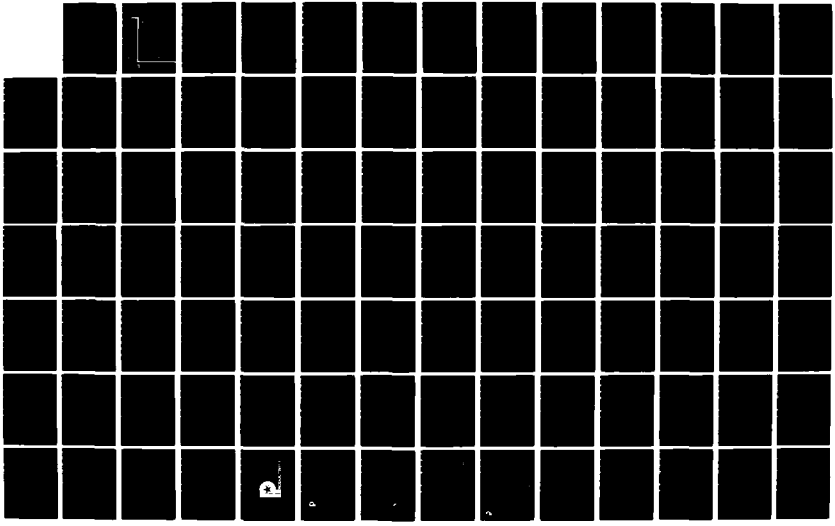
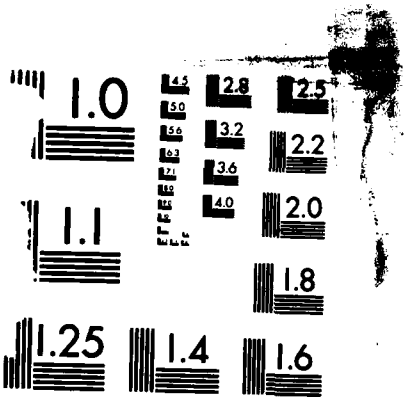
AD-A165 918 PRODUCTIVITY RESEARCH AND DEVELOPMENT PLANNING WORKSHOP 1/3
(U) TEXAS MAXIMA CORP SAN ANTONIO W SILVA ET AL.
MAR 86 AFHRL-TP-85-10 F33615-83-C-0030

UNCLASSIFIED F/G 5/9 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

AFHRL-TP-85-10

(2)

AIR FORCE

HUMAN RESOURCES

AD-A165 918

PRODUCTIVITY RESEARCH AND DEVELOPMENT PLANNING WORKSHOP

Willie Silva

St. Mary's University
One Camino Santa Maria
San Antonio, Texas 78284

Rodger D. Ballentine, Lt Col, USAF
Charles N. Weaver

MANPOWER AND PERSONNEL DIVISION
Brooks Air Force Base, Texas 78235-5601

March 1986

Final Paper for Period August - December 1983

Approved for public release; distribution unlimited.

LABORATORY

DTIC FILE COPY

DTIC
ELECTE
MAR 2 5 1986
S D
B

AIR FORCE SYSTEMS COMMAND
BROOKS AIR FORCE BASE, TEXAS 78235-5601

86 3 24

NOTICE

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely Government-related procurement, the United States Government incurs no responsibility or any obligation whatsoever. The fact that the Government may have formulated or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication, or otherwise in any manner construed, as licensing the holder, or any other person or corporation; or as conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

The Public Affairs Office has reviewed this paper, and it is releasable to the National Technical Information Service, where it will be available to the general public, including foreign nationals.

This paper has been reviewed and is approved for publication.

NANCY GUINN, Technical Director
Manpower and Personnel Division

RONALD L. KERCHNER, Colonel, USAF
Chief, Manpower and Personnel Division

Unclassified
SECURITY CLASSIFICATION OF THIS PAGE

ADA 165918

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution unlimited.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S) AFHRL-TP-85-10
6a. NAME OF PERFORMING ORGANIZATION The Texas MAXIMA Corporation 6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION Manpower and Personnel Division
6c. ADDRESS (City, State, and ZIP Code) 8301 Broadway, Suite 212 San Antonio, Texas 78209	7b. ADDRESS (City, State, and ZIP Code) Air Force Human Resources Laboratory Brooks Air Force Base, Texas 78235-5601
8a. NAME OF FUNDING/SPONSORING ORGANIZATION Air Force Human Resources Laboratory 8b. OFFICE SYMBOL (If applicable) HQ AFHRL	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER F33615-83-C-0030
8c. ADDRESS (City, State, and ZIP Code) Brooks Air Force Base, Texas 78235-5601	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. 62703F; PROJECT NO. 7734; TASK NO. 08; WORK UNIT ACCESSION NO. 23,24

11. TITLE (Include Security Classification)
Productivity Research and Development Planning Workshop

12. PERSONAL AUTHOR(S)
Silva, W.; Ballentine, R.D.; Weaver, C.N.

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Final	FROM 8 Aug 83 TO 15 Dec 83	March 1986	202

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	efficiency measurement
05	09		efficiency measurement organizational effectiveness
05	10		effectiveness productivity criteria (Continued)

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

This paper documents a workshop (20 to 23 September 1983) to identify behavioral science initiatives that would further enhance the current productivity research and development (R&D) program of the Air Force Human Resources Laboratory (AFHRL). The workshop began with a one-day session (confined to AFHRL personnel and selected Air Force Productivity Principals) in which Air Force productivity concerns were identified and discussed. On the second day, consultants made presentations on diagnosing and resolving productivity problems, creating climates for productivity, and implementing productivity programs. In addition, persons with productivity responsibilities in the Navy and Army and in other Air Force agencies made presentations on their programs. On the third day, the AFHRL presented its program of productivity research, including productivity measurement; feedback, goal setting, and incentive systems; and performance relevant situational constraints. The fourth day was devoted to group discussions to identify, evaluate, and prioritize productivity R&D initiatives for the AFHRL.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT [X] UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION
22a. NAME OF RESPONSIBLE INDIVIDUAL Nancy A. Perrigo, Chief, STINFO Office	22b. TELEPHONE (Include Area Code) (512) 536-3877 22c. OFFICE SYMBOL AFHRL/TSR

DD FORM 1473, 84 MAR 83 APR edition may be used until exhausted. All other editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE
Unclassified

18. (Concluded)

productivity measurement
productivity improvement

AFHRL Technical Paper 85-10 March 1986

PRODUCTIVITY RESEARCH AND DEVELOPMENT PLANNING WORKSHOP

Willie Silva

St. Mary's University
One Camino Santa Maria
San Antonio, Texas 78284

Rodger D. Ballentine, Lt Col, USAF
Charles N. Weaver

MANPOWER AND PERSONNEL DIVISION
Brooks Air Force Base, Texas 78235-5601

DTIC
ELECTE
MAR 2 5 1986
S D
B

Reviewed by

Rodger D. Ballentine, Lt Col, USAF
Chief, Productivity and Performance Measurement Function

Submitted for publication by

R. Bruce Gould
Chief, Force Utilization Branch

This document includes papers presented at the Productivity Research and Development Planning Workshop conducted by the Air Force Human Resources Laboratory on 20 - 23 September 1983.

SUMMARY

The productivity research and development (R&D) program at the Air Force Human Resources Laboratory (AFHRL) is guided by a model which asserts that productivity is a function of opportunity, capability, and motivation. This R&D applies behavioral science principles to productivity enhancement and measurement, with the work group as the level of analysis rather than the individual.

The primary objective of the Productivity Research and Development (R&D) Planning Workshop was to develop Air Force behavioral science R&D initiatives that would further enhance the current AFHRL program. The process for accomplishing this task included technical presentations, group discussions, and working sessions during which ideas were formulated, developed, recorded, and reiterated to workshop participants for final definition and consensus.

These proceedings provide abstracts, transcripts, summaries, and charts of presentations and discussions which occurred during the four-day workshop. This documentation concludes with a description of various R&D initiatives generated through the dedicated efforts of the workshop participants.

Accession For
NTIS
DTIC
Unan
Just
By
Dist
Dist
A-1

PREFACE

The idea for the Productivity Research and Development Planning Workshop surfaced in the fall of 1982 and actual planning started in early 1983. The organizing effort for the workshop was guided and directed by Lt Col Rodger D. Ballentine and Dr. Charles N. Weaver of the AFHRL Manpower and Personnel Division. Workshop chairperson was Dr. Willie Silva of St. Mary's University, and Ms. Sandra Martin served as administrative assistant. Discussions with personnel from the Air Force Productivity and Research Office (AF/MPME) contributed significantly to the structuring of the program. In addition, valuable contributions were made by the Air Force Human Resources Laboratory staff; productivity principals from Air Force major commands and separate operating agencies; personnel from the Air Force Academy (AFA), Air Force Institute of Technology (AFIT), Leadership and Management Development Center (LMDC), Army Research Institute (ARI), and the Navy Personnel Research and Development Center (NPRDC), and productivity consultants from industry and academia. The participation and special address by Major General Vince Luchsinger, mobilization augmentee for the Commander of the Air Force Systems Command, was especially appreciated.

Productivity R&D Planning Workshop Agenda
20-23 September 1983
Air Force Human Resources Laboratory (AFHRL)
Brooks AFB, Texas

Host: AFHRL Manpower and Personnel Division
Workshop Chairperson: Dr. Willie Silva

Program

Tue. 20 Sep

AM Plenary Session I: AF Productivity Principals

0800	Welcome/Purpose of Workshop	Dr. Nancy Guinn
		Lt Col Rodger Ballentine
0830	HQ MAC/MPME	Lt Roger Hawkins
0900	HQ ATC/XPMMS	Lt William Long
0930	BREAK	
0945	HQ TAC/XPMP	Mr. Bob Leckliter
1015	HQ AFSC/MPME	Mr. Stan Stepnitz
1045	HQ AFLC/MAJE	Mr. Al Reese
1105	SAALC/XRS	Mr. Frank Wing
1125	HQ AF COMS/XPS	Mr. Jerry Bonin
1145	LUNCH	Brooks Officer's Open Mess

PM Working Group Session I: AF Productivity R&D Needs

1315 Discussion of Productivity Problems and Needs

1500 BREAK

1515 Determine Research Recommendations

1630 ADJOURN

Wed, 21 Sep

AM **Plenary Session II: Productivity Consultants**

0800	Welcome/Purpose of Workshop	Col Tom Bronzo Vice Commander, AFHRL
0815	Approaches to Diagnosing and Resolving Productivity Problems	Dr. Raymond Katzell New York University
0915	BREAK	
0930	Creating Climates for Unit Productivity	Dr. Benjamin Schneider University of Maryland
1030	Productivity, Organization, and People	Mr. Charles Zimmerman Defense and Electronics Ctr
1130	LUNCH	Brooks Officers' Open Mess

PM **Plenary Session III: Services' Productivity Programs**

1300	ARI Productivity Research Program	Dr. Laurel Oliver Army Research Institute
1320	Overview of AF Productivity Program	Lt Col Bob Dahms Air Force Productivity and Research Office
1340	AFMEA Functional Review Process	Lt Wayne Hanson Air Force Management Engineering Agency
1400	AF Behavioral Enhancement Techniques	Maj Robert Ginnett Maj Robert Gregory Air Force Academy
1430	Special Address	Maj Gen Vince Luchsinger HQ Air Force Systems Command
1500	BREAK	
1515	Consulting and Research Programs	Lt Col Ron Halsted Lt Col Lloyd Woodman Leadership and Management Development Center
1555	Quality Circles	Dr. Bob Steel Air Force Institute of Technology
1620	NPRDC Productivity Research Program	Dr. Kent Crawford Navy Personnel R&D Center
1700	ADJOURN	
1730	Social Hour	Brooks Officers' Open Mess

Thurs. 22 Sep

AM Plenary Session IV: AFHRL Manpower & Personnel Division Division Productivity R&D

0800	AFHRL R&D	Dr. William E. Alley Scientific Advisor, Manpower and Personnel Division
0845	Methodology for Generating Efficiency and Effectiveness Measures	Dr. Tom C. Tuttle University of Maryland
0930	BREAK	
0945	Enhancing Productivity through Feedback, Goal-setting, and Incentive Systems	Dr. Robert D. Pritchard University of Houston
1030	Measurement and Assessment of Situational Constraints in Air Force Work Environments: A Brief Summary	Thomas W. Watson, Manpower and Personnel Div. Dr. Ed. O'Connor and Joe R. Eulberg, UT Dallas, Dr. Larry Peters, Southern Illinois University
1115	Establish Working Groups and Provide Tasking	Dr. Willie Silva St. Mary's University
1130	LUNCH	Brooks Officers' Open Mess

PM Working Group Session II: AF Productivity R&D Needs

1300	Working Group Meetings	
1600	Reconvene/General Summary	Dr. Willie Silva St. Mary's University
1630	ADJOURN	

Fri. 23 Sept

AM Plenary Session V: Summary/Conclusions

0800	Review/Discussion of Working Group Recommendations	Dr. Willie Silva Working Group Chairpersons
1000	BREAK	
1015	Comments by Consultants and Participants	Drs. Schneider & Katzell, and Mr. Zimmerman
1115	Closing Remarks	Dr. Willie Silva, Lt Col Ballentine
1130	Close Workshop	

TABLE OF CONTENTS

Page

Plenary Session I: Air Force Productivity Principals.....1

Introduction.....2

Military Airlift Command Productivity Enhancement Program.....3

Air Training Command Productivity Program.....5

Tactical Air Command Productivity Program.....7

Air Force Systems Command Productivity Enhancement Program.....12

Planning for Depot Maintenance Productivity Measurement in the AFLC Industrial Productivity Improvement Program.....15

Air Force Commissary Service Productivity Program.....18

Working Group Session I: Air Force Productivity Research and Development Needs.....19

Introduction.....20

Summary of Productivity Issues and Potential Research Initiatives.....21

Plenary Session II: Productivity Consultants.....27

Introduction.....28

Approaches to Diagnosing and Resolving Productivity Problems.....29

Creating Climates for Unit Productivity.....43

Productivity, Organization, and People.....56

Plenary Session III: Services' Productivity Programs.....67

Introduction.....68

Productivity Research in the Army: An Overview and Future Directions.....69

Overview of the Air Force Productivity Program.....74

Air Force Functional Reviews.....92

TABLE OF CONTENTS (Cont'd)

Page

Programs, Problems, and Potential Research in the U.S. Air Force.....96

Special Address: A People-Productivity Partnership.....103

Air Force Management Consultation Program.....105

Leadership and Management Development Center Productivity-Related Initiatives.....110

Air Force Institute of Technology's Quality Circles Studies Project.....115

Productivity Research of the Navy Personnel Research and Development Center.....122

Plenary Session IV: The Air Force Human Resources Laboratory Manpower & Personnel Division, Productivity R&D.....128

Introduction.....129

Organizational Productivity Measurement: Development and Field Test of a Methodology.....130

Enhancing Productivity in Air Force Organizations through Feedback, Goal Setting, and Incentive Systems.....144

Measurement and Assessment of Situational Constraints in Air Force Work Environment: A Brief Summary.....155

Working Group Session II: Air Force Productivity R&D Needs.....162

Summary.....163

Plenary Session V: Summary/Conclusions.....164

Introduction.....165

R&D Initiatives.....166

Concluding Comments by Consultants.....167

Productivity R&D Initiatives: Description, Comment, and Consolidation...178

Appendix A: List of Workshop Participants.....188

PLENARY SESSION I

AIR FORCE PRODUCTIVITY PRINCIPALS

PLENARY SESSION I

INTRODUCTION

Plenary Session I included presentations on the productivity programs of several Air Force major commands and agencies. Productivity principals, personnel responsible for managing the Air Force's Productivity Enhancement Program, and managers of other Air Force Productivity efforts provided overviews of their respective productivity programs. Presenters were asked to submit summaries which are included in this section.

Military Airlift Command (MAC)

Productivity Enhancement Program

Summary

Lt Roger Hawkins

Introduction MAC (Military Airlift Command) has been involved in the Air Force PEP (Productivity Enhancement Program) for many years in the following areas: organization, productivity plan, capital investments, participation, methods improvement, and publicity.

