. Therefore, they are motivated to perform at high levels all of the time since reinforcement is unpredictable. Operant conditioning literature postulates that these variable incentives are likely to be highly effective in maintaining desired work behaviors.

Overall, incentive management was found to be 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 contingencies of different organizations and job functions targeted for this type of motivational engineering.

Incentive Management Aid

An interactive computer aid for workforce supervisors, managers, and organizational development experts has been designed that can help them make effective incentive decisions tailored to the unique requirements of the job they wish to influence. This system is designed to:

- Integrate quantitative data on previously evaluated incentive plans, and
- Provide contingency based analyses of incentive plans that are likely to be appropriate and effective in certain organizations.

A demonstration package has been developed and implemented on a micro-computer to provide a preview of the final aid. As currently designed, the prototype system will:

- Display, classify, and describe popularly used incentive plans,
- Display productivity data on incentives, and
- Recommend tailored, job-specific incentive plans.

Overall, this Incentive Management Aid provides an easy method to obtain productivity data on incentive strategies and can help supervisors choose the best incentive plan to motivate their workers.

EFFECTS OF CIVIL SERVICE REFORM ACT OF 1978 ON PUBLIC EMPLOYEE INCENTIVES

The 1978 Civil Service Reform Act contains several provisions that relate directly to productivity improvement and the use of incentive management

in the Federal Government (U.S. Civil Service Commission, 1978; Office of Personnel Management, 1978, 1979). These formal changes in the Federal civilian workforce have already heightened interest in incentive management and increased demand for motivational analyses and tools to assist Federal managers implement these innovations smoothly. Some of the relevant provisions include:

- New employee performance appraisal systems will be developed for each agency that will, in part, help establish performance standards against which superior performance can be measured and incentives granted.
- A merit pay system will be established for managers and supervisors in grades GS-13 through GS-15. This system will directly link pay increases to performance on the job rather than length of service, and, thus, will add meaningful incentives aimed at improving worker productivity. On the basis of a formal performance appraisal, merit increases will be awarded in direct relation to a distinctive record in cost efficiency, timeliness, productivity, and quality of work.
- The Senior Executive Service (SES) will be established to include managers at GS-16 through Executive Level IV or their equivalents. The objectives of SES are to attract, retain, and motivate (A-R-M concept) top managers in the Federal system. To date, approximately 98 percent of those eligible for the SES have decided to join (approximately 8,000 managers). The SES has the following incentive provisions:
 - Up to 5 percent of SES executives may be awarded the rank of Meritorious Executive and receive a \$10,000 lump sum award.
 - Up to 1 percent may be awarded the rank of Distinguished Executive and receive a \$20,000 lump sum payment.
 - Up to 50 percent may receive performance awards in amounts up to 20 percent of base salary.

ORGANIZATION OF THIS REPORT

The remainder of this report summarizes the analyses and conclusions of the study.

- An expanded empirical taxonomy of incentives is developed (Chapter 2).
- The coding of the sample database of 54 cases is expanded to enable more detailed description of the conditions under which incentive strategies succeed and fail (Chapter 2).
- The database is reanalyzed statistically (Chapter 2).
- The pilot productivity study conducted at Red River Army Depot is described (Chapter 3).
- A model of the incentive management decision process is designed to help identify the crucial decision points that are considered by operational workforce managers (Chapter 4).
- The design for an interactive, computer based Incentive Management Aid is expanded (Chapter 5 and the Appendix).
- Recommendations on the broader application of incentive management techniques for productivity enhancement in various types of organizations in the private and public sectors are discussed (Chapter 6).

CHAPTER 2. INCENTIVE MANAGEMENT: TAXONOMY DEVELOPMENT AND SUCCESSFUL
TECHNIQUES

UTILIZATION OF INCENTIVES

In the Private Sector

Twenty-six percent of all U.S. workers are covered by work incentive plans that are targeted at improving some aspect of productivity (Fein, 1976). In Europe, over 50 percent of all workers are covered by such plans (Belcher, 1975). Incentives are more prevalent in manufacturing than in nonmanufacturing firms. Out of 291 firms surveyed by one researcher, 59 percent of the manufacturing companies utilized incentive plans, whereas only 6 percent of the nonmanufacturing firms employed them (Rice, 1977).

By far, the most common incentive techniques are standard hour plans in which workers are given bonuses for rapid task completion within an established time standard (covers 61 percent of surveyed workers) and straight piecework plans in which employees are compensated based on the number of products or services they complete (covers 35.9 percent of surveyed workers) (Rice, 1977).

First line, middle, and top management levels in the United States are also included in broad incentive management strategies to enhance productivity growth. The specific types of incentive plans used to motivate executives, however, are often of a different nature than those used to stimulate worker productivity. In a survey of the top 200 U.S. manufacturing firms, 187 reported having long term executive incentive plans (93.5 percent) (Cook and Company, 1978; Rice, 1977). These consist primarily of stock option plans, performance grants, and profit sharing.

Unlike production line workers, the development of work standards and measurement for management level personnel is often more difficult and abstract. However, above standard managerial performance against which incentives are offered has been measured by tracking cost and budgetary performance, the productivity of supervised employees, and overall company profits.

In the Public Sector

The Federal Incentives Awards Program has made significant strides toward lowering Government costs and thereby enhancing overall productivity results (OPM, 1979). Investments in cash rewards amount to only 0.1 percent of the entire Federal payroll. However, the benefits in measurable cost savings to the Government averaged \$11 for every \$1 provided in incentive cash grants in fiscal year 1978.

By far, Government-wide benefits are highest in the Federal suggestion program, in which cash awards are granted to employees if their suggestions are adopted and cost savings result. The benefit-to-award ratio averaged 38.5 to 1 in FY78. The special achievement cash awards, on the other hand, were less effective incentive management techniques and maintained a benefit-to-award ratio of only 7.3 to 1 Government-wide. Over all the military services, the military awards program that offers cash rewards for superior performance accrued a measurable benefit for the Department of Defense of \$37.3 million with an investment of \$1.0 million in incentive awards paid out.

These cash awards are cost effective, in part, because of an attitude of pay deprivation that is prevalent among public employees. In a survey of civil servants in Texas, one researcher (Moore, 1977) found that after the intrinsic satisfactions obtained by serving clients, extrinsic rewards such as increased cash bonuses ranked high among desired goals.

INCENTIVE MANAGEMENT TAXONOMY

Given this widespread use of extrinsic incentives plans at worker and management levels in the public and private sectors, it would be useful for practitioners and researchers alike to have a systematic method for defining, classifying, and designing incentive strategies that are most appropriate for their purposes. A taxonomy has been developed for this purpose.

Thoughtful incentive management design tailored both to the manager's goals and style and the employees' needs is the key to effective incentive implementation and productivity growth.

To be effective, incentives must certainly be perceived as valuable and worthwhile rewards by workers and must be clearly linked to the attainment of performance goals that are, in turn, viewed as being achievable if sufficient worker effort is expended (Lawler, 1973). But managerial style and prerogatives are the principal factors involved in deciding whether or not incentive management is in fact used as opposed to other productivity maximizing techniques, and, if incentives are chosen, in identifying the incentive types that are most likely to reflect managerial style as well as meet organizational requirements and constraints.

The appropriate and most effective incentive plans can be chosen by managers if the crucial characteristics of the plans match these employee and managerial needs (see Chapter 4 for more on this decision process). The incentives taxonomy that has been developed helps to classify specific plans using five descriptive dimensions that include fifteen detailed attributes. Figure 1 presents these dimensions and attributes.

Starting at the base of the triangle, the definitional dimension includes attributes that identify the essence of an incentive plan -- the type of reward, its intended targets, its size, whether recipients get incentive

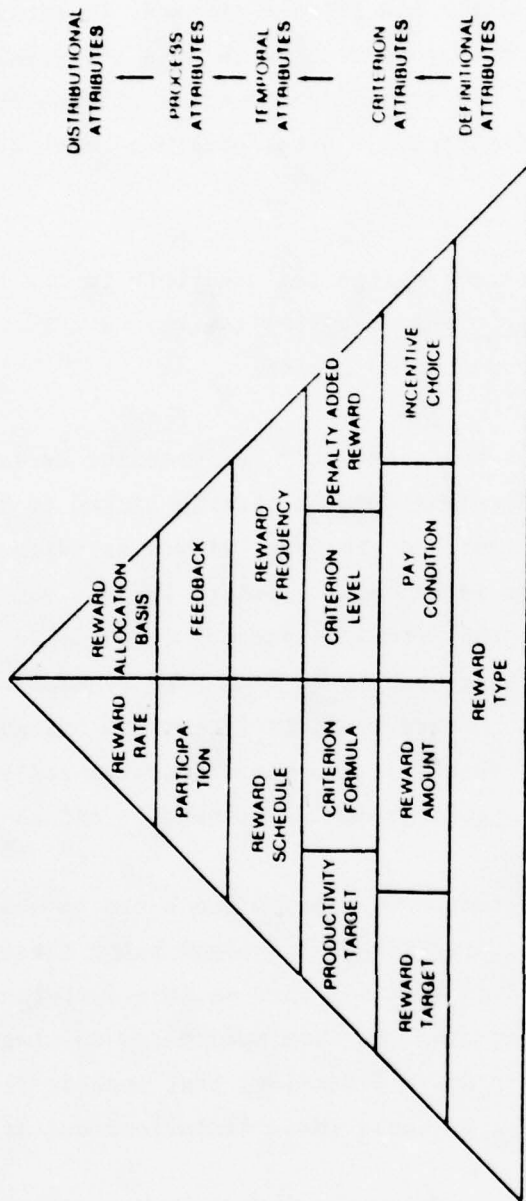


Figure 1. Incentive Management Taxonomy

pay only or in combination with a minimum wage, and if recipients have a choice among rewards. The criterion dimension deals with management objectives and standards employed to assess productivity enhancement. It includes such factors as the productivity targets, the formula upon which productivity is measured, the present levels of productivity at which different amounts or percentages of the reward are granted, and the established performance thresholds at which penalties or added rewards are provided.

The temporal dimension identifies the frequency and schedule with which rewards are granted based on superior performance. The process dimension includes such characteristics as the degree of employee participation in developing or maintaining incentive systems and the nature of performance feedback incorporated in the plan. Finally, the distribution dimension deals with the rate at which rewards are distributed and the allocation method among employees.