MAC Organization The MAC Productivity Principal, Lt Col Fred P. Drayer, is the Management Engineering Division Chief (XPME). He is responsible for the traditional PEP activities and development of the functional review performance work statement. In each MAC DCS (Deputy Chief of Staff), a person is designated as the productivity representative and, as such, acts as the focal point for AF PEP activities.

The base-level PEP structure consists of 17 management engineering units. Each MET (Management Engineering Team) Chief is encouraged to designate a technician to act as a reviewing official for all productivity program actions on the base. Through the wing commander, some METs have established base productivity working groups to facilitate education, crossfeed, and plan development.

Productivity Plan MAC/XPMEZ sends out reminders to all wing commanders in March and provides METs with tasking letters, Air Force goals, and feedback on their previous year's plan. The MET assists base functional productivity representatives in annex preparation, consolidates annexes with program information, obtains wing goals and endorsements, and forwards the plan to HQ MAC. The MAC DCS representatives screen base-level initiatives and document DCS initiatives. The MAX/XPMEZ adds background information, obtains command section goals and endorsements, forwards copies to Air Staff, and sends crossfeed back to wings, METs, and DCSs.

Capital Investments MAC had 19 Fast Payback Capital Investment Program (FASCAP) projects in FY 83 for an investment of $741K with projected savings of $5M. Currently, MAC has four Productivity Investment Fund (PIF) projects in different stages of implementation and one awaiting funding in the fall of 1983. The four approved projects represent an investment of $8.05M.

Participation MAC is striving for total force involvement. To emphasize this point, a quote from the current command productivity plan and briefing is provided.

> A dedicated effort is required to improve readiness while minimizing resource expenditures. To achieve this end, everyone in this command must comply with both the spirit and intent of the Air Force and

Command productivity programs. Our goal is to make people aware so they consider productivity enhancement in their day-to-day operations. We need good ideas designed to improve our operating procedures, making us more ready and capable to conduct the wartime mission. These ideas must come from everyone in all echelons of the Command.

The MAC quality of worklife efforts consist of quality circles, labor-management councils, and other efforts to involve workers in the improvement of products or services. There have been several starts of such efforts, but most die out after a short time. We have not witnessed a strong commitment to participative management techniques.

Methods Improvement This element consists of productivity enhancement studies (PES) and management advisory studies (MAS). There are other activities that fall under this category that do not meet the traditional management engineering study parameters. MAC accomplished several MASs this year. Other activities ranged from special studies, including some conducted at the request of the command section, to the many studies completed by the management analysis functions.

Publicity Getting the word out and keeping productivity a consideration in the everyday activities of command personnel is a constant process. To accomplish this, the MAC productivity principal pursues several avenues, including coordinating with the wing commander, senior enlisted advisor, and squadron commander. In addition, productivity information is disseminated through MAC News Service and base newspapers, daily bulletins, and flyers distributed to all work centers.

Summary The MAC productivity program has gone from awareness and education to actively seeking enhancements that improve operations. With the advent of functional reviews, MAC fully intends to aggressively pursue all known enhancements that make for efficient operations while not adversely affecting war readiness.

Air Training Command (ATC) Productivity Program

1Lt William A. Long

Overview

- who participates
- command goals
- functional goals
- Productivity Enhancing Capital Investment program participation
- promotion of productivity program
- future of Air Training Command productivity program

Participants

- top management - support is critical
- productivity principals
  - command
  - functional
  - base - Office of Primary Responsibility varies from base to base

Command Goals - as outlined in productivity plan

- develop tangible, measurable indicators of effectiveness and efficiency as useful management tools for commanders and supervisors at all organizational levels
- improve command posture by finding more efficient ways to use our resources
- provide credible data that will support the justification for increased resources
- deal with counter-productivity by eliminating inefficiency within current operating practices and procedures
- take an innovative look at improving methods, procedures, use of resources, and encouraging all personnel to become more concerned with personal and organization productivity efforts.
- document positive achievements and publicize results
- utilize all available programs to promote and measure productivity improvement and effectiveness

Common functional goals

- install automated equipment
- remodel or build facilities
- upgrade or replace equipment
- emphasize training (from a technical training aspect and training on processing reports, forms, etc.)

ATC participation in the PECI program has been in Fast Payback Capital Investment primarily

- only one Productivity Investment Fund project has been approved in ATC for a minicomputer for Community College of the Air Force at Maxwell AFB
- one project has been approved for a microcomputer for Graphics at Maxwell AFB in 1982, HQ ATC/DA submitted nine projects, each with an average cost of $90,000 in 1983, HQ ATC/LG submitted 11 projects, each with an average cost of $31,250

Advertisement

- periodicals and books are reviewed for ideas and drafted for use by command personnel
- PECI project information is assembled, categorized by function and is distributed to DCS and base productivity principals at least twice a year

Recognition

- nominations are requested from all ATC DCSs and bases the command nomination is using material obtained from the individual nominations received and from the Personnel suggestion program monitor
- a board chaired by Assistant DCS Plans and comprised of a Colonel (Assistant DCS) from each DCS selects the individual to represent ATC from the nominations received
- ATC participated last year for the first time with Col Roberts ATC/DA selected to represent ATC

Future of ATC productivity program

- continue to crossfeed initiatives, articles
- publicize achievements
- success of a productivity program will only be attained if everyone is involved

Tactical Air Command (TAC) Productivity Program

Mr. Bob Leckliter

This presentation looks at productivity in the Department of Defense, the Air Force, and very specifically the Tactical Air Command and Tactical Forces. I will discuss the environment for productivity and different ways productivity may be viewed. Hopefully these perspectives will stimulate thought about personnel research needs.

PRODUCTIVITY ENVIRONMENT

A successful productivity program must penetrate all levels of command, from the Air Staff to the lowest hierarchical unit. It must consider the needs, attitudes, and environment of line, staff, and command personnel.

By definition, the Air Force Productivity Enhancement Program (PEP) involves all the resources of production, including manpower, facilities, and materiel. Although organizational responsibilities reside in the Manpower and Organization Directorate of the Air Force DCS for Manpower and Personnel, PEP is not just a labor-based program. The need for productivity is recognized by all who support national defense. Resources to support defense, however, are limited both physically and monetarily. Therefore, successful defense means getting the most out of inputs.

Productivity is one of the most talked about subjects on our national agenda. Study groups, such as the recent Grace Commission, have generated much "smoke" or rhetoric about the need for productivity enhancement. But in all this "smoke," what is the level of the "fire"? What has actually been achieved in productivity enhancement? What has been the Air Force's actual performance? The test is in how much fire is generated, not in the volume of smoke.

To answer the above question and to provide a jumping-off point for my presentation, I would like to briefly discuss the nature of the armed services. The most fundamental characteristic of a military group is that it is a resourced force, i.e., it is resourced for contingent operations. For instance, the Air Force is resourced for fighting an air war. The armed forces are like a stable of prized race-horses. The horses are fed and maintained not for morning workouts, but for convincingly winning the race. After the race starts, it is too late to worry about resourcing. The point of this is that resources for combat must be on hand regardless of the level of their peacetime need. According to AFR 28-40, "Mobility for Tactical Air Force," the tactical organizations in the Air Force are supplied and maintained for their wartime role because, in most cases, that role represents the "high water mark" of resource needs. There are, of course, some commands, such as ATC, whose peacetime missions are quite similar to their wartime missions. In any case, the important point is that large segments of the Air Force are supplied and maintained according to their wartime rather than peacetime needs.

We can build on this idea to determine when we score a meaningful productivity enhancement "bulls-eye." If peacetime resource requirements are higher than wartime resource requirements, then we score a "bulls-eye" if productivity enhancement efforts "streamline" the peacetime mission so that peacetime needs do not exceed wartime needs. On the other hand, it would be a productivity "miss" if streamlining peacetime needs became an end in itself and resulted in resourcing below the level necessary for wartime. A miss also occurs if productivity enhancement efforts focus on peacetime needs and result in changes in wartime levels. At this point you might say this is obvious. It is obvious to us, but you would be surprised at the number of people involved with resources who forget and neglect this important concept.

The Economies and Efficiences Theory of Productivity. We turn now to another aspect of the PEP environment in the Services. Resources, especially manpower, have flexibility. Commanders and supervisors like to hold on to authorized manpower so that cutbacks can be handled with ease and unprogrammed requirements can be accomplished with what has been authorized. This becomes a "hold on to what you have" game. Even though you know you can do with less you never volunteer a reduction in resources. You never know what is around the corner in terms of additional requirements. You have to safeguard the extras. Commanders and managers are rarely criticized for having extra capability, but they are surely criticized if they cannot fulfill their missions because of a lack of resources. The system says it is their job to secure the resources so that the mission can be accomplished. The dollars to produce the capability is not the bottom line, but having or not having the capability is! Related to this is the fact that commanders and managers deal with "institutional" dollars and not personal dollars. But, as just observed, mission success is defined as deterrence through capability; rarely is there a worry about dollars.

Another aspect of the PEP environment in the military is the notion that "productivity is everybody's job." The problem is that when something is everyone's job, it is no one's job. This has been true in the industrial sector but, of late, groups are being set-up there whose sole responsibility is productivity. They have the authority to do something about productivity and if it is not accomplished they lose their jobs.

Another important aspect of the PEP environment is that Defense is a hierarchical institution. Movement happens from the top down. The Services and Government are bureaucratic. Therefore things are done according to prescribed procedures resulting in a procedural richness. This is accompanied by a reluctance to get procedures changed and the security of doing things by the book.

Other features of the military bureaucracy which affect the PEP environment include:

1. A plethora of "dos and don'ts."
2. A definition of good soldiering as conformity to systems and procedures.

3. A situation in which risk-taking innovators are paid no more than others. There is a non-equivalence between managerial risk-taking and pay. Improvements/changes must agonize up and down through many steps. Minor considerations are many and can derail many good ideas.
4. Performance rating systems are notorious for their "halos"...everybody is a "9." Boatrockers, by and large, are punished.
5. Turnover is endemic. One hardly learns the job before being sent to a different one. One never has to stew in the "witches brew" one has cooked up. That is left to the next poor soul.
6. There is precious little feeling of personal proprietorship.

The hierarchical system of the military has a strong sense of "dualism." The first part of this dualism is that what the top wants, the top gets. For instance, if the top puts a discernible interest in productivity, then productivity results will be achieved. The other part of the dualism is that if the top's interest in productivity is diffuse or sporadic, then the results will be diffuse or sporadic.

PRODUCTIVITY PERSPECTIVES

So much for the environment. We turn now to another subject. How do we score a PEP "touchdown"? Quite simply, we score a PEP touchdown when we get "more bang for the buck." In the combatant segment of the Air Force, "bang" is determined in terms of "lethality" and "survivability."

Let us look at productivity now in its environmental sense in two different and contrasting situations: a shoe factory vs. Tactical Air (TACAIR). Chart 1 makes the comparison. *In the center of the chart are* various attributes of the production or mission situations. On the left is the situation in the shoe factory. On the right is the situation of the TACAIR. As we start down the rows, we see that the shoe factory produces tangible products while TACAIR deals with capability. The hardware (tools and equipment) to produce shoes is plain as contrasted to the exotics of the TACAIR hardware. In the shoe factory, the ratio of plant and equipment to workforce consumables runs about 1 to 4. For TACAIR the ratio is 6 to 1. In terms of dollars, this ratio in TACAIR is close to 22 versus 4 billion. As you make other comparisons, note the product-service costs attribute. In the shoe factory this relationship is crucial for survival. In Defense (and TACAIR), however, such costs are largely peripheral. In fact, in Defense and TACAIR cost accounting is not applied so as to reveal what end or intermediate products and services really cost. Productivity measurement, the next attribute on Chart 1, is meaningful in the shoe factory. In the combatant services, however, productivity assessment, defined in terms of an output-input ratio, lacks meaning. The bottom line concern of combatant force managers and commanders is assessment of capability, not the change in profitability. The productivity of combat forces is assessed in terms of their lethality and survivability. That is what the mission is all about, just as it is the mission for a shoe factory to produce shoes at a profit.

Among the best ways to assess TACAIR productivity is to evaluate over a period of time sufficiently long so that advancements in lethality and survivability can be observed. Chart 2 captures such productivity advancements. Imagine a hardened, well-defended target. Because of the greatly improved lethality and survivability of our strike aircraft, F15s, we are able to "kill" the target with dozens of sorties as opposed to the hundreds it might have taken with 1960 weapon systems, F84s. The chart further shows that present weapon systems are very expensive in terms of aircraft, crews, crew training, and other costs. The chart also shows that if we had not made our "air" business more productive and competitive over time, costs would have virtually driven us out of business. Our old productive apparatus would require hundreds of F84 sorties and attrition would be very high. Even though aircraft, crew, and other sortie costs would be relatively low for F84s, the overall cost to kill the target would be much higher when compared to our present forces. Thus, the Air Force is making noteworthy productivity strides in lethality and survivability.

Chart 3 provides a graphic portrayal of the same point by looking at two cases. On the left of the chart, case #1 looks at relative dollar costs to kill a target. Clearly the Air Force has improved its productivity. We do it cheaper and we can get the job done. Case #2, on the right side of the chart, shows that from the peacetime perspective, the cost of sorties is very much higher. Conventional thinking would suggest that we are getting less output per dollar of input. But are we? Real productivity in the Air Force is up. The problem is that it is easier to think about productivity in orthodox or conventional terms than in the sense of weapons systems and technology. People plus support costs are a part of those new weapons systems and of the advancing technology.

Contributing to this problem is the requirement of the Air Force and Department of Defense that we report productivity in unclassified terms. Unfortunately, lethality and survivability are classified when bottom-line sense is being made about productivity in combatant commands.

Attitudes about productivity are an outgrowth of the way people are asked to look at productivity. Three cases of this may be distinguished. In the first, wartime resource requirements are higher than peacetime and the unit uses wartime resources for peacetime work. In this case, the big picture productivity outlook provides a proper perspective. This means dealing with issues that go beyond peacetime production and measuring productivity in terms of wartime requirements. In the second case, wartime needs again outstrip peacetime needs. The unit is supplied for wartime. But if today's productivity is used to gauge the unit's productivity, it will be a "turn-off" to commanders and senior officials who are well aware of their wartime roles as the planning basis for their resources. They are concerned that peacetime economies will be made at the expense of the organization's real needs, those related to wartime. In case three, peacetime needs may be equal to or greater than wartime needs. Here the conventional way of thinking about productivity is used and is appropriate to the situation. This means of measurement should not be a source of concern to the organization being studied.

These cases clearly demonstrate that the assessment of productivity in the Air Force must have a multiple design. The arena in which the organization is working must be clearly defined so that the design of a productivity assessment procedure can be made appropriate and meaningful. Once the right design is determined and understood by both productivity practitioners and operators, resources necessary to attain higher levels of productivity must be provided. Resources must be sufficient so that effects can be felt and sustained. Critical size and dedication must be reached before enhanced productivity outcomes will be forthcoming.

Once the commitment to resources is made, the best organization for those resources becomes important. AFR 25-3, Air Force Productivity Enhancement Program, provides a good conceptual framework for organizing Air Force productivity efforts. Productivity principals should be positioned high enough in organizations to have ready access to the commanders and senior staff and to operate effectively as catalysts for enhancing productivity. Making this concept a reality takes influence and goes beyond issuance of a regulation. There is need for sustained commitment that can be seen by everyone.

Air Force Systems Command (AFSC) Productivity Enhancement Program

Mr. Stanley Stepnitz

There are three working components in the AFSC Productivity Enhancement program under AFR 25-3, Air Force Productivity Enhancement Program: the annual AFSC Productivity Plan, the Fast Payback Capital Investment (FASCAP) Program, and the Productivity Investment Fund (PIF) Program.

Our annual plan is formatted according to AFR 25-3. After a short introduction of what the Systems Command does, we list a few of the very broad objectives of the plan that should result in increased productivity. Two examples are reducing the cost to maintain the required level of effectiveness of operations and promoting greater use of productivity improvement oriented programs and labor saving capital investment opportunities.

A short section on organization and responsibilities outline where the command productivity principal is assigned and his attendant responsibilities. Likewise, Productivity Principals are listed for each functional staff element in the headquarters and are responsible for administrating a productivity program within their staff element.

Our plan contains definitions of terms used in productivity discussions and writings. The basic plan provides guidance and direction to field commands for preparation and submission of their productivity plans. Finally, the basic plan contains reporting guidance and a description of the functional annexes that comprise the second part of the plan.

The functional annexes follow the format guidance described in AFR 25-3. The first part of each annex has an introduction, a list of productivity goals and, where appropriate, how the total function will be measured. The second part contains the initiatives to be taken or being taken to improve productivity and help achieve stated goals.

A few observations concerning the productivity plan process are in order. The concept is great. The utility from a major air command standpoint is fair to good. The reason for this can be found in the variety of presentations we have experienced. Some are evidently trying to improve the way they do work and prepare initiatives that are realistic. Others initiatives are to improve "quality," but are not quantifiable.

Just why we have as many initiatives for quality as we do is not really understood. I suspect there are some people that think productivity improvement is not important or is not even necessary. There are some that have an empire they do not want disturbed. Others may believe their work is so important they cannot take time off to work on something else. Some believe their work cannot be changed because it is controlled by higher authority. I believe research could be conducted on how to motivate people to get them involved in planning for productivity improvement.

The second recognized component is the FASCAP program. Since the inception of that program, disqualifying criteria have dictated that a FASCAP project cannot be initiated to allocate funds to Major Force Program VI (R&D). Within Air Force Systems Command, that is a severe restriction. We have 37532 Program VI authorizations which is 67 percent of the Command. Programs VII (R&D) and VIII (R&D) are almost the only areas where we can use FASCAP and they represent only 24 percent of the Command. And, that is almost exclusively where our FASCAP proposals have originated. A recent message from HQ USAF Productivity and Research Office (26 Aug 83) was music to our ears. From that message, we believe we will have a FASCAP program starting in FY 85. At least we are making that interpretation. We have written a letter to all METs and productivity principals around the Command. We suggest that they re-familiarize themselves with Atch 3 to AFR 25-3. We have told them we want to be ready to submit a number of proposals the minute the door is open. So, we have not been very productive in the FASCAP program, but we hope to be productive in the future.

The third component is the Productivity Investment Fund (PIF) program. For some reason, we seem to like it. Our participation rate is the highest in the Air Force. During the four years 1980 through 1983, we submitted 34 proposals to HQ USAF. That is more than 27 percent of all PIFs submitted. From a productivity standpoint, that is good. True, it is nice to be able to say we are participating more than anyone else. On the other hand, if there is that much participation, it can be construed as evidence that our productivity is very low or that a lot of our equipment is antiquated or both. If we combine these thoughts it begins to look like we should do a lot more in the name of productivity. If there is that much real need for capital expenditures to increase productivity, and I suspect there is, I think it is time that the Air Force Budget System should start something new. Dollar justification requests for equipment or facilities should have a productivity increase rating. Budget reviewers and approvers should develop some method to prioritize based on greater productivity potential.

That is my overview of the Air Force Systems Command Productivity Program. As you may surmise, I think of my effectiveness or efficiency with mixed emotions. The Command Productivity Program causes me some concern. There has been no emphasis on a need for really meaningful initiatives. As a result, we have many of the "quality" initiatives. A possible reason is that people do not know how to measure the work they do and, therefore, cannot envision how to construct or prove an improvement.

Our FASCAP program is not very strong. For years our promotional efforts have caused many people to lament the lack of support for R&D areas. We have not been able to get much participation in the other areas. We had a member of the Surgeon's staff make an effort to arouse some interest; at least he did just before he was reassigned. We are not happy with the FASCAP program, but I have hope for the future.

I must say I am happy about our PIF program. I believe one main reason for our success is the great amount of time spent on the telephone giving guidance and encouragement. In all correspondence we emphasize ways to construct a competitive proposal and encourage people to call if assistance is needed.

That is why we are there. I suspect that the informal helpful approach does more for the program than anything else except the dire need to get new equipment.

I have a few comments about other productivity efforts in AFSC. The folks on the mission side of the house, namely the Systems Program Offices (SPOs) and the Contracting and Manufacturing Offices, have been concerned about the productivity of contractors. They have been doing things to reduce costs and improve productivity for some time. There is a requirement that contracts over a certain dollar figure must have work measurement programs. There has been an effort to give multi-year contracts that provide lower per unit costs to the Air Force. There are programs in which the Air Force bears part of the capital investment costs for items or systems that will improve contractor productivity.

These are all commendable efforts. One possible problem I see is that there is no effort to link these efforts to the Air Force Productivity Enhancement Program. I said possible problem because I don't really know if it is worth the time and effort to get them under the umbrella. I think it is something that could be discussed.

Planning for Depot Maintenance Productivity Measurement in the Air Force Logistics Command (AFLC) Industrial Productivity Improvement Program

Mr. Al Reese

The organic depot maintenance organization in AFLC is a huge industrial complex. It involves nearly 36,000 employees in eight different geographic locations across the country. These people work in facilities covering approximately 18 million square feet which are valued at more than $3.5 billion. Annual operating costs for FY 1983 are expected to exceed that same value. In terms for Fortune magazine's ranking, that kind of cost base would place AFLC depot maintenance organizations among the top 150 American corporations.

Productivity measures how well resources are used to produce an output and is an inherent characteristic of any human effort. Certainly it is an important consideration in the management of AFLC depot maintenance organizations. These organizations have always been concerned with producing goods and services resulting in accomplishment of mission and that concern has always been expressed in terms of cost, time, and quality. Such expression did not, however, adequately measure on a total factor basis change in productivity from one period to another.

During the last three years, the DCS/Maintenance at HQ AFLC has been making organization, management, and policy changes designed to bring about systematic and effective investment in new technologies, improvements in workload management, and enhanced levels of production in terms of both quality and timeliness. Very recently this corporate effort has transitioned into the AFLC Industrial Productivity Improvement Program. This program is aimed at institutionalizing ongoing efforts and structuring new initiatives in a manner that will maximize the return on investment. Productivity growth of 5 to 10 percent annually has been established as an objective. A special communications network has been created as an organizational technique for achieving maximum interest and participation in this program.

The emergence of this new program subjected current means of measuring productivity to very critical review and analysis by management. This revealed that current measurement is at best a fragmented, incomplete, and complex system which does not give a true indication of actual productivity.

The Maintenance Productivity Steering Group surveyed both the private sector and other DoD organizations and sought the advice of special consultants in seeking a satisfactory means of measuring productivity of the organic depot maintenance organization. This survey did not produce a measurement system that was acceptable to the Steering Group. It did produce a decision to establish an internal working group tasked to develop a viable measurement system.

The Productivity Measurement Working Group (PMWG) was created and charged with developing a measure that indicates how well resources are employed in performing depot maintenance. The tasking required that the measure be an all inclusive, universally applicable, simple measure that would capture the cost of labor, capital, material, energy, and other resources used by depot maintenance activity in producing goods and services.

On 15 July, 1983, I was asked to put together a plan addressing this tasking and to organize and head up the working group charged with its accomplishment. The initial plan was approved by the Maintenance Productivity Steering Group in late July. In mid-August the PMWG had a kick-off meeting at Oklahoma City. Out of this meeting came proposals for a definition of productivity, selection of a measure, a baseline for measurement, initial sizing of data requirements, a PMWG plan of action and some initial taskings. These actions were reported to the Steering Group during a Command Director of Maintenance Conference at Wright-Patterson AFB in early September.

The Steering Group approved the measure proposed by the PMWG with one change. The measure was expanded to include economies and cost avoidances attributable to the maintenance work force that would not have been captured by the measure as initially formulated by the PMWG. The balance of the plan and recommendations made by the PMWG were accepted by the Steering Group.

Under the revised measure, productivity can be defined for the purpose of the AFLC Industrial Productivity Improvement Program as:

> Efficiency with which input resources are used to produce output as modified by considerations of effectiveness such as timeliness and quality and as further modified to include all economies attributable to the maintenance work force including cost avoidances and savings in other functional areas.

The revised measure will address three indentures of productivity:

1. Gross Productivity: Change over time in the efficiency with which resources are used to produce output.

2. Net Productivity: The change over time in gross productivity factored by the change over time in timeliness and quality of output, i.e., efficiency modified by effectiveness.

3. Total Productivity: The change in net productivity plus the value of economies and cost avoidances not captured in net productivity that occur during the same period.

The PMWG is still in its infancy. We are just getting into the most difficult part of our task. Identifying all the causes of change in resource cost and output measures and classifying these into categories of "productivity related" and "not productivity related" is a sizable undertaking. Arranging for data processing that will automatically accumulate productivity information in this fashion is perceived as a very difficult and long term undertaking. We do not feel we have captured the measurement technique that will adequately measure productivity and respond to our tasking.

Air Force Commissary Service (AF COMS) Productivity Program

Mr. Jerry Bonin

The Air Force Commissary Service Productivity Plan is prepared in compliance with AFR 25-3, Air Force Productivity Enhancement Program. This year we received twenty-nine proposed initiatives from our headquarters and field units. Sixteen of the proposals were not included in the plan. The majority of these were reworked from previous years' plans. Some were restatements of what is currently being done or deleted for reason of not receiving support from headquarters. The initiatives in our plan contain no innovative or noteworthy ideas. If any or all of them were fully implemented, they would not materially affect the way we conduct business nor realize any significant savings. Cost avoidance is the major source of our increased productivity.

Our greatest problem is in educating our productivity monitors and workers in the field concerning exactly what the Productivity Program is all about. Many of our people, even productivity monitors, are confused by the multiplicity and overlapping of the various productivity programs. They are unfamiliar with terminology and virtually ignorant of how to prepare progress reports. For these reasons, many field units take the easy way out and submit negative replies. The units that do take the time usually do not follow the formats and/or submit initiatives that are restatements of their primary duties. A considerable amount of time is thereby taken in contacting initiators, coordinating rewrites and changes to prepare the initiatives for inclusion in the plan.

A feeling persists that while everyone supports productivity in general, not many want to affect the status quo in their area. This tendency is especially prevalent at the middle to high management levels when an initiative, if implemented, would impose new methods upon them from lower levels or other functional areas. It is very difficult to overcome resistance to "this is the way it has always been done."

Before being implemented command wide, some of our initiatives require testing to see if the idea is workable and will increase productivity. For the most part, personnel in the field do not have the time or expertise to evaluate and prepare reports for submission to headquarters. Further, if the initia- tive were their own, they would be more likely to view them favorably.

It seems to us that a full-time independent manager of <u>all</u> productivity programs is needed at the headquarters level. This individual would be able to devote the time required to educate monitors at lower levels of management. Initiatives could be discussed with an impartial person and, if testing or evaluation were required, the productivity manager could make the arrangements. If all Air Force people could be told that the evaluator of their ideas won't be someone in their functional area at a higher level, someone who probably won't be receptive to ideas below him, then we might build a program people will trust. Ideas should then flow much more freely. Until some change is made in how the flow of initiatives culminates in the productivity plan, we will continue to get grudging compliance and not many truly new ideas.

WORKING GROUP SESSION I

AIR FORCE PRODUCTIVITY

RESEARCH AND DEVELOPMENT NEEDS

WORKING GROUP SESSION I

INTRODUCTION

Participants in Working Groups Session I included the speakers from Plenary Session I, representatives from the United States Air Force Productivity Office, Air Force Human Resources Laboratory scientists, and the Workshop staff. The primary purpose was to identify R&D initiatives applicable to productivity. The session provided a forum in which productivity program managers could discuss their programs and share ideas. Participants were encouraged to identify program issues, deficiencies, needs, and enhancement opportunities. This section contains a summary of the issues supported by edited excerpts from group discussions. The issues represent enhancement opportunities and potential R&D initiatives.

SUMMARY OF PRODUCTIVITY ISSUES AND POTENTIAL RESEARCH INITIATIVES

Participants in the group discussion approached their task in a conscientious manner. The issues addressed reflect the wide range of abilities and responsibilities of productivity managers.

A review of the discussion indicated that several issues surfaced repeatedly during the dialogue. These issues and samples of the dialogue applicable to them are summarized below.

Roles

There was concern that the roles in productivity of commanders and productivity principals are not adequately defined. It was suggested that more emphasis be placed on the commander's responsibilities in the Productivity Enhancement Program (PEP). In addition, it was suggested that there may be conflict in the role of a PEP manager since this program may be only one of several jobs for which the incumbent is responsible. Selected comments reflecting these attitudes are as follows:

> It has to come from the top down, not from the bottom up. We should not be convincing commanders. They should be beating us over the head saying, "Give me more! What are you doing? What can I do to help?"
>
> When we rely on a productivity principal and management engineering throughout all the major commands to keep this program up and running, I do not see how we can ever get it to the point of the commander or vice commander. That is the person who should be the productivity principal - somebody who has the stick.
>
> Productivity has to have top level support. A couple of times this morning it was said that the (Orthodox Job Enrichment) OJE program may have failed in part by lack of support from the middleman. I am wondering how a program can have top level support and not have the middle manager support. Is that an organizational problem? That top- and middle-level are not staying with a problem in the same way?
>
> So, I think the commander who knows the bottom line is going to increase productivity, but it is up to him to carry out all these responsibilities.
>
> I think the enlisted force and company grade officers are well motivated and trying their hearts out to be more effective and efficient. I think the question needs to be asked at the field and flag officers levels.
>
> The people in this room can tell you it is just part-time training and work and they respond to it like that.

Program Structure and Definition

There was much concern about the overlap of the various productivity programs. It was suggested that this causes ambiguity in the definition and scope of the PEP. The integration of the programs may be made more difficult by the fact that organizational responsibilities for the programs belong to different functional areas, e.g., Manpower vs. Comptroller. Selected comments from the discussion are as follows.

> I think one of the problems we have is trying to define the umbrella. Everyone had to do something about productivity. A lot of people are doing things. We have the suggestion program, the quality of worklife program, and the Tech Mod program. All of these programs are productivity oriented, and they should all fit under this productivity program umbrella. We have so much going on, so many productivity programs, and no central accumulating point to eliminate overlap, to eliminate duplication of effort.
>
> We can take productivity enhancement in terms of the daily worries commanders have and they do worry about productivity in their own terms. They do worry about efficiency so they can get resources and devote them to other persons. They do worry about effectiveness and they do worry about quality. But they do not think in terms of a PEP, they think in terms of the programs they are using.
>
> I wonder, does having management engineering as the principal focal point for this program tend to take away from its effectiveness in some way?

Understanding and Participation

The lack of more complete understanding of the PEP by Air Force personnel as well as a widespread lack of enthusiasm were concerns. It was felt by many participants that stronger executive support is required to overcome this problem. In addition, the need for improved feedback and greater visibility of the payoffs was stressed. Relevant comments are:

> How are we going to define this productivity program to get the masses involved? To get an education program going? I think we have a problem of voids. What points exist within the Air Force productivity-wise that some program will fill? It is like market research. You cannot sell a product unless there is a need for the product. What is the need for an umbrella program?
>
> From a worker level, savings means something different than it does to someone up in Air Force or DoD. Down at the worker level, the guy asks, "why should I give someone an idea to save money when they are just going to take it from me and give it to someone else?"

The Air Force has to be able to demonstrate that we have an aggressive effort to improve productivity and that it works. That is the absolute bottom line. But, we never really institutionalize the Productivity Enhancement Program in terms of structure and resources through four-star level support. The deliverables which do, in fact, have meaning are not recognized as being needed by the populace of the Air Force.

A problem I see is the lack of understanding. I am getting down to basics. The people that are doing the work, wherever they are, do not really understand what productivity is, or what the program is. I do not know how we would get the information to them or how we would educate the masses. The masses do not understand productivity; therefore, it is very difficult for them to get motivated.

Personnel Manning

This issue dealt with both the number and kind of personnel allocated to the job of productivity principal. To do the job properly, more such positions are needed. Concern was also expressed about the fact that a large proportion of productivity principals are officers of lower rank, a situation seen by many as a de-emphasis of the Program. Related to this was the feeling that the job itself or the tasks involved need to be made more meaningful and rewarding. Applicable examples of the dialogue are:

One of the things you might want to do is to determine the qualifications and the experience of the productivity principals, not only of the productivity principal in each command, but across the spectrum of the commands. What skills do you have, what experience, and what kind of turnover.

We are flailing out there the best we can with the resources we have, but I just do not think it is doing the job that turns commanders on or that they relate to.