The values that each of these attributes can assume are detailed in Table 1. Essentially, by combining one value from each of the fifteen attributes, a user can identify a unique class of incentives. By combining values in different ways, users can experiment and innovate toward designing incentive plans that accommodate employee and managerial needs as well as organizational constraints and opportunities. Given the number of values identified in Table 1 for each attribute, a total of 25.92 million unique incentive categories can be identified in this taxonomy!

Distribution of Incentives Within the Taxonomy

A comparatively small number of these 25.92 million incentive categories have been filled with incentive plans that have been tested and implemented in actual organizational contexts.

TABLE 1
Dimensions and Detailed
Attributes in the Incentives Taxonomy

DEFINITIONAL VARIABLES

Reward Type : The inducement.

1. Salary increase
2. Cash bonus
3. Recognition
4. Valued privilege: Excused
5. Valued privilege: Enabled
6. Recognition, privileges
7. Recognition, privileges, and cash bonus
8. Disciplinary action
9. Cash bonus and valued privileges (enabled), including Scanlon Plan

Reward Target: Entity whose performance is measured; recipient(s) of reward.

1. Worker group
2. Individual worker
3. Individual manager
4. Manager and workers

Reward Amount: Amount granted per unit of superior performance as perceived by offeror or objectively assessed.

1. Small
2. Large

Pay Condition: Source of income.

1. Incentive alone
2. Guaranteed time-based wage if productivity criterion is not achieved

Incentive Choice: Does recipient choose among several incentives ("cafeteria style")?

1. Yes
2. No

TABLE 1
Dimensions and Detailed Attributes
Continued

CRITERION VARIABLES

Productivity Target: Preset productivity objective communicated to reward targets prior to incentive system implementation.

1. Quantity target
2. Quality target
3. Cost savings target
4. Time savings target
5. Quantity and quality

Criterion Formula: Basis upon which the productivity target is established.

1. Time and motion study (goods or services produced per unit time)
2. Profit calculation
3. Productivity value
4. Cost savings
5. Subjective performance appraisal

Criterion Level: Preset levels of the productivity criterion at which different amounts or percentages of the reward are granted.

1. Single level
2. Multiple levels

Penalty/Added Reward Conditions: Preset regulations on achieving criteria that add penalties or extra rewards.

1. Penalties if quantity criterion is not met
2. Penalties if quantity criterion is met, but quality criterion is not
3. No penalties if criterion is not met
4. Additional rewards if quantity and/or quality criteria are met
5. Not applicable/None

(Continued)

TABLE 1
Dimensions and Detailed Attributes
Continued

TEMPORAL VARIABLES

Reward Frequency: How many responses required to receive reward.

1. Low (every time or almost every time)
2. High

Reward Schedule: Preset schedule upon which rewards are granted.

1. Fixed ratio - each time/response related
2. Variable ratio - varying rewards/response related

PROCESS VARIABLES

Participation: Degree of participation of reward target(s) in developing or maintaining incentive systems.

1. No participation
2. Participation

Performance Feedback: Nature of feedback to workers on their criterion performance.

1. Irregular
2. Regularized but delayed
3. Regularized and immediate

DISTRIBUTION VARIABLES

Reward Rate: Proportion of savings distributed to the reward target.

1. Target gets a set percentage of gain in improved productivity
2. Target gets a reward proportional to increases in performance over baseline with no ceiling
3. Target gets a reward proportional to increases in performance over baseline but with an established ceiling

Reward Allocation: Distribution algorithm for incentives.

1. To all equally based on averaged group performance
2. To all based on individual performance
3. To all equally based on lowest performer's work
4. To all equally based on highest performer's work
5. To all based on individual's salary level

Hayes, Spector, and Fain (1979) contains a detailed account of the derivation of a sample database of 54 cases in which the impact of extrinsic incentives was evaluated quantitatively in industrial, governmental, military, educational, and laboratory settings.¹ Table 2 indicates the distribution within the taxonomy of various incentive plans from this database. Reading down each column, it is possible to identify how each of the six principal incentive strategies differs empirically from the eleven other incentive attributes in the taxonomy that could be coded in the database. Each "X" in the table indicates where the majority of cases in the database fell on each attribute. Using this table, the trends in incentive strategy usage can be described in detail:

- Salary Increase. Merit pay principles usually apply organization-wide once implemented. Increases tend to be small, and are granted at regular and established review periods despite the fact that a worker may be producing at above-standard rates over an extended period of time. Surprisingly, the amount of salary increase tends to be more a function of a percentage increase that has been fixed by management than of worker effort. Quantity rather than quality criteria are often judged when deciding on salary increases.
- Predictable Cash Bonuses. These bonuses tend to be based on individual performance and are of small amounts. They are often granted along with a guaranteed wage, but are also used independently, such as in sales commissions and piece rates. These bonuses are offered proportionately to the amount produced.
- Variable Cash Bonuses. These types of cash bonuses do not reward workers for every instance of superior performance, but rather set up a variable, and thus an uncertain, schedule of reinforcement. These bonuses tend to be larger than the predictable kind, but are also granted proportionately to production levels.
- Cash and Noncash Plans. These mixed plans tend to be oriented toward individual targets and low cost awards. They are often granted based on fixed award rates despite

¹ Appendix A contains descriptive summaries of each case in the database.

TABLE 2
Quantitative Taxonomy of Incentive Plans

Incentive Types Incentive Attributes	Cash Plans			Cash and Noncash Plans		Noncash Plans
	Salary Increase	Predictable Cash Bonus	Variable Cash Bonus	Recognition/Privilege (Excused and Enabled)/Cash Bonus	Recognition/Privilege (Excused and Enabled)	Disciplinary Action
Frequency	1	33	7	6	6	1
<hr/>						
<u>Reward Target</u>						
Group	X					X
Individual		X	X	X	X	X
<hr/>						
<u>Reward Amount</u>						
Small	X	X		X	X	
Large			X			X
<hr/>						
<u>Pay Condition</u>						
Incentive Alone		X				
Guaranteed Wage	X	X	X	X	X	
<hr/>						
<u>Reward Frequency</u>						
Low						X
High	X	X	X	X	X	
<hr/>						
<u>Reward Schedule</u>						
Fixed Ratio	X	X		X	X	X
Variable Ratio			X			
<hr/>						
<u>Reward Rate</u>						
Fixed Percentage	X			X	X	
Proportional Return		X	X			X
<hr/>						
<u>Allocation Basis</u>						
Average Productivity	X					X
Individual Productivity		X	X	X	X	
<hr/>						
<u>Participation</u>						
None		X	X	X	X	
Some	X					X
<hr/>						
<u>Performance Feedback</u>						
Delayed		X		X	X	
Immediate	X	X	X			
<hr/>						
<u>Productivity Target</u>						
Quantity	X	X	X			
Quantity & Quality				X	X	X
<hr/>						
<u>Cafeteria?</u>						
Yes					X	
No	X	X	X	X		X
<hr/>						

the level of production. Feedback under these plans is often delayed.

- Recognition and/or Privileges. These noncash incentives are usually granted based on individual productivity rates and are low cost alternatives for management. They are often presented to employees in "cafeteria" fashion in which workers are given a choice of rewards for above-standard performance. The quantity and quality of performance are usually evaluated when offering these types of incentives.
- Disciplinary Action. This negative incentive is usually meted out against work teams as opposed to individual workers. These penalties are often activated by just a few major decreases in performance quality. They are usually graduated in severity in relation to the degradation in performance.

WHEN INCENTIVES SUCCEED

Further analysis of the sample database provides an indication of the relative effectiveness of incentive management techniques under a variety of conditions. Each of the 54 cases in the database was recoded since the analysis conducted in the interim report (Hayes, Spector, and Fain, 1979) to reflect a more detailed coding system that expands the number of descriptive variables from 7 to 36. In addition to the more refined coding of incentive attributes that was described earlier, the following characteristics were coded to measure the context and outcomes of incentive management experiments:

Organizational/Task Attributes

Organization Type
Total number of workers targeted for
incentive management
Worker unit size
Worker type
Task definition
Intrinsic task interest
Work stress
Established work standards
Prior organization climate

Productivity/Effectiveness Attributes

Percentage improvement in productivity:
quantity
Percentage improvement in performance
quality
Longevity of productivity response
Did quantity increase?
Did quality increase?
Did cost savings improve?
Did time savings result?
Did job satisfaction improve?

Experimental Attributes

Study type
Number of subjects/workers in the
experimental condition

Cautionary Notes

Since the subsequent analysis is conducted on a small sample database, several limitations must be noted.

1. The database upon which statistics are calculated is comparatively small and is artificially bounded by a narrow range of publication dates (1975-1978). The sample of incentive evaluation tests that constitute the database should 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 are aggregated over all incentive types, all organizational types, and all job functions or tasks. Because measurement criteria often differ from test to test and from organization to organization, these aggregate findings should be viewed as only very general indicators of potential productivity improvement attainable by using incentive management. The remaining tables in 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. 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 most 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.

Results

Table 3 presents the conclusions from a detailed statistical analysis of the database.² Over all 54 cases, incentive management techniques elicited gains in productivity of 23.1 percent and in performance quality of 11.0 percent. More specifically, variable cash bonuses significantly improved performance quality 48.3 percent over all cases, and disciplinary action evoked a 31 percent improvement in quality (but only in one case).

Under various situations, particular incentive plans proved most effective in enhancing productivity outcomes. The variable bonus technique appears to be effective under more varied circumstances than any other.

² Appendix B contains more specific results on the average percentage gains in productivity due to incentive management. Significance tests were conducted using analysis of variance techniques.

TABLE 3
The Most Effective Incentive Strategies in Various Contexts^a

Situational Characteristics	Incentive Plans			
	Variable Cash Bonus	Cash Bonus and Noncash Incentives	Recognition/Privilege	Disciplinary Action
All cases	Quality up 48.3%			Quality up 31.0%
Group Reward Target				Productivity up 46.0%
Individual Reward Target	Quality up 48.3%			
Incentive Pay Only, no Guaranteed Wage	Productivity up 40.0%	Productivity up 41.9%		
Few Responses Required to Obtain Reward				Quality up 31.0%
Many Responses Required to Obtain Reward	Quality up 48.3%			
Individual Performance Used as Basis for Reward Allocation	Quality up 48.3%			
Participation in Maintaining Incentive Systems	Quality up 48.3%			
Delayed Feedback of Performance	Quality up 48.3% Productivity up 40.0%	Productivity up 30.7%		
Immediate Feedback of Performance			Productivity up 87.0%	
Fixed Set of Incentives Available, no Cafeteria Choice		Productivity up 35.0%	Productivity up 87.0%	Productivity up 46.0%
Productivity Target Only		Productivity up 41.9%	Productivity up 87.0%	Productivity up 31.0%
Productivity & Quality Targets	Quality up 48.3%			Quality up 31.0%
Educational Institution		Productivity up 41.9%		
Blue Collar Workers			Productivity up 87.0%	Productivity up 46.0%
Training Tasks	Quality up 48.3%			
Interesting Tasks	Quality up 48.3%			Quality up 31.0%
Boring Tasks		Productivity up 35.0%	Productivity up 87.0%	
Field Tests				Quality up 31.0%
Lab Tests	Productivity up 40.0%	Productivity up 41.9%		

^a Only contexts in which statistically significant differences were found among incentive types are presented. Improvements of 30 percent or more are indicated.