I have heartburn about military involvement in quality circles and possibly even in productivity programs because of their rotating assignments, i.e., PCS and the like. How can they get involved in a particular aspect of a productivity program, including a quality circle when the are going to be on a circle for a certain amount of time and then be gone? How can they really get enthusiastic about a problem in time to make the contribution toward solving the problem, see the payoff, and derive some personal gratification out of it?

The other aspect is schooling. We train management engineering personnel at Keesler to develop standards. They do not all have expertise to do productivity enhancement. And it is what the guy has on his sleeve that counts. I do not care what you say, if I send in a buck sergeant, he is not going to get anywhere. He may have the right background, the expertise, but he does not have the right advantage.

Tools

There was a general belief among participants that productivity principals need better tools with which to perform their job. Suggested tools include incentive or reward systems, education packages, better measurement methodologies, utility functions, organizational strategies, and evaluation criteria or measures of merit. Relevant excerpts from the discussion include the following:

> I think it is almost a two-step problem for this type of research: what is the void we need to fill and what are the points of leverage by which we could best fill that void. Everything else follows from that - your support, your structure, your enthusiasm, particular deliverables.
>
> If you enhance, you have to be aware of what is going on. There is a lot of technology out there that most of us are not aware of. We need to synthesize all this information.
>
> It is important to have some kind of comprehensive, sensible productivity measurement system that accurately affects what is going on. I think we need it for the purposes of publicity and for dealing with the public.
>
> I would propose we need to know the measures of merit that each one of the commands is using now and if there are some deficiencies in those, they should be corrected.
>
> Do commanders know what to do with those measures? They have lots of data, but do they know what to do with the data? Do they need to be educated about what to do? How to use the data? What the data are really telling them?
>
> Because of the measurement problem I think we are missing a lot of the initiatives. It takes a lot of time.
>
> I think we need some capability to analyze the utility of our productivity programs. How much advantage is there to quality circles? What is the advantage to having quality circles? Are they significantly improving productivity in the units where it is used?
>
> How do we measure some of our organizational development programs, e.g., job enrichment and quality of worklife? How do we evaluate them? Do we want to evaluate them in terms of impact on productivity?
>
> Dollar savings are demonstrated easily by using labor productivity, by taking the efficiency formula, output/input. So there is that orientation from the top view. There is not a whole lot of attention being paid to the effectiveness side of the formula. The macro-measurement scheme that exists is more of an efficiency measure.

Given the above issues, the Working Group defined specific productivity needs and enhancement opportunities which could require research support. Twelve items were identified and are summarized below. This list represents an initial statement of potential research initiatives.

RESEARCH - RELEVANT

NEEDS AND ENHANCEMENT OPPORTUNITIES

1. Identify/develop reward systems which encourage and/or enhance program participation.
   -- implementation process

2. Determine job requirements of productivity principals
   -- assess qualifications

3. Conduct Air Force-wide attitude/opinion survey.
   -- assess:
      -- knowledge/understanding
      -- program commitment
      -- perceived utility/need
      -- etc.

   -- perspective of:
      -- Air Force managers
      -- productivity principals
      -- Air Force members

4. Define educational requirements; develop programs
      -- principals
      -- management
      -- Air Force members

5. Investigate/describe the relationship between program enhancement methods and organizational characteristics (e.g., mission or function, wartime vs. peacetime objectives).
   -- problem x solution x organizational structure
   -- leverage points for change

6. Identify/develop measurement methodologies and criteria which are applicable to non-product oriented service functional areas.

7. Identify/develop organization/management structures and strategies which enhance or support productivity programs across functional areas.

8. Determine relationship between currently available measures of unit capability and productivity.
   -- C status
   -- percent manning (i.e., manned vs. authorized)
   -- Inspector General/Operational Readiness Inspection

9. Identify technology data bases (equipment, processes, techniques) and determine how they may be utilized.
   -- accessibility
   -- productivity principal as resource person

10. Identify indices (criteria) currently being used by management for the purpose of determining the merit of enhancement programs.
    -- utility of indices
    -- commonality/standardization

11. Identify/develop costing techniques and strategies relevant to Productivity Enhancement Program (PEP).
    -- commonality/standardization

12. Conduct systems analysis of PEP
    -- utility
    -- needs
    -- structure/organization
    -- process
    -- products (output)
    -- technology available

PLENARY SESSION II

PRODUCTIVITY CONSULTANTS

PLENARY SESSION II

INTRODUCTION

In this session and those that follow, participation in the Workshop was expanded to include representatives from various Air Force agencies who are involved in productivity R&D or analysis. Representatives from Army and Navy personnel research organizations were also in attendance.

Colonel Bronzo, AFHRL Vice Commander, opened this session by welcoming attendees and stressing the importance of the Workshop to the AFHRL Productivity R&D program. Following Colonel Bronzo, productivity consultants from academia and industry presented papers on diagnosing and resolving productivity problems, creating productivity climates, and implementing productivity programs. This section includes overviews of these presentations, edited transcripts of the actual speeches, with accompanying charts.

Approaches to Diagnosing & Resolving Productivity Problems

Overview

Dr. Raymond A. Katzell
New York University

This paper focuses on two main points:

A. A review of the results of 207 productivity experiments, and

B. A paradigm for analyzing motivational conditions underlying productivity problems.

A. Review of Productivity Experiments

My colleagues and I located and reviewed 207 experiments designed to improve workforce productivity as reported in American publications during the 11-year period of 1971-1981. Our objectives were to catalog the various approaches that had been employed and to assess their effects.

A content analysis of the methods employed indicated that they could be categorized under 11 rubrics. The eight principal interventions are listed in the accompanying table (Chart 1 of transcript), which also shows the frequency into which each was employed and the number of instances in which it had a favorable impact on each of three kinds of productivity measures: output (including quantity and quality of work done), withdrawal behavior (such as absenteeism and turnover), and disruption (including strikes, accidents, and other contra-normative behavior).

It can be seen that by far the most frequently employed technique consisted of some form of personnel training. Moreover, in the vast majority of instances, training was reported to have a positive effect on productivity, especially output. Predominantly favorable effects were also reported for all of the other techniques as well, although it must be remembered that negative feelings are less likely to be published. Nevertheless, all in all, 87% of the reported experiments done in actual organizational settings had a positive effect on at least one concrete measure of productivity.

Quite a few of the experiments also included a measure of personnel attitudes. Again, a large majority reported favorable effects on those variables as well. In short, improvements in productivity need not be gained at the expense of the quality of work-life; indeed, it is the rule rather than the exception that they can be enhanced together. Moreover, calculations show that considerable economic benefit can accrue from such programs.

B. Analyzing Motivational Conditions

Those instances in which improvement attempts fail are usually characterized by a mismatch between the problem and the solution. It is therefore important that productivity improvement programs be based on a sound analysis of each situation. An example of a methodology for making such diagnoses is the "Motivation Audit" procedure which we have been developing at New York University for the past two years. This procedure has as its objective the identification of possible weaknesses in the conditions required for productive motivation in an organization's work force.

The Motivation Audit has the following features: (Chart 2)

Based on a synthesis of the leading theories of work motivation, leading to identification of a number of key constructs that are linked in a theoretical model;

Utilizes three types of measures, including a self-report questionnaire, an inventory of organizational policies and practices, and records of performance;

Adapts existing measures that have shown promise;

Furnishes a motivational analysis in terms of major points of possible action, i.e., the key constructs;

Keys various management programs to the action points as guides for improvement;

The key constructs covered by motivation audit include:

Employee needs and values (intrinsic and extrinsic);

Work incentives (extrinsic and intrinsic);

Goals for performance (management, group, own, and processes involved);

Resources;

Reinforcement;

Equity;

Performance Outcomes;

Attitudes.

Experience to date suggests that these data are relevant to productivity and can provide a useful guide to improvement efforts.

Conclusions

The behavioral sciences have developed technologies that can simultaneously improve productivity, quality of work life, and financial performance, provided that they are properly matched to the underlying problems.

Edited Transcript of Workshop Presentation

Dr. Raymond Katzell

In calling attention to the seriousness of the subject that we have for today, I am reminded that further manifestation of this seriousness is the fact that for the next couple of days there is going to be a National White House Conference on the subject of productivity. This conference with representatives of government, industry, labor, academia, and others is a further symbol of the importance of the topic that we are gathered together for the next couple of days to discuss. It really is a topic that is on the front burner of national, indeed, international consciousness.

There are two main focuses of my talk this morning. First, I would like to share with you the results of a review of the last 11 years of published research on staff productivity improvement efforts that I and some of my colleagues, notably Dr. Richard Guzo, have conducted recently. Some of you may have seen the published outcome of this, but it may serve as a useful springboard for the discussion for the next couple of days to have as a context the kinds of programs that have been tried and something of the nature of their results.

The second focus that I would like to share with you is how we can help ensure that the programs and efforts that we undertake to improve productivity are appropriate to the problem that exists in any given situation. After all, a whole group of techniques have been tried, many of which in one situation or another have been found useful. On the other hand, some of those same techniques tried in another situation have not been found to be particularly effective. And so, there is an issue here of matching the treatment and the disease--the solution and the problem. Therefore, in the latter part of my talk, I would like to address the question of how we can make diagnoses that will help to ensure that the productivity improvement programs that we undertake are in fact relevant to the situation with which we are confronted.

Review of Productivity Improvement Literature

First, I wish to discuss the outcome of the review of productivity improvement literature. We were deputized a couple of years ago by the Work in America Institute, with some funding from the Federal Government, to look into the American literature published since 1971 that reported experiments which had the objective of enhancing the productivity of the workforce in an actual, functioning organization. We scoured that literature and came up with 207 reports that satisfied our criteria; the experiments were not all done with high sophistication, though we particularly welcomed reports of that kind. However, the criteria required that the studies had to be actual interventions into real-life organizational situations. Some aspect of the situation actually had to be changed. Also, the impact of that change had to be assessed in terms of at least one concrete measure of productivity. We did not want to report studies that simply reflected people's feelings or ratings, but some tangible result had to be studied.

When we did a content analysis of the interventions used in the efforts to change productivity, we found that we could arrange the methods into 11 categories. I will cite those using the first of the charts (Chart 1).

I have listed in the left-hand column eight of the principal interventions or methods used to increase productivity. There were three others used so infrequently that I did not bother to portray the results in the chart. It was not that they were not important. For example, selection interventions were an additional category, but surprisingly, in the ten or eleven years worth of literature that we reviewed, there were only a handful of experiments that assessed on a follow-up basis what happens when you change the technique of selecting people. Most of such studies are correlational, rather than evaluative in terms of the impact of the change, so that there are only a few of them that qualified and we have not included them in the chart. There are a few studies also in the new area that is emerging, decision making techniques, that is a promising area, but has very few studies as yet to assess. Also, a third category had to do with organizational restructuring, dealing basically with changes in channels of communication, levels of hierarchy of authority, distribution of responsibilities, departmentalization, and related kinds of things. Again, there were too few of these to include. Incidentally, in all these three instances, the few studies that existed indicated that these too are rather promising techniques, so they are not excluded here because they were worthless. They were simply excluded because there were not enough cases to give them much weight.

Turning to the remaining eight, these are not unfamiliar to you, I am sure. For example, training is our good old war horse and turns out to be the most frequently employed intervention in those 207 productivity improvement efforts. This category involves the training of the staff of an organization to improve some aspect of the competence of the staff. And sure enough, as you can see looking at the three right hand columns, training programs generally had positive effects.

Let me explain further what is in those three right hand columns. The three column headings, i.e., Output, Withdrawal, and Disruption, refer to the kinds of outcomes or dependent variables that were used to assess the impact of the changes. In categorizing output variables, various kinds of rate of production or quality of production measures were included. Withdrawal typically had to do with personnel statistics like turnover, absenteeism, tardiness, and the like; that is, withdrawal from the work situation either by quitting or absenting oneself temporarily. Disruption had to do with a variety of contra-normative behaviors; things like accidents, strikes, and pilferage. We employed this as a term to capture the variety of those things that were disruptive of the normal flow of operations. So these are the three major types of outcomes.

Incidentally, the reason why we included things like withdrawal and disruption as a measures of productivity are two-fold. One is that it is apparent in our review of the literature on the subject that the popular conception of productivity includes such kinds of outcomes as well as the more mainstream

goal concerns of actual production of goods or services. In other words, management, labor, and the public-at-large think of productivity not only as delivery of goods and services, but also of these related kinds of behaviors which are, let us say, assumed to affect somehow the effectiveness of the staff of an organization. The other reason is that, of course, these are all cost factors in some way. If they do not directly show up in output, they indirectly make output more costly because the organization must either replace those people who are absent at a particular time or invest more money in recruiting, selecting, and training replacements for people who have left. In a real sense, these outcomes also affect the economic efficiency of an organization and, therefore, belong in productivity. So, for those reasons, we included them as well as the more customary output measures.

Getting back to the chart, we can see that there were 52 instances in which training was evaluated in terms of some measure of output - that is the denominator in that ratio. In 47 of those 52, or in other words, in 90% of the 52 instances, a positive effect was found. The next column refers to the fact that there were 18 instances in which the effects of training were assessed in terms of some measure of withdrawal and in 72% of those instances a positive effect was found. Finally, as you see in the third column, there were five studies that used some measure of disruption, and of these, three had a positive effect. The training programs included mostly the traditional kinds of things that we are well acquainted with. The newer sorts of things that appeared in more recent years had to do with computer-assisted training methods, the use of reinforcement techniques, behavior modification, and so on. All of these are grouped under a rubric of training.

Proceeding with the chart, appraisal and MBO refers to programs in which systematic procedures were devised for monitoring the performance of people on the job and providing them with feedback of the effectiveness of their performance. These kinds of programs differ from the old fashioned rating and appraisal programs in that they tend to be focused more specifically on particular productive activities of the personnel and furnishing them with complete and accurate and specific feedback rather than the once-a-year waltzing around which is so characteristic of the older type of merit rating program. You can see in the chart that those programs were not as widely used as some of the others, as shown by the denominators. They are, however, used fairly often, and in the vast majority of instances they have positive, favorable results on some aspect of productivity.

Goal-setting is somewhat related to appraisal and MBO, but tends to be characterized more by the specification of performance objectives by somebody in a supervisory responsibility. Typically, these goals are set at a challenging, high level - a level higher than has been customarily achieved before, and also often accompanied with feedback to the individuals of how effective they have been in achieving those goals. So these are goal-setting plus feedback kinds of situations in most instances, although not all, for some of them did not include feedback as an aspect of it. An increasing number of studies of this sort, which by and large support the results of earlier laboratory work, suggest that the clarification of higher level of goal expectation is a powerful motivating device that helps improve productivity.

Work redesign was typically a form of job enrichment where an effort was made to restructure the nature of workers' responsibilities so as to load them with more challenge, more variety, greater scope in their activities. Sometimes this was done for entire teams, not just for individuals. Job redesign programs saw quite a bit of experimentation in the earlier years of the period of review but seem to have dropped off in terms of published reports in recent years. Again, in the vast majority of instances, the reports are positive but there is a sprinkling of instances of no appreciable effects and even a few where there are adverse effects. These latter effects were the result of the redesign efforts being introduced into a situation for which they just were not appropriate. For example, the technology does not always lend itself to the restructuring of jobs or the inclusion of greater responsibilities may be at variance with a managerial philosophy which does not particularly encourage initiative and growth on the part of the personnel. So the result is a conflict between two kinds of philosophies of how things ought to be done.

This finding, incidentally, of a substantial sprinkling of negative or null findings, is not inconsistent with what Richard Hackman found. Hackman is one of the principal researchers in this area of job redesign. He did a follow-up of a number of redesign efforts a few years ago and found that in about half the instances the program was not successful even if there were some initial evidences of success that had peaked out. His conclusion was that this was usually a result of trying to introduce job redesign into inappropriate situations. He cautioned in an article called "The Coming Demise of Job Enrichment" against the use of these techniques as artificial gimmicks in ways that are really foreign to the nature of the problem or the situation.

Supervisory methods is the next category in the chart. Of course, many of these other techniques that we have already covered involve input from supervisors. Training, appraisal, and Management by Objectives, for example, also involve the supervisor. So the supervisor is an important element in a variety of these programs. But in this category we refer specifically to attempts to change the style, the techniques by which the supervisor deals with his/her subordinates rather than the supervisor as an instrument of some other kind of program. This is, again, a well established strategy and was widely used through the period with many instances of positive results.