Other conclusions suggested by the research can be summarized as follows:

- When work teams are rewarded, disciplinary action is most effective in improving productivity. When individual workers are the unit of analysis at which awards are granted, variable cash bonuses are most effective in improving quality performance.
- When incentive pay is the only form of compensation, variable cash bonuses and cash-noncash mixes are the most appropriate options.
- When rewards are granted based upon few above-standard responses, quality can be improved substantially by using disciplinary incentives. When rewards are granted only after many above-standard responses, quality usually can be upgraded by using variable bonuses.
- When reward allocation is based on the individual worker's productivity rather than on teamwork results, variable cash bonuses are most effective.
- When incentive systems encourage employee participation, variable bonuses yield greater performance quality.
- When immediate feedback is provided, noncash recognition or special privileges are most effective. On the other hand, when feedback on performance is not immediate, variable bonuses yield significant quality and quantity gains, while cash-noncash incentive mixes yield high productivity improvements.
- When there are a fixed set of incentives available and the employee is not given a cafeteria choice, productivity improvement can be obtained by using cash-noncash mixes, recognition or privileges, and disciplinary actions.
- When management objectives prescribe productivity goals only, cash-noncash mixes, recognition or privileges, and disciplinary actions are most effective. When productivity and quality goals are to be achieved, variable cash bonuses yield the highest quality gains.
- In educational institutions, cash-noncash incentive mixes are the most effective plans.

- o Blue collar workers are motivated to significantly higher performance levels by recognition or privileges and by disciplinary actions.
- o In training tasks, variable bonuses are most effective in assuring high quality.
- o When tasks are inherently interesting, variable bonuses yield significantly more effective qualitative results. With boring tasks, on the other hand, workers can be stimulated by cash-noncash mixes and by recognition or privileges. (These results, in part, dispute the assertions of Deci (1972, 1976) and the intrinsic motivation school who believe that extrinsic rewards can reduce intrinsic motives and resulting quality performance.
- o Finally, among all the field tests in the sample, disciplinary actions yielded the most effective results. Among all the laboratory experiments, variable cash bonuses and cash-noncash incentives were most effective.

WHEN INCENTIVES FAIL

Table 4 summarizes conditions under which several incentive systems are likely to fail in achieving high productivity or performance quality improvements (see Appendix B for more detailed statistics).

- When the performance of work teams is measured for potential rewards, predictable cash bonuses yield the lowest productivity gains. When individual workers are measured, predictable bonuses elicit low performance quality improvements as do cash-noncash incentive mixes and recognition or privileges.
- When rewards are offered on the basis of only a few above-standard responses, predictable bonuses yield the lowest performance quality. On the other hand, when rewards are granted only after a large number of above-standard responses, cash-noncash mixes and recognition or privileges produce low quality outcomes.

TABLE 4
The Least Effective Incentive Strategies in Various Contexts^a

Incentive Plans Situational Characteristics	Predictable Cash Bonus	Variable Cash Bonus	Cash Bonus and Noncash Incentives	Recognition or Privilege
All Cases	Quality up 6.4%		Quality up 0.8%	Quality up 2.9%
Group Reward Target	Productivity up 6.4%			
Individual Reward Target	Quality up 6.4%		Quality down 2.0%	Quality up 2.9%
Few Responses Required to Obtain Reward	Quality down 5.0%			
Many Responses Required to Obtain Reward			Quality up 0.8%	Quality up 2.9%
Individual Performance Used As Basis for Reward Allocation	Quality up 6.4%		Quality down 2.0%	Quality up 2.9%
Participation in Maintaining Incentive System	Quality up 6.4%		Quality down 2.0%	Quality up 2.9%
Delayed Feedback on Performance			Quality up 0.8%	Quality up 2.9% Productivity up 9.2%
Immediate Feedback on Performance		Productivity up 8.0%		
Productivity Target Only		Productivity up 8.0%		
Productivity and Quality Targets	Quality up 6.4%		Quality up 0.8%	Quality up 2.9%
Educational Institution	Quality down 3.3%			
Blue Collar Workers		Productivity up 8.0%		
Interesting Tasks	Quality up 8.9%		Quality down 2.0%	Quality up 2.9%
Boring Tasks		Productivity up 2.0%		
Field Tests			Quality up 0.8%	Quality down 1.9%

^a Contexts in which statistically significant differences were found among incentive types are presented. Improvements of less than 10 percent are indicated.

- When rewards are allocated on the basis of individual productivity, predictable bonuses, cash-noncash mixes, and recognition or privileges elicit few performance improvements.
- When employees participate in incentive plan development, predictable bonuses, cash-noncash mixes, and recognition or privileges yield poor productivity responses.
- When there is immediate performance feedback, variable bonuses result in limited productivity improvements. When there are delays in the feedback loop, cash-noncash mixes and recognition or privileges fail to improve productivity.
- When management sets productivity targets only, variable cash bonuses are ineffective. When productivity and quality criteria are established, predictable bonuses, cash-noncash mixes, and recognition and privileges do not improve performance results.
- Predictable bonuses are ineffective in educational institutions.
- Blue collar workers are not motivated by variable cash bonuses.
- Predictable bonuses, cash-noncash mixes, and recognition or privileges are essentially ineffective for stimulating quality when tasks are inherently interesting. When tasks are boring, variable cash bonuses are not likely to improve productivity.
- Finally among all field tests, quality of performance decreased significantly when cash-noncash incentive mixes and recognition or privileges were applied.

CONCLUSIONS

One thing is clear: certain incentive categories are more effective than others in improving productivity and quality under different circumstances. Thus, incentive management decisions must take into consideration the needs, requirements, opportunities, and constraints of the

organization and job functions that are to be stimulated. Chapter 4 develops a model of the incentive management decision process that includes these considerations.

CHAPTER 3. RED RIVER ARMY DEPOT -- A CASE STUDY

BACKGROUND

In the exhaustive search to identify systematically evaluated incentive programs for inclusion in the study, numerous interviews were conducted with key Department of Defense (DoD) personnel knowledgeable of productivity improvement efforts throughout the military services. These contacts led the study team to particular organizations that might warrant further investigation and analysis. One program conducted by a U.S. Army field installation in the Materiel Development and Readiness Command (DARCOM) -- the Red River Army Depot -- was the subject of numerous favorable comments by the Deputy Commanding General and key personnel in the Materiel Management Directorate, HQ, DARCOM. Preliminary information obtained on the extent of their efforts led the research team to visit this Depot in Texarkana to review its productivity program in detail and secure information for inclusion in the study.

ORGANIZATION AND OBJECTIVES

The productivity program at Red River Army Depot resulted from a decision by the Commanding General, U.S. Army Depot System Command (DESCOM) to conduct a major productivity study with three main objectives:

- To articulate productivity improvements made in the depot system,
- To determine the effects of factors that decrease productivity, and
- To develop techniques to improve productivity and Army readiness in the future.

The scope of the study was to include all major depot functions -- maintenance, supply, and base operations. It was conducted during the period from March to October 1978.

MAJOR CONCLUSIONS

1. Due to intensified productivity management employed during the study, there was a significant productivity improvement of 37.4 percent in the M113A1 armored personnel carrier overhaul program during FY78-79 as compared with FY77.
2. Compared to FY76, on-time performance for shipping improved 2.1 percent and for receiving 6.0 percent.
3. There was a productivity improvement of 10 percent in the Base Operations area during the period FY76-78.
4. Both increased employee motivation and management training stimulated productivity improvements and added significantly to projected cost savings in future years.

SUBJECTS

The experiment was conducted on 2,150 civilian personnel assigned to maintenance activities, 1,912 in supply operations, and 975 in support and base operations functions. Subjects were primarily Government civilian employees covered by a wide range of civil service job classifications with the majority wage-board or "blue-collar" types.

ORGANIZATIONAL ENVIRONMENT

Although there was some participation in the established DoD Suggestions Program and the depot had been utilizing industrial engineering, work measurement, and value engineering techniques for a number of years, there had been little prior effort to develop or apply specific incentive plans for the various functional areas. In addition, personnel authorizations for the maintenance areas at the depot had been reduced over the past few years while workloads generally increased.

The productivity improvement program that was designed as part of this experiment received strong command support and was instituted on an installation-wide basis with an extensive range of techniques attempted at different organizational levels.

TECHNIQUES EMPLOYED

The primary thrust of the productivity improvement program was to provide incentives for the depot workforce to increase the quantity and quality of the depot's output in its various functional areas. This was accomplished by

- Providing increased visibility to productivity improvement efforts,
- Developing approaches to workforce motivation, and
- Applying specific management techniques to improve work methods and increase efficiency.

Recognizing the value of making the program for productivity improvement highly visible, a comprehensive briefing was given to the workforce. It presented the depot's history, its mission, its role in the Depot Systems Command organization, its impact on the local area, and other items of interest in a series of colorful 35mm slides. Special emphasis was placed on including photographs of the employees working on the job.

Increased visibility was also promoted by face-to-face sessions between workers and top management of all depot working areas and discussions with employees on the job. All outstanding performance awards and other special awards were presented by the Depot Commander on-site in the presence of the recipients' coworkers. Pictures of employees at work sites were circulated through the medium of the depot newspaper. Open house occasions such as Armed Forces Week were also used to provide visibility to the workforce and to stimulate pride in performance.

Special management techniques were also used to improve operating procedures and increase efficiency. Particular attention was given to the M113 overhaul program where industrial and value engineering studies with worker participation led to greatly improved shop layouts and work flow. The improved working conditions provided the opportunity to meet increased production goals and stimulated greater productivity on the part of the employees.

The principal approach used to enhance productivity throughout the depot's programs was made through special attempts at workforce motivation. Although limited in extrinsic motivational tools, a continuous effort in a variety of ways was made to provide intrinsic motivational stimuli.