Compensation is the age-old, I guess the oldest, technique for motivating people. In recent years, the emphasis has been on devising techniques for productivity sharing which somehow link the incomes of employees to performance, not of their individual jobs as in the traditional incentive plans, but rather to the productivity of the enterprise as a whole or some major subdivision of the enterprise. It is not even a group bonus kind of thing. It is not profit sharing. It is productivity sharing in terms of linking income to the amount of work that gets done. As Mitchell Fein, one of the people active in installing these kinds of programs, says, "What we measure is what goes out the back door," and income sharing is linked to the gains in the number of units or pounds or whatever it is that is being delivered. Incidentally, there are some interesting instances where productivity sharing has been used in service organizations as well as manufacturing operations,

so it is beginning to see use there. Again, the data show a large number of instances of positive results with this type of program.

Rescheduling work principally involves two kinds of schemes. The first includes growing use of "flextime" which involves setting up work schedules where there is some core of working time during the day when everybody is expected to be present, but usually there is some time early in the day and late in the day when people have some freedom to set their own schedules. Employees are expected to put in the normal 36 or 40 hour week, but with some latitude as to when they come in and when they leave. This is typically accomplished with the agreement of a supervisor. Here the results are not uniformally positive. Although generally people like this type of flexibility, it does not always seem to have beneficial effects on productivity. On the other hand, even in the instances where it did not have a positive effect, it did not seem to have a particularly negative effect either. So it does not seem to be a costly thing to do where it is feasible; it might be a morale builder even if it does not have much effect on productivity.

The other kind of work rescheduling scheme has to do with the redistribution of hours through the work week. The most frequent example of that is the so called 4-40 pattern. In this instance, a 40-hour week is redistributed form five eight-hour days to four ten-hour days. The cycling of the four days is usually scheduled so that the workforce is involved in a seven-day operation, with any given worker or employee being on the job for only four of the seven days during the week. The results that are recorded are similar to the flextime, although employees are not as uniformly in favor of such redistribution of working hours.

Finally, by Sociotechnical Systems we refer to a massive change in a number of respects, typically involving supervisory style, communication, redistribution, of responsibility, participation, and the like. So many other things happen that they add up to a revision not only in the human relationships on the job, but even in how the work gets done. The program, therefore, involves technological as well as social and human dimensions. There are a number of different ways of accomplishing this. The Scanlon plan is a widely known example. It starts out being a device for encouraging ideas as to how to improve the productivity of an organization and it has ramifications as to how people are compensated and expands to include the scope of people's jobs and responsibilities. Changes are often made in materials, equipment, scheduling, and so on, so you cannot put your finger on any given dimension of the work setting that is being affected. There are many dimensions being affected. Organization development programs, in lower case o.d. only, would fit under this rubric as well. By being lower case, I am not using it in the jargony sense of sensitivity training or T-group kinds of interventions, although that may be part of it, but rather in the sense of a systematic attempt to change and develop the organization by survey feedback, the introduction of a Scanlon type of program or even by using the outside expert consultants to restructure work relationships. In any event, these kinds of sociotechnical system interventions are again typically highly successful in at least some aspects of productivity improvement.

To summarize, you can see that of the 207 programs, 181 of them reported positive results in at least one of these aspects of productivity, and 87% success rate. Now I hasten to add that as we all know here, it is not very likely that a study failing to find a positive result or a favorable outcome would get published. So this probably represents a somewhat biased sample of experiments, that is, biased in the direction of those that had something positive to report. It is difficult to estimate how many failures there would have been had the full picture been divulged, but none the less, it is still pretty impressive. If the correct figure is not 87%, maybe it is 67%, so we are still clearly finding evidence that we have developed over a period of time a set of techniques, a technology, if you will, based on behavioral science principles and methods that have positive impact on various aspects of productivity.

Incidentally, another thing is that quite a few of those studies included a measure of attitude concerning how people feel about their jobs, on a before and after basis. In better than 70% of those instances where such measures were included, favorable effects were found on attitudes as well as measures of productivity. This suggests, of course, that in increasing productivity, you do not have to do so at the expense of the quality of worklife, but in fact, more often by improving the productive system in some way, you also help people develop a more satisfactory working life. I suspect this is because a good bit of job satisfaction can be attributable to success on the job. People are satisfied when they are effective. They tend to be dissatisfied when they are ineffective or when conditions prevent them from doing the kind of job that they are hired to do and prepared to do. Facilitating their work performance and removing some of the constraints from effective performance will at the same time help develop a better quality of worklife.

Matching Solutions with Problems

I think you all know there is a tendency for people to pick solutions off the shelf, figuratively and literally. They hear about a solution in a conference or they read about it in a magazine and the reaction is one of "let us try it."

A recent example of that is the use of quality circles. Somehow, with horribly little in the way of firm data they just spread like wildfire through the country. I am not suggesting that it should not have spread like wildfire, but I do not think it was particularly based on a thoughtful, careful analysis of what was the problem. It was just picked up as a "here is a solution...let us see if it works." I suspect that in a number of instances it is going to backfire and maybe, unfairly, quality circles will be disparaged. It may not have been noted that they were used where they should not have been. They may have been good in the right situation, but were not being used for a problem that lent itself to that particular solution. What is needed, then, is some system for relating problems and solutions. That means that you have to have some kind of denominator that equates them, or a Rosetta Stone, if you will, that translates hieroglyphics into Greek, and vice versa, so that you can move back and forth. You need some way of tracking or monitoring what is going on in this situation and identifying it and then saying "OK, we have a problem in this regard, here is a solution that bears on that kind of problem." You see,

you need this translation back and forth from problems to solutions.

The last couple of years at New York University, some of us have been working on an approach which I will outline. It is not altogether unique, but I think it illustrates a way to meet that objective. We have developed a program focusing on the motivational dimension of productivity. We started out with an assessment of the principal theories of work motivation that were founded on reasonably good research, and extracted from them a number of key constructs that we felt helped clarify the dynamics and the mechanisms for motivating or demotivating people. Then we devised a set of instruments and procedures for assessing the status of each of these constructs in a work force. And the third step of this was to hypothesize from our knowledge of various kinds of intervention programs, which of those constructs are likely to be related or affected by that kind of an intervention. Let me illustrate what I am talking about, making it a little more concrete, by referring you to Chart 2.

Incidentally, just let me make some parenthetical point that I was going to make but which I have omitted from my earlier remarks. In talking to management groups and technical groups as well, I have found it useful to follow-up that summary of the effective motivational programs that I had on Chart 1 by indicating that there are financial benefits of these things as well. I have used as examples some of the published attempts various people have given to put dollar and cents values into the effects of programs. Specifically, I have used the Schmidt, Hunter, et al. example of the benefits that would accrue from an improved selection program. If you introduced a better selection program than the one that you had, it develops some interesting figures. For example, what would happen if we selected computer programmers with a more valid selection technique, one that actually exists rater than the usual one that is used. The result might be that the nation would benefit in the form of hundreds of millions of dollars annually from the introduction of a more valid technique for selecting computer programmers.

Similarly, recent published research has shown that the improvement in personnel attitudes can be translated back into financial terms. Again, one can be a little skeptical about the accuracy of the particular figures that are used, but the sense of it communicates. So we can say that these improvement methods not only improve the quality of worklife, but they have dollar value as well, and that communicates very well to hardheaded management types who are concerned with the bottom line and cost effectiveness considerations of programs that we are talking about. Does it pay? Does it result in a saving?

Getting back to Chart 2, the column labeled variable really should be titled construct. The constructs we arrived at are not going to be foreign to you because they were extracted from the contemporary theorizing about what it is that makes people tick motivationally. We have included Employee Needs and Values - the intrinsic and extrinsic ones; Incentives or rewards - intrinsic and extrinsic; Goals - managements' goals, groups' goals, the person's goals, and goal-setting processes. In your own research program you have the notion of constraints which is sort of the complement of what we have called Resources. Expectancy is the cognitive representation of this, that is, the expectation that "If I were to try would I be able to perform?" Cognitively that is what resources mean. If you can answer "yes" then you have adequate

resources, or limited constraints. If your answer is "I am not sure" then there is a question about resources. Reinforcement is Expectancy II, that is, "If I do perform, will I get rewarded?" That is the expectation. If the answer is "Yes" then there is a high expectation of reinforcement. If the answer is "I am not sure" then the reinforcement contingencies are apparently weak. Equity is essentially the fairness or the appropriateness of the ratio of reward to input. In addition, we also measured various attitudes and outcomes, including job satisfaction, involvement, effort, and performance. Again, if time permits, I would like to discuss how these constructs get related into the grand theoretical framework. But I think you can get the sense of the principal constructs that we think are important. If one measured these things, we believe you would have a pretty good sense of the ways in which people are being turned on or off in their work situations.

The columns in Chart 2 to the right of the constructs indicate the methods that we use for getting readings on these constructs. We used a questionnaire, which we mainly adapted from existing questionnaires, rather than try to reinvent them. Where the literature suggests that there is a pretty good measure of something, we do not try to replace it, we use it. Thus, for example, we have used the Minnesota Satisfaction Questionnaire as one source of our items, and similarly in other areas.

A second source of information consists of a review that we make of the organization's policies and practices. We look into how they recruit and select people, how they train people, how their technology has been arrived at, whether it has been modernized or revised, if there have been any problems with it. We look at how they are designing jobs, describing them, communicating with the people, their appraisal processes, etc., so that we are getting a picture of the environment - the context to which people are reacting when they answer the questionnaire. So we have the employees' view of the situation and we also have outside views of the stimulus situation - the environment in which people are operating.

A third source of information is recorded data that exist in files or can be obtained from files. For instance, we try to track employee absenteeism not only by asking the employees for their perceptions or ratings of absence, but we also look at the company records. We gather data on the average salary or wage paid for people in different classifications, we determine variation in wages and so on. Therefore, we use three sources of data: the employees' perceptions and reactions to the work situation, the outsider's view of the environment that the company is providing in terms of the policies and practices that are followed and archival data that further supplement that picture. The upshot of this is to provide essentially a profile of highs and lows of the various motivational constructs in terms of which we can better describe the organization's workforce. So, for example, we look at the strength of employees' values in order to assess how appropriate are the incentives that are being offered. What about the goals? Are they being set at a high level? Are the goals clear? Do people understand and accept them? What about the resources, are they adequate so that motivated people can maintain their motivation, or are they demotivated? Are the incentives and rewards linked in some meaningful way to performance? Or is there some erratic relationship between what people do on the job and what their rewards are? The overall

object is to identify areas of possible deficiency.

We also have a manual which lists some 50 kinds of motivation improvement programs that have been used in various organizations and which links these programs to those key motivational constructs. For example, if there is some evidence that the goals set by management are unclear, or they are weak, or they an inconsistent, we relate various kinds of intervention programs as shown on Chart 2 to that construct. One possible action might be getting some consensus among managers to what they want people to be doing, because the source of the problem may be lack of agreement among the managers or the leaders of an organization as to what they really should be trying to accomplish. Or another problem may be there is pretty good agreement, but it is not communicated to people what is expected of them, what the organization stands for, or is trying to accomplish. Perhaps it has not been translated down to the individual job as the work you, Mr. Jones or Ms. Smith, are expected to accomplish - here are the standards of performance that are expected of you in order to accomplish our goals. If the area of a problem tends to be in terms of group norms, that is, that the work group is not supportive of high performance, then consideration should be given to group development programs of various sorts that may be used to build team consensus, harmonious worker relationships, sense of common purpose, and so on.

I am just using these as illustrations. The general point is that we have a set of key motivational constructs, a measurement methodology for assessing the state of those constructs in an organization, and guidelines that suggest the kinds of changes or interventions that might be appropriate to use in shoring up one or another of the construct areas in which deficiencies appear to exist. To date, we still have had only a limited tryout of this approach. We now have six companies that are working with us to test it further. The early results are rather encouraging, both from the standpoint of the theory of the model underlying this, that is, the data seems to relate to each other in a meaningful way, and also, in terms of the practical utility for the organization.

SUMMARY

Basically there seems to be a large armamentarium of technology that behavioral scientists have devised that show evidence of strong effects on productivity; that these, when translated into financial terms, appear to be cost effective; that they also have favorable bearing on the quality of worklife of people. In short, they have both economic and human payoff. However, they do not always work. We saw in Chart 1 that, given even the bias of the positive results being reported, there were enough negative results to present an amber signal that these things do not always work. When you look into why they do not work - the negative cases - it is often because there has been a mismatch between the problem and the solution - because someone has indiscriminantly pulled an intervention technique off the shelf in an effort to solve a problem. Our second focus, therefore, has been the need to develop diagnostic approaches that enable us to discern what is going on in a situation so that we can somehow key available behavior science technology and to introduce changes that are appropriate to the deficiencies creating the productivity problems in specific situations.

QUESTIONS AND ANSWERS

Questions about numbers on Chart 1 being recorded more than one time.

Answer: Yes. Some of these are multiple studies - for example, a goal-setting study might have included both a measure of output and a measure of withdrawal.

Question: With reference to the variance of longitudinality on these productivity study measures, how long were these measures tracked?

Answer: They vary tremendously; more often than not, the duration was not very long. There might be a period of six months to a year. There were a few that took longer range views of two or three years, but they were in the minority. I would say 75% of them were under a year. It is a good point to note the possible long-term decay of the effects of these interventions. I think it is important to have more longitudinal studies to see whether they stand up or whether they even have a kind of momentum quality to them. We do not know much about that. In the studies of productivity sharing that I have been involved in, there sometimes is evidence of a drop-off after about 6-9 months. The early results, on the average, seem to be about a 17% productivity improvement for the first six months or so, and then, it may begin to taper off. There are ways of delivering booster shots so that you can recapture that 17%, but you just cannot assume that it is going to go on forever without doing something about it. I think that part of the effect of the productivity sharing schemes is the goal-setting quality. Initially, there is a big surge of people determining what it is you are really trying to build and how many of these things you are trying to put out the back door, to use the vernacular. So, it is a consciousness-raising thing, but eventually people begin to pay attention to other things, and the attention given to the goal fades. By boosting it, you can get them to realize, "Oh, yea, that is right. This is what we are trying to do," and it gets back up there again.

Question: In your review of the literature, does supervisory style have potential as far as pay-off goes? Is it the best way to go?

Answer: Well, I would not base that on these figures particularly. It is true that it is one of the highest, but I do not think that the differences in these percentages are particularly significant. Maybe this one (rescheduling work) is significantly lower but the others are all pretty much in the same neighborhood.

Question: In studying the data in the 207 research projects, was there any indication that the leader or manager appeared to be choosing between an either/or situation as if there were only two solutions to the problem?

Answer: Yes, but I think more often than not it is "either we will do this or we will not do anything," rather than "should we do this or that?" It is more as if a way to go has been suggested and the question that is being pondered is should we take this way or should we not, which, of course, is really A versus B, but A is the status quo and B is something new.

Question: If you identify these deficiency areas in an organization, you can assume there are a number of areas where the organization is deficient. Do you have any suggestions on where to start?

Answer: That is a very important issue that you have raised and it is relevant not only in this approach we have described here, but to any attempt at organization improvement. Where do you start? My general advice is to locate what I call a "point of stress," where there is wide agreement "this is a problem for us." It may be how we train people, it may be that we do not communicate, it may be that there may be a conflict about what is really the way to go, but whatever it is, it suggests that there is a difficulty here. It is not just some kind of delusion, but it is a problem for us, and we have some kind of data to suggest it. If you use an approach like that it provides data for decision makers to examine and ask themselves collectively, "What is going on here?" and creates an occasion for identifying such points of stress where you find some coalescence around the notion "it is about time we did something about this." That is where you would start and then the other things could follow. The objective eventually is overall organization improvement unless there is already an unusually well developed organization, in which case you already have a built-in improvement method. Once you have a good organization, it is going to continue to improve itself. You do not have to do special studies for it. The problem-solving capability has already been developed in such a good organization.

In organizations that are not developed to that point, I would do what we have called a sociotechnical systems redesign, making adjustments in the utilization of people, in their relationships and goals on the jobs, and finally in the kinds of equipment, technology, and procedures that they follow. All of these things are elements of an improved total work system, but those things do not just happen. You have to start somewhere but it is important to have an overall plan. Incidentally, some of the most dramatic experiences have been where new organizations have started up because that is the easiest way to set up a really effective system. You do not have all the weight of the past traditions and of existing space or technology or people weighing you down. You start all over again, and you can do all sorts of wonderful things. In most instances, however, we are trying to develop an existing organization where the objective is to gradually rework various kinds of things and eventually wind up with a revised sociotechnical system.

CREATING CLIMATES FOR UNIT PRODUCTIVITY

Overview

Benjamin Schneider
University of Maryland, College Park

First, a summary of the contemporary research literature on the topic of organizational climates is presented. The summary is divided into two main categories: conceptual progress and methodological progress. Four major conceptual advances are discussed: (a) the role of perception in behavior in work organizations, (b) the focus on multiple levels of analysis, (c) the distinction between psychological and organizational climate, and (d) the idea that organizations have multiple climates. Four methodological advances are also proposed: (a) the measurement of climates, (b) the differentiation of climates from satisfaction and other attitudes, (c) the multi-dimensional assessment of climates, and (d) the aggregation problem. It is suggested that the climate approach to research and theory represents a half-full, rather than a half-empty cup.

Second, a definition of how climates emerge in work settings is proposed: Work climates emerge from the naturally occurring patterns of goal-oriented interactions of people with each other and (changing) facets of the work environment. Each of the elements in the definition is considered for discussion focusing on the idea that climates emerge as much as they are created in a reciprocal create-emerge cycle.

Third, the conditions necessary for the creation-emergence of climates are outlined. This outline builds on the work of Daniel Katz and Robert L. Kahn (The Social Psychology of Organizations, 2d ed. New York: Wiley, 1978) and specifies six major issues that contribute to the kinds of climates that exist in work settings: (a) membership, (b) socialization, (c) identity, (d) structural, (e) interpersonal, and (f) environmental. Each of these issues is discussed in detail because it is proposed that, in combination, they communicate to incumbents the kinds of behaviors that the system will reward, support, and expect. In addition, however, it is proposed that the very rules, procedures, and authority structures that permeate organizations and yield the behavior we observe are created by the incumbents or at least legitimized by them or they will not influence behavior. Finally, it is proposed that because organizations cannot possibly specify all of the important behaviors required for success, it is important to monitor the climates created there because in the absence of role prescriptions, climates will dictate behavior.

Throughout, the implicit definition of productivity is a broad conceptualization of the multidimensional behaviors required for meeting both short-term efficiency criteria and long-term effectiveness criteria. It is assumed that the hard work necessary to specify both sets of criteria has been accomplished; whether or not and how this is done contributes to the climates in an organization. With respect to productivity and specification of criteria, the notion that organizations differ from each other in qualitative as well as quantitative ways is presented.

Edited Transcript of Workshop Presentation

Dr. Benjamin Schneider

This morning I would like to tell you where I think we are in research on organizational climate. I will talk about some conceptual and methodological progress that we have made, and then I will provide you with an everyday handy-dandy definition of what organizational climate is and how it emerges in work settings. Following that, I will try to speak on the range of topics that I think organizations must address in order to create particular kinds of climate that they would like to have in their organizations. Throughout, I will provide you some of my favorite quotations from writers, especially Daniel Katz and Robert L. Kahn (The Social Psychology of Organizations, 2nd ed. New York: Wiley, 1978), who are two very prominent writers in the field of understanding organizations from a systems perspective, that is, trying to take into account all these many things that go on from a human resources standpoint. In addition to quotes from them, I will quote from another person of that same sort, Edgar H. Schein. He has written a very interesting, relatively small book called Organizational Psychology (Englewood Cliffs, N.J.: Prentice-Hall, 1980) which I think outlines very well the many human issues regarding organizations that are important to attend to.

Conceptual Progress

Let us talk about some conceptual progress that I think we have made (Chart 1). In following up on Dr. Katzell's talk, it seems that the focus in organizations has been on human resources attempts at change in organizations. The focus has always come from the motivation standpoint. When I go into organizations, the first question I hear is, "how can we motivate our people to do better?" I have turned that question around and said, "Let us make the assumption that your workers are motivated. What are the things that are keeping them from showing that?" So once you take that perspective, then you say to yourself, "What are the things that the workers are seeing or sensing or feeling or perceiving? What are the things that the workers are perceiving that lead them to be doing things that you would rather they not do? And/or failing to do things you would like to see them do?" This is where organizational climate is. Climate focuses on the perceptions, the cognitions, the senses, that the workers in a place have about what is important for them to do or how it is important for them to behave. What are the cues and clues that the organization is giving off that lead them to interpret what they should do? That is where organizational climate is--on the perception side. It is not on the motivation side. So we make the fundamental assumption that workers are motivated and that what they are always trying to do is figure out "What the heck am I suppose to be doing here?" That in its most generic sense is "What the heck is going on?" They have no control over asking the question, and in order to answer the question, they take a look at the different things that are going on and interpret. They make interpretations regardless of whether or not you want them to make interpretations, and they have to because they have to figure out what is going on. They cannot keep everything they see

and experience separate in their heads. They have to group them into categories.

A second question concerning organizational climate is this: Is not climate a very subjective kind of thing? We make a distinction in the literature which I believe is false about things that are more objective versus things that are more subjective. Life and the experiences of people who live it are subjective. Life is subjective. Now the question is "Is there anything objective?" Well, merely choosing to count something that looks objective in an organization is a subjective decision. So, if you choose to count the number of gizmos that go out the back door, you have made a choice about what is important; i.e., the number of gizmos that go out the back door. If you do not care about the quality of gizmos that go out the back door, only about the quantity of gizmos you see, that is a choice you made. That is a subjective decision. So most of the things that we focus on in our organizations are on the subjective side.

Now, how do we make them objective? Objectivity is the answer to the question: Can people agree on whatever it is you're interested in? So for example, the reason why the number of gizmos going out the back door looks objective is that it is relatively countable. If two people count those things going out the back door, they will both get the same number. So, that makes it look objective. Okay, now the question is: Can you be in agreement about what is going on in organizations? Is there agreement? If you go into a work unit and you ask two people "What is the atmosphere in this place?" and two of them say it is confusing, do we not then have objective indices? The people have agreed. I mean, that is as much agreement as you can get on the fact that there were 47 things that went out the back door. I and other researchers in my field can show that people in the same work unit do tend to agree on the kinds of things that are going on there. That it is not so vague, it is not amorphous as long as we try to phrase the questions we ask them in terms that refer to actual behaviors or actual experiences, rather than ask them to make attributions about why somebody did something. So, for example, if you ask people why does your boss behave the way he or she behaves, then you will not get much agreement. If you ask them how does your boss behave with respect to performance appraisal or with respect to setting goals, then you will get agreement. This is because they are looking at the same person and people do not tend to differ so much from each other that you cannot get an agreement.

A third conceptual issue that we have dealt with is the question: Is climate something that refers to the individual, that is, is it psychological--the psychological climate, you know, this private perception of reality? That is a myth that we have. On the other hand, does it represent something more about the unit or organization we have? By the way, I am using the word "organization" here as a generic term, but it also refers to unit or group. It is that system of which a person feels a part. So it might be a unit, or the group, or the team, or the larger organization. It turns out that people do not have such private perceptions of the world--private in that they are different, remarkably different, from other people they work with. We will get into why that may be so when we talk more about the definition.

While we can differentiate psychological from organizational climate, concep-

tually, it turns out that people in the same work unit tend to share their perceptions and that makes it a unit climate thing as well as a personal kind of thing.

The fourth issue is that we have largely agreed that organizations have many climates rather than a single climate. What happens is that when each of us as an individual goes into an organization, we are able to say the climate of this organization is, and we attach a label. Then we go to another organization and we say "ooh, the climate in this unit is," and we attach a label. Usually we attach funny words like "rotten" or "terrible," and those are not very useful. What we have to do is label the climate unit in terms that describe what we are interested in the unit doing. For example, we go into a unit and say the climate for safety in this unit is remarkable. Now what would you draw on for information to reach that conclusion? Well, you would be wandering around and you would see everyone wearing what they should be wearing in that place if they were behaving in safe ways. Or you would check the records in the organization. Does the organization buy the kind of equipment that people have to wear in order to be safe? Are supervisors assessed in regard to how many accidents there are in their units? You see, there is a whole host of things that would happen that would lead you to the conclusion "Yes, there is a climate for safety here."

Okay, now you can do that with lots of different things. I have done research in climates of service, I have done research on climates for quality, and what happens, you see, is you go in and you try and track down all of the instances or all the examples of how the organization is literally communicating to its people with respect to these issues of interest. And so, organizations do lots of things that are important to them. Now the organization may not know what is important to it. It may not know that, but it is communicating it. Implicitly by the things they reward, support, and expect, organizations communicate to their people, through their behaviors and through all of the practices, rules, and procedures that exist, what is important...what kinds of climates. People pick up and draw on these cues as a frame of reference for guiding their behavior. So, when I get into a situation that requires a choice, e.g., am I going to behave safely or am I going to behave to increase productivity, it depends upon the cues that have been pounded into my head. That is what is going to help me determine the decision that I am going to make when I come to that choice.

We have a conceptualization of what I refer to as the climate approach to research or the climate approach to productivity in organizations. And what it says, in general, is that organizations communicate the things that are important to it by its manifold practices and procedures--by everything it does. The smallest part of communication in an organization is memorandum. Organizations communicate through their practices to employees, through procedures, and what they reward and support. Whether or not they know they are doing it, that is the way they communicate. Again, I would like to draw on Dr. Katzell's work. I think one good way to find out what is important in an organization is to look at the dimensions on which managers in that organization are evaluated, or the dimensions on which supervisors in organizations are evaluated. Supervisors are not stupid. They will do the kinds of things for which they are told they will be rewarded. Over the past 15 years we have had

this emphasis on affirmative action/equal employment opportunity--how many organizations evaluate their supervisors on whether or not the supervisors do things to promote that? If they do not have that in the supervisory performance appraisal, I can guarantee that there will be little behavior directed towards that end. So these are the conceptual kinds of progress that I think we have made.

Methodological Progress

Methodologically, one of the most important progresses made is that we can assess where organizations are putting their emphasis now (Chart 2). For a long time we did not even try to assess these things. We walked in and we made inferences, and now we know we can assess these kinds of things. We can ask the people in organizations what is going on and what are the practices and procedures with respect to different kinds of issues. In doing that we have made some progress. We can develop the kinds of audits that Ray is talking about, and that is a relatively new accomplishment. You know, we are talking about 15 years or so at the outside.

The second methodological progress is that when we are speaking about these kinds of audits we are not talking about job satisfaction measures--that is a separate thing. We are talking about the distinction between belief and affect. Belief is what I believe is going on around me and what is happening to me. Affect is how I feel about what is going on around me, or happening to me. We can make this distinction around measures between how happy I am with what is happening and what is happening. When you ask people to fill out questionnaires or respond to interviews, if you carefully word your questions, they will respond differentially. Say, "Yeah, this place has this incentive system whereby the people who produce more units an hour get more money than the people who do not. And that is all they pay attention to." They have described something and they have given you a hint that they may not like it. But you see the difference. And so, the next thing out of that person's mouth might be "I hate the system." That is the difference between what I believe is going on and how I feel about it. You can get people to talk about things in that way.

Omnibus vs. Specific. What I mean there is that for a while we focused on measuring all the many hundreds and thousands of things organizations can do that give off these messages to employees about what is important or unimportant. I refer to those as the omnibus kinds of measures. In my own work, I found it much more useful to focus on the specific issues that are troubling organizations such that I can isolate the issues that need to be addressed for the specific problem. Again, I hate to agree with people all the time, but I agree with Ray that the place to start change in organizations is to get some consensus on what the problems are, then focus your procedures on the assessment and specific diagnosis of those specific issues. So remember, I said I have done research on climates for service, climates for safety, climates for quality. As I move on to those specific different kinds of topics, I may change the dimension I am assessing because some dimensions are more relevant for some issues than others. I do not have a model worked out, like Ray's, but I guess I have been doing it intuitively rather than framing it against an

explicit framework. What I do depends a great deal on my observation in the organization and my discussion with the people who work there.

Aggregation Unit vs. Item Referent. One of the errors that we have made in our climate research is that we have borrowed measures that were developed for job satisfaction and then used them for measures of organizational climate. However, those measures of job satisfaction always referred to I or me or how I feel or how I am and so forth. Those were poor questions to use in climate questionnaires and as the basis of interviews because you do not want to know so much about how the individual is reacting or feeling, as you want to know how individuals describe what is happening to them and around them. So the items in a questionnaire or the questions in an interview must ask the respondent to describe what is happening in the group or unit rather than just how they feel about what is happening to them or what is only happening to them. So we try to use questions like: "I am rewarded for what I do," and then add up the responses to those questions for a group and say this group feels so and so about being rewarded for what they do. That is a no-no. That is an impossible aggregation. You cannot take those personal responses and aggregate them and say "Well, the average personal responses in this group is so and so." It is not that you cannot do it, I would suggest you do not do it because what you want to know is what the people say is happening in the group. Then, you will be able to have some information about the group rather than the individuals. So the very important kind of progress that we have made methodologically is to make that distinction as well.

I think that is where we are in climate research. I like to think of climate research as a half full cup. If you read the literature, there is a lot of people talking about it as a half empty cup, but, being an optimist, I just cannot help myself.

Organizational Climates

A question you obviously have is how do climates come about? Well, this is a sort of working definition of how I think they come about (Chart 3). They emerge from natural occurring patterns of interaction, usually goal-oriented interaction, of people with each other and the different and sometimes changing facets of their work environment. I believe, then, that climates come about as a result of a sharing of common experiences and a sharing of what those common experiences mean. Now I want you to think and close your eyes and imagine one of the work units you are associated with. When I say work units I mean some squadron or whatever. Think about a work unit you have been associated with and think about how much sharing of information there is among the people in those work units. When I say sharing information, I do not mean people sitting down and saying "Well, let us share some information." I mean what is happening when they are griping about what is going on, when they are casting aspersions on the supervisor, either in joking or acid manner; these are the ways people share information with each other. Think about the way you and your colleagues share information about your boss. You do it in all of these information kinds of interaction patterns and that is the way information gets shared about what is important; literally, what the climates are in a work setting.

Later, I will suggest that it is extremely important that somehow or other the way people come to know what is important and the kinds of things they interact over be at least monitored so that you have some sense of what is happening in this informal kind of way that people come to know what is important in an organization. I am going to go through this definition one step at a time and try to speak to each of the facets of the definition (Chart 4).

Work climates emerge - Much of what behavioral and social scientists try to do in organizations is very similar to what managers try to go in organizations: both try to manage what happens. Well, there is only so much managing that you can do. An alternative view of the job of a manager is to create circumstances such that what emerges is what will promote the organization's long term effectiveness. If I had to make a choice about designing an organization so that the design would facilitate the emergence of climates for long term effectiveness, I would go toward the sociotechnical system approach. This approach would be to set up both the technology and supervision such that what emerges out of the naturally occurring interaction patterns would be the kinds of behaviors I would like to see exhibited. I do not think we can view people as being puppets on a string, such that we can control them so when we jerk the thing this way they will do exactly what we want them to do.

The word "controlling" needs to be exorcised. Planning. I like planning. I like organizing. I like delegating responsibility. The controlling issue makes the assumption we have to motivate. That is what control means in the management literature--that you control the behaviors of people. What we need to do is think about creating situations in which the behavior will be the sorts of things we expect, support, and reward, but you have to literally expect it, reward it, and support it.

Naturally occurring patterns of interaction - this is a little bit deeper kind of idea than "I just learn by being with others, by going out for a beer after work." I think people come to know what is important when they have a sense that they understand what <u>other</u> people know is important. That is another level of knowing. It is not that I just know. It is I know when I think I understand what the other person knows and that comes out of these interaction patterns - comes out of creating situations in which people can interact over what they are doing, what they should be doing, how they should be doing things, and so forth. This is one of the reasons why I think quality circles can work so well. In circles you come to know and to understand what the other person knows about the chores involved in being effective from interaction with them. It is not something you can come to know, again, through memoranda. So these naturally occurring patterns of interaction are very important.

If there is one productivity improvement technique which, as a technology, really does seem to work it is goal-setting and feedback. I put the two in the same category: goal-setting and feedback. People need clarity. They are going to seek clarity no matter what you do, and if you want them to be clear about where the organization wants to be headed, then you have to tell them that by rewarding, supporting, and expecting particular kinds of behaviors.