The Red River approach did not lend itself to scientific measurement and quantification that could distinguish among the motivational factors contributing to increased productivity. The productivity task force assembled by the Depot Commander, however, felt that the workforce did respond to a series of specific challenges that provided not only an increased sense of direction but greater opportunity for individual and small group recognition. Feedback was provided on an immediate, real time basis to show employees their progress in meeting the challenges. Contests between individuals and groups with increased emphasis on employee recognition and a high degree of visibility for workers achieving or surpassing productivity goals were highly successful. Major efforts were also made toward improvement of working conditions and work areas throughout the depot.

PRODUCTIVITY/PERFORMANCE RESULTS

The M113 overhaul program showed marked productivity improvement as measured by the decrease in man-hours required to produce one unit. From a previous level of almost 1000 man-hours, the time required to overhaul a M113A1 was reduced to below 800. In a production run of 100 vehicles during FY78 there was a total savings of 11.1 man-years with attendant

savings in personnel costs. The productivity improvement techniques used in the M113A1 program were to be extended to work on the Chaparral guided missile and the M163 self-propelled Vulcan Air Defense System programs.

In the Supply Operations area, significant improvements in productivity were achieved in both shipping and receiving. Despite an increase of 45 percent in the number of line items shipped, there was a decrease in man-hours per line item handled from 1.21 in FY76 to 1.05 in FY78 or an improvement of 13 percent. Dollar savings for FY78 were estimated to be over \$1.75 million. The number of line items received in FY78 totaled 301,012, a reduction of 45,313 items. Man-hours per line item handled decreased by 6 percent with an annual savings of \$291,379. In both of these functions, the challenge program was used as an incentive to improved performance.

In the Base Operations area, productivity was improved 10 percent despite increased workload. Overall staffing was held relatively constant and employees were motivated to achieve increased productivity and meet workload requirements.

LIMITATIONS OF RESULTS

The productivity improvement program at Red River Army Depot successfully employed motivational techniques in the workforce to achieve its objectives. The approach used in the preliminary study was well conceived but lacked sufficient experimental controls to enable systematic comparison with the database described in Chapter 2. Overall results, however, have been outstanding and strongly support the concept that motivation of a workforce through incentives to increased performance is sound and should be investigated further.

The depot has a number of activities, functions, and procedures that their study has shown warrants further efforts to improve productivity. Through

the establishment of proper control groups, adequate measures of the activity prior to launching a program, and careful selection of incentive techniques (extrinsic and/or intrinsic), extremely valuable research on incentive management in the environment of a large Government installation could be carried out. Moreover, the byproduct of such a study would be applied productivity gains that would benefit Red River as well as eight other Army depots.

CHAPTER 4. A MODEL OF THE INCENTIVE MANAGEMENT DECISION PROCESS

PRINCIPAL DETERMINING FACTORS IN THE DECISION PROCESS

To identify and analyze possible incentive management strategies that could be employed effectively in Department of Defense installations with the objective of stimulating workforce productivity, primary consideration must be given to the specific functional areas that will be affected. Employees must be engaged in tasks in which there is a tangible, measurable output so that the degree of productivity improvement can be determined without question. Moreover, from management's perspective, improvements in employee output in particular functional areas must be sufficient to warrant the effort of devising, installing, and administering an incentive strategy designed to stimulate worker productivity.

Following determination of a functional area that appears to have the desired characteristics, an appropriate incentive strategy must be selected to assist in meeting the objective of increased productivity. A number of factors must be analyzed individually and then collectively in arriving at a positive decision to implement a strategy in the functional area concerned. The principal factors that must be considered include:

- What types of incentive plans can be considered?
- Are there any legal, regulatory, or policy restrictions that would preclude use of the incentive plan considered?
- What costs will be involved in carrying out the incentive plan being considered? Does the agency have the funds to implement it?
- Is the value of the expected productivity increase sufficient to warrant the costs involved?

- What are the characteristics of the workforce?
- What is the current work environment?
- Are the employees members of a union? If so, will there be any problem in securing concurrence from the union for implementation of the plan?
- What are the likely reactions of the employees to the plan?
- Does the installation or activity have adequate administrative capabilities to support operation of the plan in the functions that would be involved?
- Are there existing standards for work output in the functions involved? Is the work output currently being measured?

For each of the factors outlined above, the existing situation at the targeted installation or activity must be analyzed and a definite decision reached as to whether to proceed with a particular incentive plan, some other alternative plan, or a completely different method of improving productivity. Each of these factors is discussed below.

TYPES OF INCENTIVE PLANS TO BE CONSIDERED

The preliminary phase of this research effort (Hayes, Spector, Fain, 1979) identified a wide variety of popular incentive systems that are currently in use in industry and Government. These incentive plans have the following characteristics:

- Extrinsic rewards are contingent on achieving a prespecified performance goal.
- Positive, rather than negative reinforcement is emphasized.
- Monetary and nonmonetary motivators are included.
- Worker and managerial rewards are included.
- Group and individual rewards are included.

An inventory describing the essential characteristics of 39 of these incentive systems was presented in the Interim Report. Moreover, a large number of plans can be newly designed using the taxonomy in Chapter 2.

Having determined the functional area in which management desires to implement an incentive plan, selection of one or more of the plans described can be accomplished. Initial selection should be made based on the philosophy of management at the installation concerned. It should reflect a strategy acceptable to the management personnel who will be charged with administering it. The selection of one or more plans for analysis should be tentative at this point in the decision process and each should be subjected to analysis with respect to the remaining factors.

POSSIBLE CONSTRAINTS ON THE USE OF A SELECTED INCENTIVE PLAN

The most important factor in this analysis is whether any existing legal, regulatory, or policy barriers prevent initiation of the plan. In Government installations in particular the question of the legal authority for expenditure of Government funds to carry out the desired plan must be determined favorably or the plan cannot be implemented. In addition, a survey of existing regulations and policy decisions by local management and higher authorities should be conducted.

If there are no legal, regulatory, or policy constraints, the analysis can proceed to the next factor. If there are legal barriers to implementing the plan, it cannot be pursued and an alternate plan must be selected. Similarly, constraints due to regulatory or policy decisions may inhibit implementation of an incentive plan if it is not in keeping with them. However, in these cases it is possible to process a request for exception to existing regulations or policy if significant advantages could potentially be achieved through use of the incentive technique and there is sufficient desire on the part of local management to use it. Processing such a request will, of course, delay the planning and scheduling of the incentive plan implementation while awaiting its approval.

COST CONSIDERATIONS

The second primary factor to be considered in arriving at a decision to install the selected incentive plan is cost. A careful estimate must be made of all of the costs of developing, administering, supporting, and maintaining the incentive plan in operation. This is particularly important if a monetary incentive plan is employed. The impact of the anticipated payments to employees on the total personnel budget must be developed and measured against funds expected to be made available. If sufficient funds are not available to carry out the plan, it cannot be implemented.

VALUE OF EXPECTED PRODUCTIVITY INCREASE

If sufficient funds are available to carry out the provisions of the incentive plan and cover the costs of the rewards to the workers for increased productivity, determination must still be made that the value of the increased output in terms of goods or services is worth the costs involved. This determination is not necessarily a cut and dried mathematical calculation.

Particularly in national defense activities, there may be an urgent requirement for increased productivity that cannot be measured solely in monetary terms. For example, the need for timely and adequate provision of supplies and equipment, maintenance spares, or ammunition to U.S. military forces engaged in a combat situation may outweigh considerations of costs involved as the principal deciding factor. In such cases, the decision to utilize an incentive strategy that could produce the desired productivity increase may be made irrespective of the costs of attaining the desired objective.

THE WORKFORCE AND THE ENVIRONMENT IN WHICH IT OPERATES

Choice of an appropriate incentive strategy can be influenced heavily by the characteristics of the workforce and the environment in which it carries out its duties. Is it primarily white collar or blue collar? An incentive strategy that would appeal to a group of production line workers might not be acceptable to senior research personnel, and vice versa. The work environment can also be very important in choosing a plan that has the greatest potential for success and that will maximize productivity increases. In some situations, it may be far more effective to develop an incentive for increased productivity by improving employee morale, upgrading physical facilities of work areas, and providing significant feedback to employees concerned than merely through additional monetary compensation.

CONSIDERATION OF EMPLOYEE UNION ATTITUDE

In planning for installation of an incentive strategy when the employees are members of one or more unions, it is essential that the acceptability of the proposed plan to union leadership as well as the rank and file of the employees involved be obtained in the initial phases. If a proposed strategy is not acceptable to the unions, attempts to force it through could be counterproductive and probably should not be attempted.

EMPLOYEE REACTION TO THE INCENTIVE STRATEGY

Whether or not there is union leadership acceptance of the strategy being considered, the acceptance by employees who will be affected by it should be determined as accurately as is feasible by first-line supervisors and the results evaluated carefully by management. Unless there is widespread acceptance on the part of employees who will participate, there is little chance that the desired productivity increases will be achieved and the proposed incentive strategy probably should not be implemented.

CAPABILITIES FOR ADMINISTRATIVE SUPPORT

Incentive strategies depend on careful and precise maintenance of records as to worker productivity in order to determine when employees are entitled to extrinsic rewards. This is an important element in the plan's credibility to participating workers. No plan should be attempted without sufficient administrative capability to support it. This is a significant consideration that must be taken into account in arriving at a decision on specific incentive strategies. Lack of adequate administrative capability, however, need not preclude adoption of the strategy permanently if actions can be taken to improve the capabilities of the installation concerned or to have the necessary support provided from some other source.

PRODUCTIVITY MEASUREMENT

Prior to implementing any strategy to increase productivity by providing some incentive for increased performance, it is essential that standards for work output be established and a system of measurement of work units developed operationally. This involves the maintenance of detailed records to support operation of the incentive program, including time and motion studies, productivity value formulas, performance appraisals, profit calculations, cost savings measurement, or other productivity criteria. As discussed previously, a capability for doing so must exist before the plan can be initiated.

A MODEL OF THE INCENTIVE MANAGEMENT DECISION PROCESS

Each of the above factors influences whether or not a proposed incentive strategy can -- or should -- be put into operation. This management decision process can be illustrated by the simplified decision-flow diagram shown in Figure 1. For each factor considered, a decision must be reached in sequence whether or not to proceed with plans to implement the proposed strategy. If the decision is positive the analysis proceeds to

the next factor. If it is negative, another strategy must be selected and the procedure begun anew, a method for overcoming the basis for the negative decision developed, or the concept of providing incentives in order to stimulate productivity abandoned.