Because people have no choice about seeking clarity about goals, the question is "Are they reaching the conclusion you would like them to reach about what the goals are?"

Ladies and gentlemen, most organizations do not know what business they are in. That is why they make such poor decisions. For example, the auto industry has for a long time thought they were in the business of selling cars or making money. You know, that is not the business they are in. They are in the business of providing people with transportation, and the reason why they ran up that creek without a paddle is that they forgot that. You know, they said, "Well, what kind of cars should we make?" The decision rule was, "Let us make the cars we can make the most profit on when we sell them." Well, you see, that is not the transportation business. Organizations need to carefully specify what business they are in. Most profit making organizations focus on making profits. Now there are some indications that organizations that are highly effective do not focus on that but they "stick to the knitting." That is what Thomas J. Peters and Robert H. Waterman, Jr. say in their book, stick to it and the bottom line will follow. You have a lot of examples of organizations for whom that works. If you have not seen that book, I encourage you to read it, In Search of Excellence (New York: Harper and Row, 1982).

Needless to say, people interact with each other. In school settings, we know that the level of accomplishment in a particular school is not a function of the amount of money spent in that school nor the amount of money spent in salaries for the teachers but the kinds of students that go to the school. I think there is a lot be said for that in work settings. I also agree with Ray that we have lousy research, almost no research, on the extent to which personnel selection procedures as an intervention do facilitate organizational effectiveness. There is much evidence at the unit level that if selection procedures are put in it will improve organizational effectiveness, but we do not have the follow-up studies. My belief and my affect tell me that it works.

The interaction is with changing facets of the work environment. Lots of times you forget that organizations change and, if we are managers in an organization, we do not want things to change until we want them to change. Most managers ask "Why do my people have to resist change so much?" My answer to that is you have been rewarding, supporting, and expecting them not to change, and now just because you want them to change, you expect them to? You see, you do not want people going off on their own and reacting to changes that they sense need to be made, right? If they do change on their own they are a problem; they will not do what I tell them to do. Now all of a sudden you want them to operate a word processor, or whatever it is, and they do not want to do that. You ask, "What is the matter with you? I ask you to change." All along you have been telling them do not change, do not use your ideas, do not do anything that you are not supposed to be doing, and so forth. So people are appropriately paranoid about whether or not they should change when they are asked to change. That is why every time we have a new administration in Washington, the new president always decries the fact no one is willing to change. You have got to be a little nuts if you change every time you get a new president, right? You get a new president every three or four years. Well, there would be no stability in government if every time you have a new president you changed. You get a new boss all the time in the Air Force. How much do you change when

the new boss comes along? You make judicious judgments about that, and that is just reality.

The other thing not to forget when discussing climate is that work environment is the context. We are not talking about some happy family. There are things that happen at work that don't happen elsewhere and there is work that needs to get done. So the climates emerge in relationship to that work, and that is important.

Let me tell you about some of the things I think you can do. I think there are six important areas in creating climates. I am going to talk about each one of them separately (Chart 5).

Membership Issues. Let us start at the beginning. I think membership issues are important for organizations, because it is out of the members interacting over goals that the kinds of behaviors you are likely to see in an organization occur. I think there are three important concerns in membership issues: attraction, attrition, and selection. I think that because of the different kinds of goals that units or organizations have, different kinds of people get selected into different kinds of units (Chart 6).

Different kinds of people get attracted to different kinds of units and if they do not fit, either through attraction and/or selection, they become attritions. Now I think that leaves a kind of residue of people who are appropriate, naturally. Organizations, you see, only can intervene in one place in the attraction, selection, attrition cycle - through selection. There is a lot of things happening there that you do not have control over with respect to the kinds of members that you have in your unit. I encourage, therefore, that we learn more about the different kinds of peoples we have in different kinds of units and I mean not only in terms of ability, but also in terms of things like values, interests, or work interests. These are different kinds of people who choose the Air Force or the Navy. Within the Air Force, different kinds of people choose different specialties. Those are different kinds of folks and you should not expect that the kinds of job redesign issues, the kinds of supervisory issues, or the kinds of goal setting issues are going to be relevant for those different kinds of folks. We know relatively little about the different kinds of people who end up in these different kinds of organizations, on the one hand, and especially in jobs, on the other hand.

Socialization. I make a distinction between three different kinds of socialization: personalization, socialization, and training (Chart 7). The question of personalization is almost totally unexplored as to whether people make their own socialization. We have almost no data on how people learn about what is important in their organization. The only literature we have is how the organization seems to affect people - what is done to them or what gives them a sense. As a matter of fact, there is an excellent article, it is called "On Sense Making in Organizations." It deals with how people make sense out of what is going on in the work settings and focuses on the formal and informal procedures that organizations, or the people within them, design. We have some research going on now, supported by the Office of Naval Research, that is looking at how much of a contribution to adjustment and knowledge of mapping of

what is going on in an organization is due to what the individual does, the proactive behavior that people display. I think we can select people who will be socialized quicker and more appropriately rather than just throwing the whole burden on the organization.

Of course, training is a fantastic socialization process. It is a great opportunity to give not only the skills required to do a particular job, but also what the norms, values, expectations, rewarding, and supporting systems are that are available in the organization. I think most organizations lose that fantastic opportunity for literally communicating all these kinds of things to people in the training process. So training is not just skill oriented because it is at that point in a person's initial entry into an organization when he is dying for information about the organization or the unit - "what is going on around here." Training is a great opportunity in which to promote the socialization kind of experience.

Identity. This is the extent to which people feel a part of what is happening to them and around them. It is also a relatively overlooked phenomenon according to the research we have done (Chart 8). I think it is critical to the long term participation of the individual in the unit. By long term participation, I mean whether or not they will come to work on time, whether or not they will likely leave the unit or organization. So, I think this is a relatively overlooked phenomenon. The military is very good at using symbols of identification and they are very important. Most non-uniformed organizations forget how important symbols are, and we could learn a lot from their use in the military and the police. There are some professions that are also uniformed that we tend not to think of as being uniformed, e.g., doctors and priests. Doctors are a uniformed profession. One of the classic books on doctors is called Boys in White: Student Culture in Medical School (Howard S. Baker, Ed. New York: Irvington, 1961). I know, for example, that if I go consulting with a bank, do not wear a brown suit. Bankers do not wear brown. Bankers wear grey or blue, especially on the East Coast, which is where I usually do my work. An acknowledgement of the importance of you to the organization is a way of gaining people's identity with the organization. Most people are never acknowledged as being important. And in most organizations, the people who receive the least attention are the people who require the most attention, your average worker. The average performer in most instances is the most overlooked performer. With the poor performers you pay attention to them like it is going out of style. That is a kind of reinforcer. The worse I perform, the more attention I get. If you are a really good performer, then you also get attention. However, the people who carry the load, so to speak, those in the middle of the distribution, they are the people who receive the least attention and require more attention - acknowledgement of the important of being a part of this organization or unit.

Also relevant here is the issue of role expectations. Role expectations are what I keep referring to as the kinds of things that are rewarded, supported, and expected. The Pygmalion effect is alive and well not only in schools, but in the military, business, and industry. The Pygmalion effect states that if we expect people to perform at high levels then they are likely to perform that way. I think it is a very important issue. If I were a unit commander I would never look at the test scores of any of the people who entered my unit because

I know what the research literature says: you will treat people according to the test scores you remember they have. So you get someone in the 93rd percentile on the AFOQT or the AFQT compared to someone in the 53rd percentile and you are automatically going to say "Boy, when I need something tough to be done, I will give it to this 93rd." That is very bad strategy.

Structures. Let me jump right into leadership (Chart 9). I think leadership has been overstudied and management understudied by behavioral scientists. We focus too much on style and not enough on substance. We have very few studies on how leaders in the military plan, organize, set goals, delegate responsibility, and so forth, but we have a lot of studies on how they go about doing things, e.g., the style and consideration vs. initiating structure. In some sense, we have been focusing more on the style than substance and leaders have to do these other kinds of things. I think leaders are required in crisis situations, not in everyday activities of the unit. Leaders look like they are important if they are poor managers because poor managers create crisis situations and then they have to cope with them. Rules and procedures I think are all extraordinarily important. There has been a movement over the last five or ten years to get rid of rules and procedures, but we need those also. Here is one of my favorite quotes from a famous person by the name of Douglas McGregor on the issue of authority in organizations (Chart 10). I think he has been grossly misread. Because most people have not read what we wrote about management, people view him as being a "softy." This is what he wrote about authority in organizations. What McGregor was saying, of course, is that we might change just a little bit in the way we view people, not just that we are going to be kind-hearted, unfocused, and so forth.

Interpersonal Issues. I think that interpersonal issues are important in organizations (Chart 11). People learn the culture or the climate of the organization through these interpersonal shared meanings that they attach to what is going on. I am not a believer in the total reduction of conflict in organizations. I believe conflict is important in an organization. Otherwise you get everybody agreeing, and that is a very sad situation, as has been demonstrated by a very famous psychologist named Janis. A kind of "group think" arises when everyone agrees, and that is not a good situation.

Environmental Issues. I think most organizations forget that they operate in a larger environment. The extent to which they are effective is determined not only by what they do internally (you might call that efficiency) but it is also determined by all of those parties on the outside of the unit who have thoughts, opinions, and data on how that unit is doing. Schein asks, "How does an organization cope with its environment?" (Chart 12). He defines that as the important issue in understanding organizational effectiveness. Every unit has these issues. And so these also must receive attention. This last chart tells us why it is important to understand the cues and clues people use as a basis for the climates they perceive and, thus, for their behavior (Chart 13).

I think that the way to make people have the kinds of perceptions that will help guide them in their spontaneous and creative behavior (which is what keeps organizations going all the time) is to pay attention to some of the issues I have tried to illuminate, and, in more specific detail, pay attention to the kinds of things Ray has specified as potential ways of making those kinds of behaviors happen. Thank you.

QUESTIONS AND ANSWERS

Question: In the Air Force, or in any military system, we have a formal evaluation program, and attitudes are rewarded but, of course, in the military we do not always get the opportunity to find out how boards really select people for promotion. Since that body of knowledge is sort of disguised and hidden, how can you find out really how an organization rewards or what it is really rewarding?

Answer: Rewarding, supporting, and expecting. I think I have actually prepared an answer for that! If in designing a new airplane, you knew you had a particular problem with a piece of equipment and you wanted to design new equipment, you would not go to the people in the unit and ask them to design a new piece of equipment. You would try and find experts on these sorts of things. I really think that everyone believes they are a great psychologist - "give me a person for ten minutes and I can tell you how they're going to work out." Well, we know that is not true. My answer is I think you need experts. I think you need people who are trained as diagnosticians to identify issues by observation and speaking, by examining records and rules and procedures, by looking at the performance appraisal systems and by, literally, diagnosing what the issues are in the unit. Now those experts need not be people with Ph.D.'s. I am not saying that at all, nor need they be consultants, but they need to be trained people. You would not turn your accounting system over to someone who did not know the double entry system so I think we place too high an expectation on the capability of managers and leaders to be such wonderful diagnosticians. Unless they are trained, I do not think they can do a really good job in that kind of diagnosis.

Productivity, Organization, and People

Overview

Mr. Charles Zimmerman

Manager, Defense and Electronics Center
Westinghouse Electric Corporation
Baltimore, Maryland

The Westinghouse Defense Center is located at the Baltimore-Washington International Airport near Baltimore, Maryland. The unit is a supplier of defense electronic systems to a wide range of military customers and other agencies. The unit consists of eighteen thousand people with its largest concentration at the airport site (about twelve thousand).

During the latter part of the 1970's, a decision was made to significantly upgrade the engineering and manufacturing processes in use at the Defense Center. Coupled with the planning for new technology was a strong desire on the part of management to create a work environment and climate that would breed high quality innovation in all facets of the organization. This thrust was in concert with a corporate mandate to create centers of excellence within the Westinghouse family of business units. These centers would become the finest facilities for the production of excellence in their line of business.

Within the Defense Center there is an Operations Division which is the central manufacturing arm of the facility. In line with modernization plans, this organization underwent radical change. In order to accommodate that change, a Manufacturing Systems and Technology Center was conceived which develops the new manufacturing processes for the Defense Center. Parallel with that move, a Human Resources Program Group was established to plan and implement changes. Critical subjects such as management culture, skills development, communications, and participation were addressed. Strong ties with the local academic community were established. It was felt the correct environment plus the right technology would motivate the organization to produce higher quality products and, bottom line, significantly improve productivity. This process is now in its fourth year and improvements in quality and productivity have been realized each year. The entire organization is involved in these efforts. This talk focuses on these efforts through the eyes of the Human Resources Programs manager.

Edited Transcript of Workshop Presentation

Mr. Charles Zimmerman

Westinghouse is a multi-national enterprise, comprised of more than 100,000 people. It is a diverse set of businesses which include bottling 7-Up, making Longines-Wittnauer watches, AWACS radar, elevators, and being a heavyweight in the broadcasting and cable TV business. I have been in the defense business for about twenty-five years. In my career, I have been primarily a line operating manager. I have also been a quality control manager, a program manager and, in recent years, a manufacturing operations manager. This experience included running the largest non-union operations group in the Westinghouse Corporation, located at Hunt Valley, Maryland, where we have about 1,000 people involved in manufacturing for the logistics world. Most recently, I have been with the Defense Center which is the largest location in Westinghouse and a unionized environment. I have had managerial experience in both union and nonunion facilities.

During my career as a line manager, some things have always bothered me. I have always had people telling me how to improve my organization. Few of the suggested programs made any sense to me, but I allowed them to happen in my organization. They had mixed results. However, I believe that if we took the practical skills used in managing hardware and applied them to the management of human resources, we would be better off. In recent years, we started sensing a need to improve. The reason for the need to improve was the competition coming from all over the world. You will not hear me talk too much about productivity, what I talk about is improvement.

I am presently in the Defense Operations Division at Westinghouse. It is the largest manufacturing entity in the entire Westinghouse Corporation. It is composed of 5,000 people and responsible for producing a wide range of products for the Department of Defense and for other customers, both national and international. We are in a very dynamic, growth-oriented, changing environment. We have many challenges on our hands. What I will talk about today is what my division manager, his staff, and I have done to improve our organization so that we can meet competition. We sensed the need for improved human resources and technology. My role in this process is to act as a change agent and in that role I bring 25 years experience which runs from working on the assembly line to being plant manager.

When I think about our organization, I think about 5,000 people (Chart 1). Five hundred of them are management people and about two hundred and fifty are first-level supervisors. One thousand are professional engineers of all types, one thousand are salaried administrators, and 2,500 are hourly line operating personnel. All of the salaried, administrative personnel and all of the hourly personnel are union members. We have three unions and our union relations climate is excellent.

To get change going, we did a few things up front. First, we made a decision to change the organizational structure. The first issue of concern was that we

did not have the right manufacturing technology to move into the future. We kept waiting for engineering to develop such technology. Before changes were made, we were forced to decide how we were going to build various products, and you just cannot exist that way. So we decided to be much more strategic in our planning and to move toward a process technology. How do we manufacture a project? As a result of our deliberations, we set up a separate entity in the organization, in a separate building, and staffed it with 250 engineers and scientists which we called the Manufacturing Systems and Technology Center. We are proud of that Center. It is where we design the new manufacturing processes of the future.

We recognized a second problem. We did not know how to manage material. We had a widely scattered organization for handling material. We did materials handling in a series, and our lead times stretched out too much when we were looking for hardware. We have now placed all materials handling functions in one building. We changed the organization, redesigned jobs, and put that complete facility together in the last two years.

It seems to be a widespread belief today, at least according to the press, that the productivity problem is one of technology versus people. Our belief at Westinghouse is that technology is the competitive edge, it is not technology versus people. That is not the issue, not in our minds at least.

After we finished looking at the materials and technology side, we created a counterpart to the Management Systems and Technology Center in the human resources area. That is my current job. When you talk about how we feed the organization, we do so from both the technology and people standpoint. The technology manager and I spend much time together. We are doing the feeding in concert.

Another set of things bother me. I had been in the business for a long time and I knew about our management culture and how we managed. Our job was to get the hardware out the back door and we <u>used</u> people to do it. If we burned a few people out along the way, so be it. We worked massive amounts of overtime, we did large hiring blocks in periods of time. We burned a lot of people along the way, managers as well as employees.