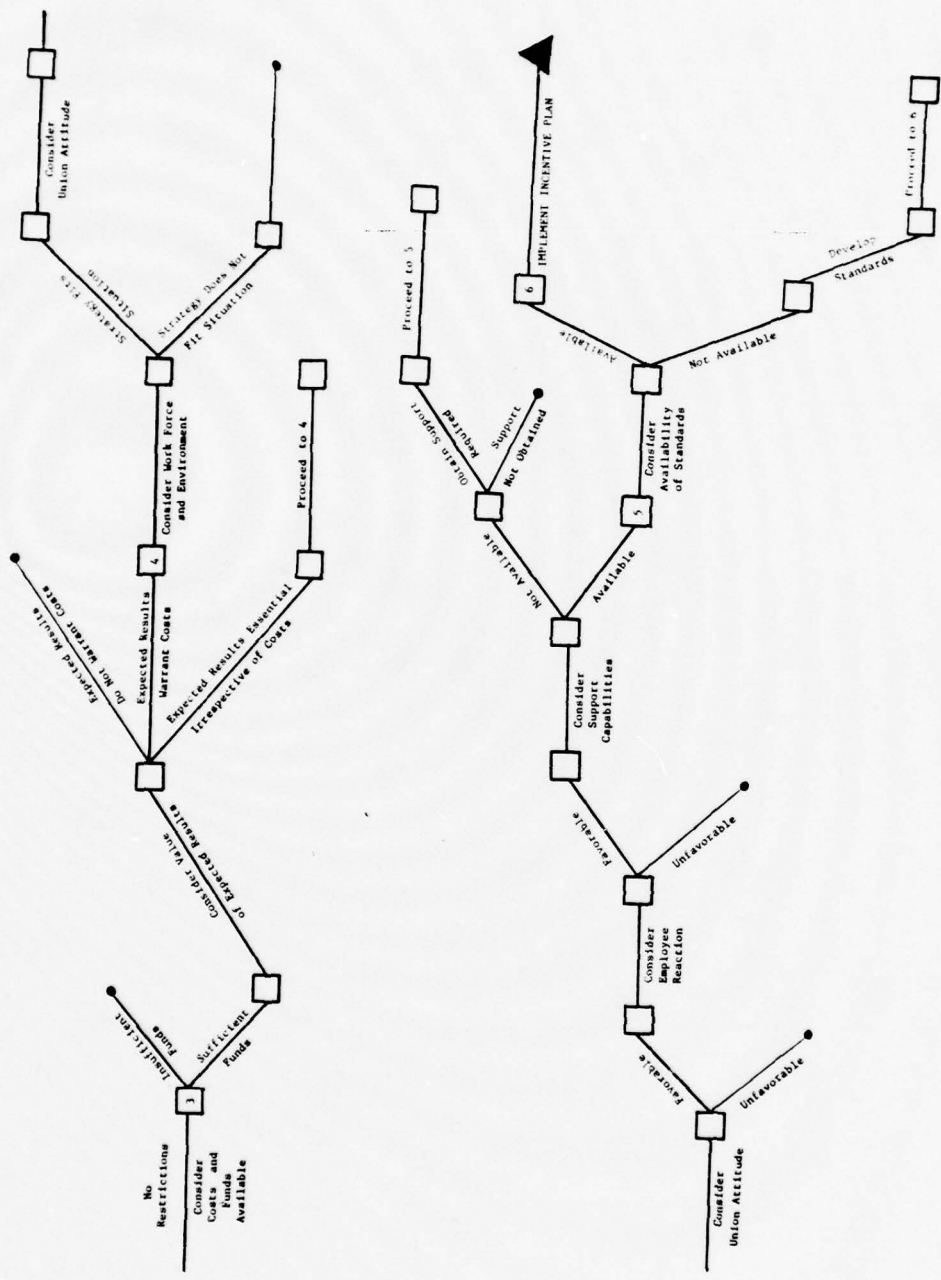


Figure 1. Adoption of an Incentive Plan -- the Decision Process

CHAPTER 5. DESIGN OF AN INCENTIVE MANAGEMENT AID

The structure for a prototype computer based incentive management aid has been designed to assist military commanders; civilian, DoD, and Government supervisors; organizational development (OD) specialists; other workforce managers; and researchers. The primary objectives of this aid are to direct users toward effective incentive management decisions by:

- Providing integrated, quantitative information on previously evaluated incentive plans,
- Providing recommendations on effective incentive plans matched to organizational contingencies, and
- Providing a method by which users can design innovative incentive strategies that may not have been tested previously.

Figure 1 presents the design of this incentive management aid. Only a partial demonstration package has been implemented to date; the aid as depicted in this chapter is only a recommended design and is not fully developed or operational. When it is implemented, it is currently conceived as an interactive system that managers and researchers can employ in an iterative fashion to arrive at optimal productivity solutions for their organizations.

DATABASE MODULES

Each of these modules would contain quantitative data from laboratory and field test cases on basic descriptions of extrinsic incentive plans, their organizational context, productivity outcomes, job satisfaction, and intrinsic incentive methods.

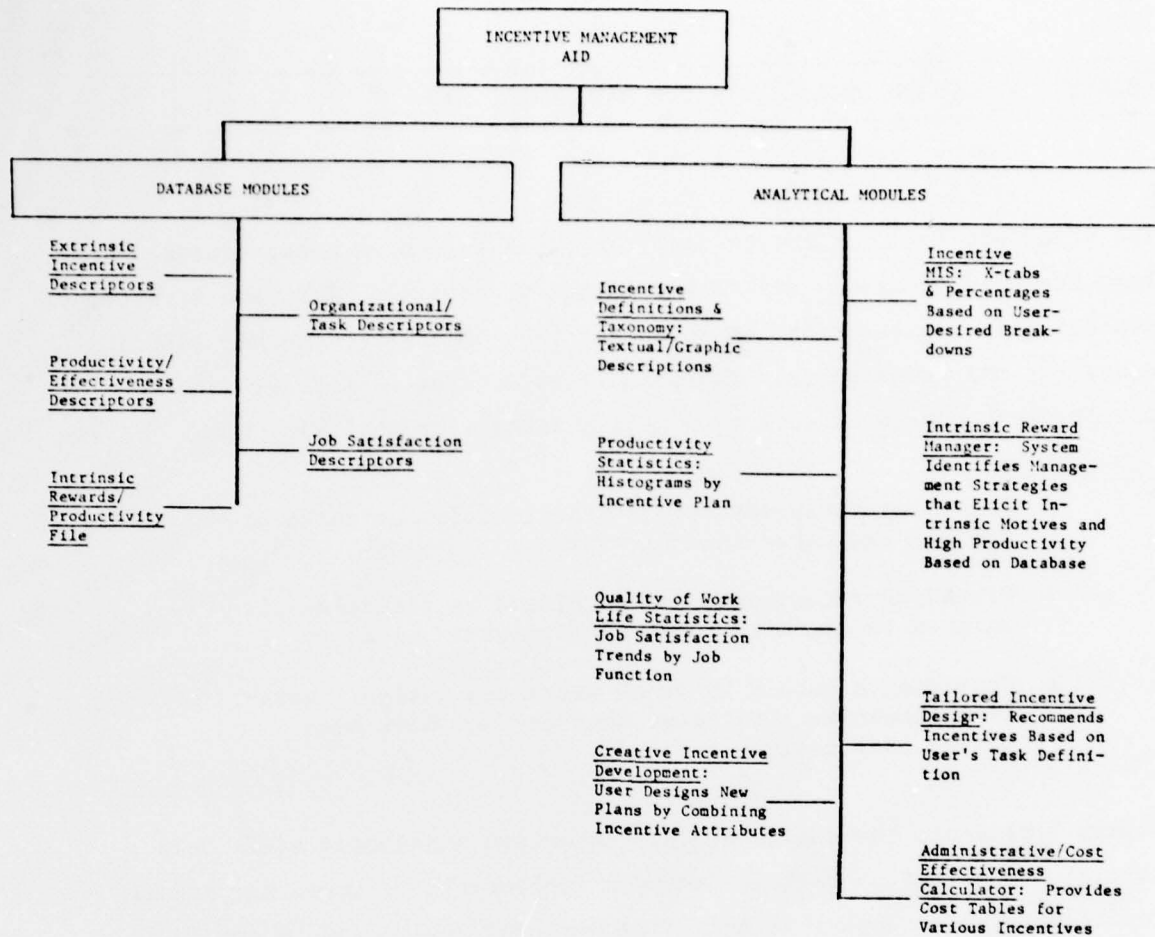


Figure 1. Incentive Management Aid Development

Extrinsic Incentive Descriptors

This file would contain data that help define extrinsic incentives (such as reward type, targets, and amount), identify their temporal characteristics (such as reward frequency and schedule), distinguish their distributional attributes (such as reward rate and allocation basis), describe the process entailed in their implementation (such as participation, feedback, and choice), and identify their performance criteria (such as productivity targets and formulas).

Organizational/Task Descriptors

This file would systematically define the context within which incentive management techniques are used, including the organization type, worker category, worker unit size, task type, work stress, intrinsic task interest, and previous organizational climate.

Productivity/Effectiveness Descriptors

Outcome variables would be included in this file that record quantitative measures of productivity improvement directly attributable to incentive management techniques. Measures of productivity enhancement, quality improvement, cost and time savings, and job satisfaction would be contained in this data file.

Job Satisfaction Descriptors

This file would consist of data on job satisfaction variables from questionnaires and surveys available in the literature. These variables would tap job satisfaction over a wide range of tasks, functions, and organizations.

Intrinsic Rewards/Productivity File

In this file, productivity data gathered from laboratory and field tests of the impact of intrinsic rewards would be presented. These data would focus on the effectiveness of techniques such as job development and environment, work appraisal and feedback, goal setting, job redesign, and work team redesign.

ANALYTICAL MODULES

The analytical modules provide users with an efficient and meaningful way to arrange and analyze productivity data for practical application. They would act upon the database modules.

Incentive Definitions and Taxonomy

This module would describe and classify specific incentive strategies for users in terms of the incentives taxonomy. Users would be able to selectively display definitions of specific plans that are in the historic inventory.

Incentive Management Information System

This module would facilitate user-desired tabulations of specific variables contained in the database modules. For example, users could request cross-tabulations and percentages that indicate the organizations that have used each type of incentive plan the most or the relative size of rewards given for particular tasks.

Productivity Statistics

This module would enable users to examine averaged productivity data that indicate the potential effectiveness of specific incentive systems. The

aid could display percentage increases or decreases in productivity, quality, and cost savings that can be anticipated if certain incentive plans are implemented.

Intrinsic Reward Manager

On the basis of laboratory and field tests on the effectiveness of intrinsic job rewards, this module would enable users to identify management strategies that have proved most useful in eliciting intrinsic satisfactions of workers and thereby enhance productivity results.

Quality of Worklife Statistics

This module would act upon the job satisfaction database to indicate empirical patterns of worker satisfaction that emerge for various job functions.

Tailored Incentive Design

This module would enable users to design effective incentive strategies tailored to increase productivity or reduce cost in a particular task, function, or organization. Users would input job descriptions and the aid would respond by recommending alternate incentive management strategies appropriate to the described organization.

Creative Incentive Development

This module would offer a user capability to design innovative incentive strategies by combining incentive attributes in new ways. This would enable users to participate interactively in designing a strategy that suits their particular leadership and management styles.

Administrative/Cost Effectiveness Calculator

This module would act upon empirical data concerning the administration of various incentive plans in different organizational contexts. It would provide users with estimates of the administrative time, staffing, and costs required to implement various plans of different size.

DEMONSTRATION PACKAGE

As indicated earlier, an incentive management demonstration package has been developed and is currently available in a stand-alone Tektronix 4051 microprocessor version and in a graphics version at DARPA's Demonstration and Development Facility (DDF) which has a PDP 11/70. This package operates on the limited database described in this report, but provides a useful preview of the fully developed aid. Sample output from this package appears in Appendix C of this report and a user's manual is presented in Appendix D.

CONCLUSIONS

The results of this effort confirm that incentive management is a sound and effective methodology for improving workforce productivity through motivational techniques. The following specific conclusions have been reached:

- The expanded taxonomy of incentive plans provides a detailed classification of the management strategies that have been and can be applied to enhance productivity in a variety of organizations and work situations.
- The analytical findings of the sample database confirm the contingent nature of successful incentive management. Effectiveness of any strategy is greatly affected by the work context in which it is used.
- Results at Red River Army Depot where intrinsic and extrinsic incentive techniques have been applied on a wide scale indicate that these techniques do indeed work when they are put into practice and supported by management. The success of tests with intrinsic motivators was so significant that the local depot commander is anxious to conduct additional demonstration projects applying specific extrinsic motivators.
- The contingency-based methodology developed can serve as a model and management tool for the development of new and innovative incentive strategies for practically any workforce situation. It employs empirical data as well as theoretical considerations in the design of appropriate incentive strategies. This methodology can assist in technological transfer of currently theoretical concepts to practical applications in the public and private sectors.

- Moreover, the design of the computer-assisted Incentive Management Aid is sufficiently complete to assist in the technological transfer process.

RECOMMENDATIONS

Having confirmed the feasibility of the incentive management approach and having developed a methodology for identifying practical solutions to the problems of worker productivity, there are a number of management techniques that should be expanded and products that should be developed beyond the scope of the current research. It is recommended that the following actions be taken:

- The existing database should be expanded to be more representative.
- A contingency model of incentive management strategies and productivity outcomes should be designed and validated.
- The existing preliminary design of the computer-assisted Incentive Management Aid should be expanded and implemented.
- A practical handbook of incentive management techniques should be developed and published for use by workforce supervisors in the public and private sectors.
- One or more carefully selected demonstration projects to scientifically test the effectiveness of different incentive strategies should be conducted in a variety of functional areas.
- Practical guidelines should be developed to assure that implementation and administration of selected incentive plans can be accomplished efficiently and at minimum cost. Current constraints on the implementation of certain extrinsic incentive plans in Government activities must be recognized, but opportunities such as those embodied in the Civil Service Reform Act should be exploited.
- An incentive management training program for operating managers should be developed and conducted.

- Innovative productivity measures and standards common to certain functions should be developed.
- Work standards for executive level positions in the Civil Service (Senior Executive Service positions) should be developed.

IMPLICATIONS

Adoption of these recommendations for further research and development will enhance the effectiveness of workforce supervisors in using incentive management techniques. Expanded incentive management research holds out the potential for higher productivity growth rates among public and private sector employees, lowered manpower costs, increased performance quality, and enhanced quality of work life. The number of potential application areas is almost limitless. Moreover, continued research efforts in the incentive management area should help to develop managerial techniques and decision processes to a satisfactory level of validity and reliability to instill confidence in expanded practical usage.

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APPENDIX A. QUANTITATIVE CASES OF PRODUCTIVITY THROUGH INCENTIVE
PROGRAMS: 1975-1978

This appendix summarizes 54 empirical cases in which various incentive management techniques were tested, measured, and evaluated to identify their impact on productivity and the quality of performance. Complete abstracts are included in Hayes, Spector, and Fain (1979). Full bibliographic citations for each case appear in the bibliography of this report.

<u>STUDY</u>	<u>INCENTIVE</u>	<u>ORGANIZATION TYPE</u>	<u>TASK TARGET</u>	<u>PERCENT IMPROVEMENT</u>	
				<u>PRODUCTIVITY</u>	<u>QUALITY</u>
Debeau and Sullivan, 1978	Cafeteria style incentives involving recognition and special privileges (enabled and excused)	Educational Institution - college students	Training/Learning Task	23.5%	21.9%
Chung and Vickery, 1976	1. Predictable piece rate cash bonus. 2. Piece rate plus variable bonus 3. Piece rate bonus plus feedback 4. Piece rate bonus, variable bonus, plus feedback	Educational Institution - college students Same as above Same as above Same as above	Repetitive Clerical Task Same as above Same as above Same as above	20.2% 16.7% 26.6% 57.2%	- - - -
The Conference Board, 1977	Scanlon Plan	Manufacturing Plant - Donnelly Mirrors, Inc.	Production Task	40.0%	65%
Devlin, 1976	Standard hour plan (cash bonus), feedback, and communication also involved	Nonmanufacturing firm - Aetna Life & Casualty Co.	Clerical tasks	72.0%	-
Farr, 1976a	1. Predictable cash bonus to individuals 2. Predictable cash bonus to groups.	Educational Institution - college students Same as above	Clerical Task - card sorting Same as above	10.7% 7.7%	- -

<u>STUDY</u>	<u>INCENTIVE</u>	<u>ORGANIZATION TYPE</u>	<u>TASK TARGET</u>	<u>PERCENT IMPROVEMENT</u>	
				<u>PRODUCTIVITY</u>	<u>QUALITY</u>
Farr, 1976b	Predictable piece rate cash bonus	Educational Institution - college students	Production Task - assembling erector set puzzles	29.0%	-
Hammer and Foster, 1975	1. Predictable piece rate cash bonus 2. Same as above	Educational Institution - college students Same as above	Boring Clerical Task Interesting Clerical Task	-9.7%	-3.5%
Hesse, 1977	Predictable cash bonus (100 percent premium plan)	Manufacturing firm - Huffman Manufacturing Co.	Production task	27.0%	-
Kelleher, 1977	Predictable cash bonus (time-saved plan)	Manufacturing firm - Bethlehem steel, maintenance employees	Logistics Task - in mechanical, electrical, and repair shops	48.0%	-
Komaki, Waddell and Pearce, 1977	1. Time off with pay 2. Predictable cash bonus and feedback	Grocery store Retail store	Store clerks Store attendants	87.0%	-
Koop, 1977	Group predictable cash bonus - for time and cost savings	Manufacturing firm - Sperry's New Holland plant	Logistics Task - material handling operations	15.0%	-
Latham and Dossett, 1978	1. Predictable piece rate cash bonus 2. Variable cash bonus	Meyerhauser Corp. Same as above	Production Task - trapping mountain beavers Same as above	52.3%	-
				31.8%	-

STUDY	INCENTIVE	ORGANIZATION TYPE	TASK TARGET	PERCENT IMPROVEMENT	
				PRODUCTIVITY	QUALITY
London and Oldham, 1977	1. Group predictable cash bonus based on highest performer	Educational Institution - male college students	Perceptual Motor Task - sorting computer cards	13.1%	-
	2. Group predictable cash bonus based on lowest performer	Same as above	Same as above	9.5%	-
	3. Group predictable cash bonus based on average performer	Same as above	Same as above	3.1%	-
	4. Individual predictable piece rate cash bonus	Same as above	Same as above	15.1%	-
London and Oldham, 1976	Predictable piece rate cash bonus	Educational Institution - college students	Perceptual Motor Task - sorting computer cards	10.0%	-
National Commission on Productivity and Work Quality, 1975	1. Disciplinary Action - for failure to meet commercial work standards	Local Government - New York City's Sanitation Dept.	Logistics Task - vehicle repair	46.0%	31.0%
	2. Two percent salary increase	Local Government - City of Orange, Calif.	Police task - crime reduction	10.0%	-
	3. Five percent predictable cash bonus	Local Government - Fort Worth, Texas	Logistics Task - auto mechanics	23.0%	-
	4. Piecework predictable cash bonus with feedback and competition	State Government - Pennsylvania	Clerical Tasks - electronic data processing supervisors	60.7%	-

<u>STUDY</u>	<u>INCENTIVE</u>	<u>ORGANIZATION TYPE</u>	<u>TASK TARGET</u>	<u>PERCENT IMPROVEMENT</u>	
				<u>PRODUCTIVITY</u>	<u>QUALITY</u>
Nelson, 1977	5. Managerial cash bonus based on productivity rate of employees	Same as above	Clerical Task - electronic data processing supervisors	60.7%	-
	Group predictable cash bonus with feedback and employee suggestion plan	Manufacturing firm making heavy wire-rope and cable	Production Task in rope mill and electro-mechanical cable departments	9.0%	-
Pinder, 1976	1. Piece rate Predictable cash bonus	Educational Institution - male high school and college students	Interesting Production Tasks - constructing model car	6.4%	-
	2. Same as above	Same as above	Boring Production Tasks - assembling pairs of identical parts	17.7%	-
Pritchard, DeLeo and Von Bergen, 1976	1. Cafeteria style incentives involving noncash privileges and recognition contingent upon performance	Uniformed military-Chanute AFB, Illinois	Technical Training Tasks-aircraft electrical repair course	1.0%	-4.7%
	2. Same as above, but contingent upon effort expended	Same as above	Same as above	3.2%	-6.1%
	3. Same as above, but including cash incentives in cafeteria list	Same as above	Same as above	13.6%	-5.4%
	4. Same as item 1 above	Same as above	Technical Training tasks-weather observer course	-	1.9%

STUDY	INCENTIVE	ORGANIZATION TYPE	TASK TARGET	PERCENT IMPROVEMENT	
				PRODUCTIVITY	QUALITY
Pritchard, Leonard, Von Bergen & Kirk, 1976	5. Same as item 2 above	Same as above	Same as above	-	1.5%
	6. Same as item 3 above	Same as above	Same as above	-	1.4%
	1. Predictable cash bonus	Bogus nonmanufacturing firm	Training Tasks - self paced programmed material on electronics	30.6%	41.9%
Schwinger, 1975	2. Variable cash bonus	Same as above	Same as above	37.7%	41.6%
	3. Variable cash bonus with variable amounts	Same as above	Same as above	42.3%	55.0%
	Predictable piece rate cash bonus	Manufacturing firms (in Israel)	Production Tasks	25.0%	-
Sherman, 1976	Scanlon Plan	Manufacturing firm - Midland - Ross Corporation's Athens, Tenn. - electrical products plant	Production Tasks	16.0%	-
Shumate, Dockrader, and Nebeker, 1978	Predictable piece rate cash bonus	Civilian employees in the Navy - Long Beach Naval shipyard, card punch section	Clerical Tasks - data transcribers	17.8%	-
Terborg, 1976	Predictable cash bonus (time saved)	Bogus nonmanufacturing firm	Training/Learning Task - written training material on principles of electricity	20.9%	0.0%
Terborg and Miller, 1978	Predictable piece rate cash bonus	Educational Institution - college students	Production Tasks - one hour tasks involving assembly of a complex model	11.1%	0.0%

<u>STUDY</u>	<u>INCENTIVE</u>	<u>ORGANIZATION TYPE</u>	<u>TASK TARGET</u>	<u>PERCENT IMPROVEMENT</u>	
				<u>PRODUCTIVITY</u>	<u>QUALITY</u>
Turnage and Muchinsky, 1976	1. Predictable piece rate cash bonus	Educational Institution - male college students	Interesting Clerical Tasks - stencil design	17.7%	-
	2. Same as above	Same as above	Boring Clerical Tasks - card sorting	7.9%	-
Yukl and Latham, 1975	1. Predictable piece rate cash bonus	Manufacturing firm - Meyethauser Co.	Production Tasks - tree planters	33.0%	-
	2. Variable cash bonus (VR-2)	Same as above	Same as above	-8.0%	-
	3. Variable cash bonus (VR-4)	Same as above	Same as above	18.0%	-
Yukl, Latham and E. Pursell, 1976	1. Predictable piece rate cash bonus	Same as above	Same as above	2.9%	-
	2. Variable cash bonus (VR-4)	Same as above	Same as above	-2.0%	-
	3. Variable cash bonus (VR-2)	Same as above	Same as above	0.0%	-

APPENDIX B. AVERAGE PRODUCTIVITY IMPROVEMENT ACCOUNTED FOR BY INCENTIVE PLANS

AVERAGE PERCENT GAINS IN QUANTITATIVE OUTPUT									
	Fre- quency	Overall Average	Salary Increase	Predictable Cash Bonus	Variable Cash Bonus	Recognition/ Privilege (Excused and Enabled)/Cash Bonus	Recognition/ Privilege (Excused and Enabled)	Disciplinary Action	
All cases	51	23.1	10.0	22.3	17.1	30.7	28.7	46.0	
By Reward Target									
Group	10	15.0	10.0	6.4	-	28.0	-	46.0	
Individual	41	23.1	-	23.8	17.1	32.5	28.7	-	
By Reward Amount									
Small	36	22.2	10.0	19.8	-	35.0	28.7	-	
Large	9	20.7	-	44.0	8.0	14.0	-	46.0	
By Pay Condition									
Incentive Alone	24	19.3	-	14.6	40.0	41.9	23.5	-	
Guaranteed Wage	26	25.7	10.0	32.3	8.0	23.2	30.4	-	
By Reward Frequency									
Low	11	16.5	-	13.6	-	-	-	46.0	
High	39	23.7	10.0	24.0	17.1	30.7	28.7	-	
By Reward Schedule									
Fixed Ratio	44	24.1	10.0	22.3	-	30.7	28.7	46.0	
Variable Ratio	7	17.1	-	-	17.1	-	-	-	
By Reward Rate									
Percentage Proportion	18	23.9	10.0	20.8	-	32.5	28.7	-	
	33	22.7	-	23.0	17.1	28.0	-	46.0	

	Fre- Quency	Overall Average	Salary Increase	Predictable Cash Bonus	Variable Cash Bonus	Recognition/ Privilege (Excused and Enabled)/Cash Bonus	Recognition/ Privilege (Excused and Enabled)	Disciplinary Action
<u>By Reward Allocation</u>								
Average	8	18.4	10.0	15.2	-	-	-	46.0
Individual	40	24.2	-	24.6	17.1	32.4	28.7	-
Salary	2	28.0	-	-	-	28.0	-	-
<u>By Participation</u>								
None	39	20.2	-	18.8	14.7	32.5	28.7	-
Some	12	32.6	10.0	35.3	31.8	28.0	-	46.0
<u>By Performance Feedback</u>								
Delayed	26	20.6	-	17.2	40.0	30.7	9.2	-
Immediate	21	26.2	10.0	29.6	8.0	-	87.0	-
<u>By Incentive Choice</u>								
Yes	6	11.2	-	12.8	-	13.6	9.2	-
No	45	24.7	10.0	22.9	17.1	35.0	87.0	46.0
<u>By Productivity Target</u>								
Quantity	30	19.5	10.0	17.3	8.0	41.9	87.0	-
Time	3	45.0	-	45.0	-	-	-	-
Quantity & Quality	18	25.6	-	26.3	40.0	23.2	9.2	46.0
<u>By Organization Type</u>								
Military	4	8.9	-	17.8	-	13.6	2.1	-
Government	5	40.1	10.0	48.1	-	-	-	46.0
Manufacturing	15	20.5	-	26.5	8.0	28.0	-	-
Nonmanufacturing	7	48.4	-	42.9	40.0	-	87.0	-
Educational	20	14.8	-	11.1	-	41.9	23.5	-
<u>By Worker Type</u>								
Blue Collar	23	25.0	10.0	25.9	8.0	28.0	87.0	46.0
White Collar	25	23.4	-	19.9	40.0	41.9	23.5	-
Uniformed	3	5.9	-	-	-	13.6	2.1	-

<u>By Task Type</u>		<u>Fre-</u> <u>quency</u>	<u>Overall</u> <u>Average</u>	<u>Salary</u> <u>Increase</u>	<u>Predictable</u> <u>Cash Bonus</u>	<u>Variable</u> <u>Cash Bonus</u>	<u>Recognition/</u> <u>Privilege</u> <u>(Excused and</u> <u>Enabled)/Cash Bonus</u>	<u>Recognition/</u> <u>Privilege</u> <u>(Excused and</u> <u>Enabled)</u>	<u>Disciplinary</u> <u>Action</u>
Production	17	18.1	-	21.3	8.0	28.0	-	-	
Clerical	22	23.7	10.0	21.3	-	41.9	87.0	-	
Service	4	33.0	-	28.6	-	-	-	46.0	
Logistics	8	21.6	-	25.8	40.0	13.6	9.2	-	
Training									
<u>By Intrinsic</u>									
<u>Task Interest</u>									
Interesting	17	23.1	10.0	22.9	37.3	13.6	9.2	46.0	
Boring	34	23.1	-	22.0	2.0	35.0	87.0	-	
<u>By Study Type</u>									
Field	27	27.8	10.0	35.3	8.0	23.2	30.4	46.0	
Lab	24	17.8	-	12.6	40.0	41.9	23.5	-	
<u>By Prior En-</u>									
<u>vironment</u>									
Acceptable	3	0.3	-	2.9	-1.0	-	-	-	
Low	10	35.4	-	40.1	5.0	16.0	87.0	-	

a p < .05.

b p < .01.

c p < .001.

AVERAGE PERCENT GAINS IN QUALITATIVE PERFORMANCE

	Frequency	Overall Average	Salary Increase	Predictable Cash Bonus	Variable Cash Bonus	Recognition/Privilege (Excluded & Enabled)		Recognition/Privilege (Excluded & Enabled)	Disciplinary Action
						Cash Bonus	Cash Bonus		
^a All cases	16	11.0	-	6.4	48.3	0.8	2.9	31.0	
By Reward Target									
Group	2	18.8	-	-	-	-	-	-	
^a Individual	14	9.9	-	6.4	48.3	6.5	2.9	31.0	
By Reward Amount									
Small	10	1.1	-	-2.5	-	6.5	2.9	-	
Large	3	9.0	-	-	-	-2.0	-	31.0	
By Pay Condition									
Incentive Alone	7	21.5	-	8.0	48.3	-	21.9	-	
Guaranteed Wage	8	-0.6	-	0.0	-	0.8	-1.9	-	
By Reward Frequency									
^a Low	3	7.0	-	-5.0	-	-	-	-	
^a High	13	12.0	-	14.0	48.3	0.8	2.9	31.0	
By Reward Schedule									
Fixed Ratio	14	5.7	-	6.4	-	0.8	2.9	-	
Variable Ratio	2	48.3	-	-	48.3	-	-	31.0	
By Reward Rate									
Percentage Proportion	8	1.3	-	0.0	-	-2.0	2.9	-	
By Reward Allocation									
Average	1	31.0	-	-	-	6.5	-	-	
^a Individual Salary	14	9.9	-	6.4	48.3	-2.0	2.9	31.0	
	1	6.5	-	-	-	6.5	-	-	

Frequency	Overall Average	Salary Increase	Predictable Cash Bonus	Variable Cash Bonus	Recognition/Privilege (Excused & Enabled)		Disciplinary Action
					Cash Bonus	Privilege (Excused & Enabled)	
<u>By Participation</u>							
14	9.9	-	6.4	48.3	-2.0	2.9	-
2	18.8	-	-	-	6.5	-	31.0
<u>By Performance Feedback</u>							
12	13.0	-	21.0	48.3	0.8	2.9	-
2	-5.0	-	-5.0	-	-	-	-
<u>By Incentive Choice</u>							
7	1.5	-	-	-	-2.0	2.9	-
9	18.5	-	6.4	48.3	6.5	-	31.0
<u>By Productivity Target</u>							
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
16	11.0	-	6.4	48.3	0.8	2.9	31.0
<u>By Organization Type</u>							
6	-1.9	-	-	-	-2.0	-1.9	-
1	31.0	-	-	-	-	-	31.0
1	6.5	-	-	-	6.5	-	-
4	34.6	-	21.0	48.3	-	-	-
4	3.0	-	-3.3	-	-	21.9	-
<u>By Worker Type</u>							
2	18.8	-	-	-	6.5	-	31.0
8	18.8	-	6.4	48.3	-	21.9	-
6	-1.9	-	-	-	-2.0	-1.9	-

<u>By Task Type</u>	<u>Frequency</u>	<u>Overall Average</u>	<u>Salary Increase</u>	<u>Predictable Cash Bonus</u>	<u>Variable Cash Bonus</u>	<u>Recognition/Privilege</u>		<u>Disciplinary Action</u>
						<u>(Excused & Enabled)/ Cash Bonus</u>	<u>Privilege (Excused & Enabled)</u>	
Production	2	3.3	-	0.0	-	6.5	-	-
Clerical/Service	2	-5.0	-	-5.0	-	-	-	-
Logistics	1	31.0	-	-	-	-	-	-
Training	11	-	-	21.0	48.3	-	-	31.0
<u>By Intrinsic Task Interest</u>								
Interest- ing	14	12.4	-	8.9	48.3	-2.0	2.9	31.0
Boring	2	1.5	-	-3.5	-	6.5	-	-
<u>By Study Type</u>								
Field	8	3.3	-	-	-	0.8	-1.9	31.0
Lab	8	18.8	-	6.4	48.3	-	21.9	-
<u>By Prior Environment</u>								
Acceptable	-	-	-	-	-	-	-	-
Low	-	-	-	-	-	-	-	-

a < p .05.

b < p .01.

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

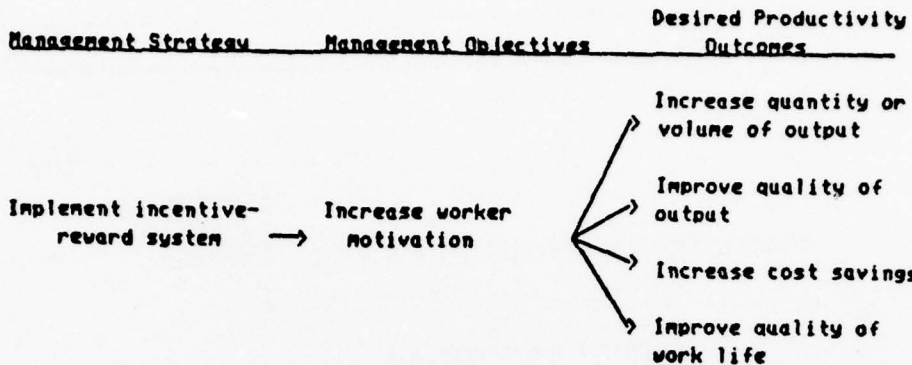
**Research Performed by
CACI, Inc.-Federal**

Objectives

- o Improve productivity in DoD by increasing worker motivation.
- o Increase cost savings in DoD by improving individual and unit performance.
- o 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

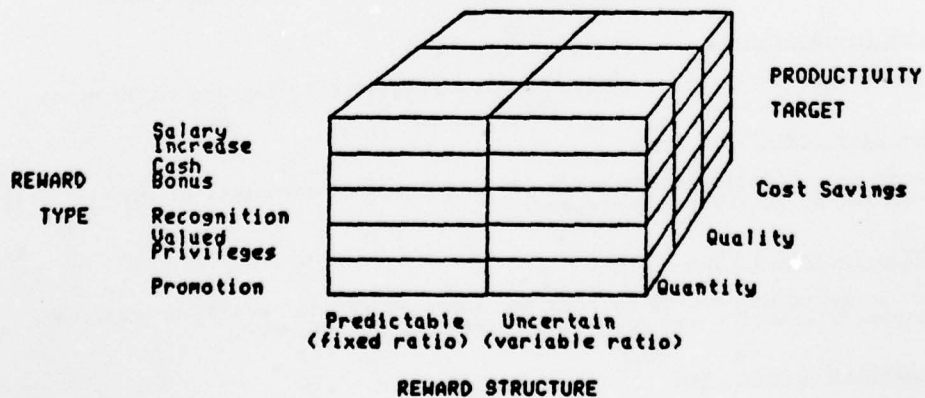
Module 3. Allows You to Design Job-Specific Incentive Plans

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:

<u>REWARD TYPE</u>	<u>REWARD SCHEDULE</u>	<u>PRODUCTIVITY TARGET</u>
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

Employee 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

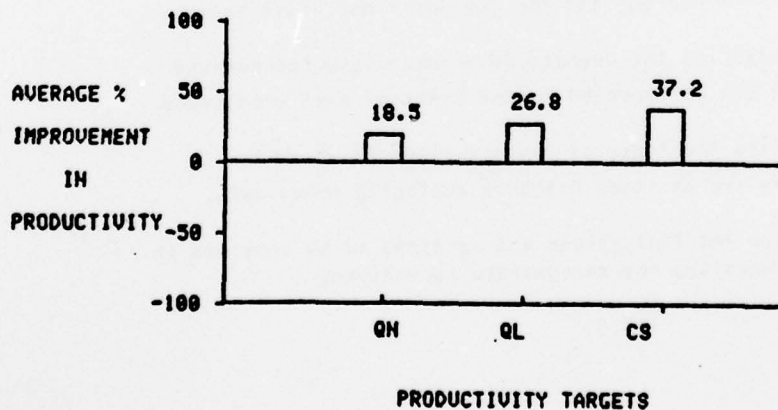
This module enables users to display productivity data on the effectiveness of specific incentive systems. The current generation of MotivAid is restricted to preliminary data on the effectiveness of five categories of incentives.

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

- | | |
|-----------------------|-----------------------------|
| '1' = Salary Increase | '4' = Valued Privileges |
| '2' = Cash Bonus | '5' = Promotion |
| '3' = Recognition | '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 | 4. Nonmanufacturing Firm |
| 2. Government | 5. Educational Institution |
| 3. Manufacturing Firm | |

<3>

Targeted Job Function

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

<3>

Number of Workers Affected:

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

<3>

Task Performance Can be Measured at:

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

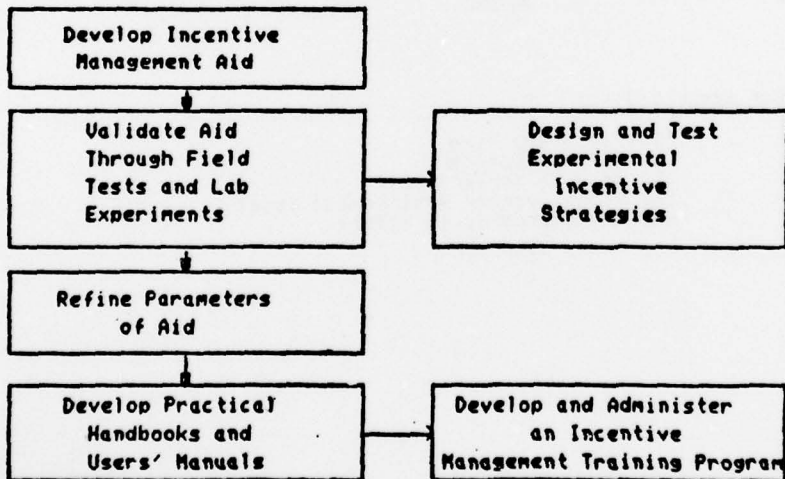
Number of recommended incentive strategies..... 2

Name of Incentive Plan : Halsey Premium Plan
Description : Time 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
studies

Press CONTINUE

RECOMMENDATIONS FOR CONTINUED RESEARCH



END OF DEMONSTRATION

APPENDIX D. INCENTIVE MANAGEMENT DEMONSTRATION PACKAGE: USER'S MANUAL

The Incentive Management Demonstration Package can be accessed at the DARPA/CTO Demonstration and Development Facility (DDF). The following commands will allow users to run the programs on the Tektronix 4027 terminal.

1. Log in to the DDF on the Tektronix 4027.
2. Enter: %CHDIR BERT
 %INCTGRAPH.OUT
3. The program is now accessed. Instructions are provided to users as they proceed through each module. The "Return" Key should be used after entering data or to continue the demonstration.
4. When users reach the "End of Demonstration" statement in module 4, they can exit from the program by holding the "Control" Key and entering "D."

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM															
1. REPORT NUMBER CAC0002AE	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER															
4. TITLE (and Subtitle) Productivity Improvement Through Incentive Management: Progress Toward Developing a New Management Resource		5. TYPE OF REPORT & PERIOD COVERED Final Technical Report October 6, 1978 - Sept 30, 1979															
7. AUTHOR(s) Dr Bertam I. Spector MG John J. Hayes, USA(Ret)		6. PERFORMING ORG. REPORT NUMBER															
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11. CONTROLLING OFFICE NAME AND ADDRESS Defense Advanced Research Projects Agency 1400 Wilson Boulevard Arlington, Virginia 22209		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS DARPA Order No. -3666 Program Code: 9D20, Program Element Code: 61101E															
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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)																	
18. SUPPLEMENTARY NOTES																	
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) <table border="0"> <tr> <td>Incentives</td> <td>Worker Motivation</td> <td>Cost Savings</td> </tr> <tr> <td>Incentive Management</td> <td>Productivity Improvement</td> <td>Depot Operations</td> </tr> <tr> <td>Productivity</td> <td>Incentive Plans</td> <td>Civil Service Reform Act</td> </tr> <tr> <td>Performance</td> <td>Management Aid</td> <td></td> </tr> <tr> <td>Motivation</td> <td>Cash Bonuses</td> <td></td> </tr> </table>			Incentives	Worker Motivation	Cost Savings	Incentive Management	Productivity Improvement	Depot Operations	Productivity	Incentive Plans	Civil Service Reform Act	Performance	Management Aid		Motivation	Cash Bonuses	
Incentives	Worker Motivation	Cost Savings															
Incentive Management	Productivity Improvement	Depot Operations															
Productivity	Incentive Plans	Civil Service Reform Act															
Performance	Management Aid																
Motivation	Cash Bonuses																
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) <p>This final 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 on performance. An inventory of popular incentive systems is compiled and a taxonomy that classifies incentives is designed. A case study of a large-scale productivity improvement effort at a major U.S. Army depot is presented. Finally, a computer-based management aid is designed and a demonstration package developed to display</p>																	

407 136

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20. ABSTRACT (Continued)

how workforce supervisors, organizational development specialists, and key installation management personnel can tailor incentive plans to the specific needs of varied organizations and job functions. Results indicate that incentive management strategies are effective tools to improve worker productivity and maximize manpower cost savings but specific tailored plans are required to meet special contingencies of different organizations and tasks.



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