This chart (Chart 2) shows our long term objective. I do not know if Dr. Schneider or Dr. Katzell will comment on it later, but I think it is a five or ten year project. It is not something that's going to happen overnight, and we recognize that. This concern shows up in our statement of objectives to management every year. We are going to continue to work on changing our management culture. I think that what is needed is a more sensitive, participative, intelligent style of management in today's environment, and that is what we are looking for at Westinghouse. We're trying to get the entire organization involved in the process of improvement.

I wrote the objective shown on this slide (Chart 3) with my line operating managers because I did not feel we knew our people. We really did not know what their skills were. But we know more today than four years ago because we have taken steps to learn. When it comes to the attitudes in the workplace, we have to shape attitudes or help shape them. We cannot just allow attitudes to

happen. We shape attitudes by the way we manage. I thought the comment by Dr. Schneider on leadership and management was very interesting. I grew up in a business of leaders, not managers. We were crisis leaders, and we were great at it, too. We received pats on the back for what we did. Of course, it did not matter how many people we burned out along the way. We were great leaders. But to be managers we have to communicate, and the concept of communication is very broad. It is not just a monthly newspaper. When a manager walks out onto an assembly line and sits down next to somebody to talk or to pat somebody on the back, that, in itself, is communication. As we move new technologies into our factories we must decide what jobs, skills, and people are needed. So one must understand employee demographics and must integrate that knowledge with the technology advancement. That is a tough objective. That also is long range. Quite frankly, we gave ourselves the better part of five years to complete it.

I play a large role in strategically planning the human resources' efforts with the line managers (Chart 4). We have a phenomenon in this country. I called it "flavor of the month," to borrow from Baskin-Robbins. I am going to try quality circles this month and when that does not work, next month I will try something else. We have done it for many years, and I do not think we are the only ones doing it in the defense electronics industry. We are so anxious to get results that we never really implement well. We never plan well. What we do is we reach out and grab something that sounds like a great idea and jam it in there. We do not measure for alternatives. I think Dr. Katzell talked about that earlier. Some of the things that I was stuck with in the beginning was the "flavor of the month." Some of the flavors of the month are good vehicles if they are used properly and if they are blended with other elements in an improvement program. Any one of them in itself is not a panacea for all the ills of an organization.

The factors I just discussed are the long-term objectives. Next, I needed some vehicles. Here on Chart 5 is the first one: Every manager in our organization is a teacher. The best managers are teaching all the time. They are developing people; they are guiding people; they are nurturing people; they are helping people grow. A good manager teaches on a regular basis, maybe not in a formal setting in a classroom, but certainly in an informal way. In my organization, we are taking teaching a step further. We are putting our managers in the classroom and there are reasons for doing that. Number one is that the managers are a tremendous resource because of their knowledge. Secondly, it makes managers talk to their subordinates. One way to get managers to talk to their subordinates is to put them in a classroom setting. So we do not implement new technology by calling in outside trainers or consultants. We implement new technology by teaching the manager how to teach or by making the manager the resource expert on a given system. When I started that effort four years ago, people said, "You cannot do it, managers just will not teach." Well, let me tell you that there is a little bit of ham in everyone, and, if you seize on that and if you can give the manager the tools and the information in a way the manager can impart it to the people, you can do it. Out of the 500 managers on the chart that I showed you earlier, last year 250 of them were in a classroom setting at one time or another. That is what we have accomplished in four years. I think that the "every manager is a teacher" vehicle is an excellent approach. It works for us. I am not suggesting that it will work in every

organization. What I am saying is that in our particular climate, in our environment, it works.

In the behavioral area, we have middle managers teaching supervisors. We had our managers trained. We put them in a classroom and they are teaching supervisors how to deal with people problems. I have 50 middle managers trained to teach behavioral techniques of how to deal with people problems. All of a sudden, I have 50 salesmen out there in the organization. They are saying "Hey, this is not at all bad. I am teaching it. I am the expert. Let me tell you a little bit about how to manage people." It works - it spreads.

Everybody is talking about quality circles today. We have a very large quality circle program at Westinghouse (Chart 6). At its inception in 1978 and 1979, I was the chairman for quality circles for the Corporation as part of the major corporate productivity effort. So, I have been involved with it from the beginning. There was a drive underneath that faddism that said we really do not care what this thing called participative management is, but what we need to do is get something that shows we really would be willing to participate with your people. Circles came along at that point. They were perfect for that.

I happen to think that quality circles is a great vehicle. It is a good motivational vehicle for people. If you do not believe me, sit in on one management presentation by a group of hourly employees who have never given a presentation in their lives. They stand up and tell us how to solve a problem in the workplace and they do it professionally. You only have to see that once to realize what a tremendous motivational vehicle quality circles are for those people. They really feel good about themselves.

Quality circles also provide a training vehicle. People receive problem-solving and brainstorming training and other more advanced techniques. In this program, workers and supervisors receive training they would not otherwise receive. In our case, circles meet one hour a week in a conference room. Participants decide what problem to work on and when they will make a presentation to management to ask for support. If circles ask us for technical support during their problem solving, we provide it.

Quality Circles is a quality vehicle. If management shares objectives and goals on a regular basis, chances are that circles work toward those objectives. If you do not share organizational objectives, circles work on issues that irritate them, such as lights, the paint, and the potholes in the roads outside the plant. When starting a circle, they work on those anyway. They have to get such matters out of their system, and you allow them to do so.

In the last two years, we have moved toward what I call ownership. This technique gets middle management involved by training them to be quality circle leaders. They may never actually lead a circle, but they understand the circle process. Do you know what typically happens when people start quality circle programs? They do not really tell middle management much of anything about it. Top management decides to do it, supervisors implement it using the bottom level workers and nobody worries about the big layer of management in the middle that really runs the show. They can easily stifle the process. For

example, suppose you are a middle manager with several work sections on the factory floor. Your boss says to start quality circles. Later, some of your circles make presentations to you and your boss on what is wrong out there in your work sections. Some of the problems the circles come up with have been wrong for ten years, and they have come up with a solution. Your boss looks at you and says, "Where the heck have you been for the last ten years?" The problems identified by the circles were not among the priorities, and that can be threatening to you as a middle manager. I have seen examples where middle managers have found out what their circles were working on and fixed the problems before the circle could make a presentation. I have actually seen that happen. That is dangerous. That is why you have to get management involved.

In my organization, I have six quality circles facilitators. They do not report to me, but I pay their salaries. They are on the staffs of line managers because that is where they belong. They are part of their organization. They work with that organization every day. In staff meetings that those managers hold, one of the discussion points is "how are the circles going?" Do not worry about the number of circles or their growth. That is not the issue. What is the health of the circles? What issues are raised? Are the circles working toward organizational concerns? If not, how much more do we have to communicate? Those are the factors that make for healthy quality circles.

Westinghouse Corporation has about 2,000 circles. That is a powerful force. That is about 20,000 people working on improvement - most of them operating people. They are a powerful force to have. That is corporate wide. The defense business unit has about 250.

Another thing we have focused on (Chart 7) is work with various universities. We want continuing education to become a way of life for our people. Many of our people and managers had stopped going to school or were not concerned about further education. They were not upgrading their skills and were merely waiting to be sent to the Westinghouse training program which was almost a reward. What we have done is to bring programs in-house from the college campus of continuing education. The programs that were related are those which focus on the objectives of our organization. We have an undergraduate program aimed at the first management level and at people who would like to get into the first level management role. I became a resource expert to review the curriculum with the school. I acted as resource expert for the course and made presentations on issues of productivity, quality, and the managerial techniques needed in today's environment and in the future. We have a good marriage with the academic community. People who are teaching our managers how to teach have designed a two-day course on how to teach in the industrial environment and have come in-house to do it on a regular basis. In the last three years, we have put about 400 people through that course and some other courses designed along the same lines.

I have always had trouble with how to select people for particular training courses. I did not understand the use of training. In fact, many managers do not know how to develop people because they do not know how to train them. I asked the University of Maryland to help us out in this case, and they had the answer. They brought some training courses which focused on issues such as how

to analyze a job for its training elements. We are upgrading our entire management force in how training is to be used and what it should be used for. This includes instruction on how to analyze a job and determine what its training elements are. It is a lengthy process, but we are going to continue sending more people to the courses.

The major point with respect to the next problem, communications (Chart 8), is that communication has to be strategically planned, just like any other program. It will not work to just put out a newspaper every month with something flashy in it. How about starting at the beginning of the year with objectives for that year? How about a series of articles, or a range of vehicles emphasizing the objectives throughout the year? Report back, give feedback to the entire organization about how we are doing on those objectives. We started two and a half years ago with a series of meetings called Viewpoints where we called in all 5,000 people. We did this 200 at a time because the size of our facility is limited. The general manager spoke at the meeting which was an hour long. We explained who our competitors were. We showed our people maps of where the plants of our competitors were located. We showed them the competitor's products. We explained the entire competitive posture problem. We then followed that with a series of meetings in which we explained how we were attacking the competition. We talked about all the things we are doing and why we're doing them. We left time for questions and answers. Most of the time the entire operations staff were present, and we would stay after the presentation to answer questions. This is a useful communications vehicle which had not really been done well in our facility before.

We paralleled the presentation on competition with video tape programs in the cafeterias and with some articles in our newspapers. We have a one-page sheet called a Friday Gram, which comes out once a week and takes care of immediate issues. For instance, it might say, "We are going to have a large contingent of Air Force people visiting us next week." We use other communication vehicles to cover the longer range issues. In any case, communication is strategically planned. We share real information. We share our objectives, our goals, our concerns, and we feed back results.

I believe that one must employ a wide range of vehicles for productivity enhancement. Not everybody is going to join a quality circle. This country grew great in large part on the efforts of some strong individualists, if you remember way back when. And, today, we have many individualists in our workforce who have good ideas but do not want to sit in a group. These individualists must have a vehicle through which they can contribute. At Westinghouse we have locked a suggestion program in place for that purpose (Chart 9). This program gives a chance for participation to those who do not want to participate in groups. I am sure there are many other vehicles to take care of that problem but we just chose that one.

Technology transition is also a big issue at Westinghouse and we are spending hundreds of dollars on new factory automation (Chart 10). This chart suggests that if one is going to be successful in implementing technology, it takes teamwork among the technology designers, the trainers, the users, whoever. Everyone must work together. One cannot design the technology, throw it over the wall, and tell the user to get somebody to help them put it in. The creators, the trainers, and the users must plan the implementation together and that is what we are doing today at Westinghouse. In a recent attempt to implement a computer system, we found systems analysts writing users manuals. I sent these users manuals out to our logistics division who put them through their computer for analyzing readability levels. The manuals were written at the 15th grade level. Naturally, we had the manuals rewritten to a lower level. Here is a good case of creator-user not working together.

To assist in technology transition, we taught our managers how to teach and taught them how the new systems work. We had about 250 people in procurement and material management who needed to learn the new technology. We have started from scratch and in two years we have trained everybody using every manager as a teacher. It works. It has proved to me that it can work, so we are going to continue that process.

All of our first-level supervisors go to school one day a month. Their teachers are middle managers. This type of interaction management (Chart 11) is a program designed to teach supervisors how to deal with their subordinates. It teaches them how to react to people problems. We chose this course because it could be taught by middle managers, it was modular, and we could string it out over a long period of time. I do not think you are going to change management culture by running people into a two-week training program. Culture change will take a long time and you must have patience with it. If you keep coming back at them with the same principles on a regular basis over a long period of time, it will sink in. Behaviorally, I do not know how that works, but our experience at Westinghouse shows that it does. We had a very high level of grievances on the floor because supervisors were not managing their people, they were not talking to them, they were not resolving individual problems. They did not know how. We actually had situations in which union stewards were managing the shop, not the supervisors. When somebody had a payroll problem instead of going to see the supervisor, he went to the union steward. The union steward picked up the phone, called payroll, and found out why somebody's paycheck was wrong. Managers are there to manage and that means worrying about products, processes, and people. So our supervisors went to school one day a month.

This last chart (Chart 12) reiterates some points I have made about the focus of our training development efforts. Such efforts have to be based on the needs of the organization as well as on individual needs. There must be considerable management involvement. What we are trying to do at Westinghouse is to develop a climate which creates excellence. We are working to create centers of excellence throughout our organization. We hope some of these techniques which I have described may help you. Thank you.

QUESTIONS AND ANSWERS

Question: What has been the union's reaction to quality circles?

Answer: In the beginning, we followed our traditional management approach of telling the union what we were going to do and not asking them whether they agreed. They were uneasy, but they did not fight us openly. Occasionally, when they got into an argument with us over another subject, they would tell their people not to attend circle meetings. Interestingly, we never had that happen. We never had people not show up for a circle meeting because they were told not to by the union. Over time, we got smarter and the union people got smarter. Eventually, we brought the union people in and trained them in the quality circle technique. We even sent our union leaders to Japan, on us, to let them look at what is going on over there. Over time, they have become very supportive of quality circles. By the way, we did the same thing with the international leadership of the Corporation. We sent all of them to Japan, gave them training in the quality circle technique, and invited them to participate. The union tried to get involved in quality circles, but they tried in the wrong way. They wanted a union representative to sit in on every quality circle meeting. Obviously, the answer to their request was no. They are not going to do that because that is not the purpose of this program. They are not going to make this a union-company fight in the middle of a quality circle meeting. We did have some words, but they came to agree with us after a period of time. We started quality circles in 1978-1979. We are now in 1983, and I would say that the unions have very positive attitudes toward the quality circles program. They are happy about it.

Training, on the other hand, is never an issue within the union. They want more training. They consider training to be a benefit, so they will actively support training. What they will not allow you to do is test or evaluate. So we always have a problem with testing and evaluation. But we have taken a positive approach in this area. If I am thinking of doing something, I will meet with the union people and talk it over. I think we have a good, cooperative relationship going.

Question: Getting back to quality circles, do issues ever come up with respect to the sharing of the financial benefits of changes suggested by quality circles?

Answer: In the Defense Center, we allow circles to participate in the suggestion program. I think there are some inequities to that, but we have allowed it anyway. Not all circles submitting suggestions get paid, but some do.

Question: What is happening to reduce the threat to middle managers from quality circles? Are you consciously doing anything?

Answer: Yes. We have put facilitators who know who the managers are into the operating organization. The facilitators are professionals who have been carefully selected. Part of their job is to work with the managers. In addition, there is heavy involvement of line operating managers at the top level. Quality circles is an agenda item at staff meetings so all managers regularly hear about the subject. Beyond that, we have sent top managers to quality circles training and had them exposed to the techniques.

Question: To get a handle on systemic problems, have you ever tried quality circles with mid-managers? I mean circle mid-managers. How does that work?

Answer: Yes, it works reasonably well, but not as well as the other circles have. In fact, we have got circles in about every element of our business. We have had several mid-management circles. Interdisciplinary circles, in fact, pop up. We have allowed that to happen and facilitated it. Where that has happened, it has been a reasonably good experience, but, I worry about the "long haul." At times I feel like we are doing it because it seems like the thing to do. However, I would prefer to defer comment on that for a few years because I do not think it has had spectacular results so far.

Question: Do you have some circles that are meeting continually?

Answer: Yes, but not many.

Question: What about your need to evaluate managers/trainers? Obviously they have a wide range of strengths and abilities. Are you giving them additional training - moving them out of that role?

Answer: They do their regular job and they do training on a part-time basis. I would like to think they will be trainers forever, in one way or another. As to how we evaluate them, we do not ask for feedback from their subordinates. Occasionally, our folks sit in on a class with them. Usually when they teach their first class, one of our developers, who is also a trainer, sits in with them and gives them a hand. We tell them it is okay to ask for help. I am willing to sacrifice some of the quality of training for the interaction. If I can get a manager into a classroom, I am willing to give up a little quality. We can compensate for that, but I want the interaction. We will try to make them feel comfortable. So, I do not have heavy assessment systems in place because that would scare them.

Question: With reference to your communication chart, you indicate that you communicate with your workers on a regular basis. On a monthly basis, how many hours are detracted from their normal work?

Answer: We call workers off the floor for a one hour communication session once a quarter--four times a year. Supervisors are encouraged to hold workplace meetings and about half of them do on a regular basis. That is about as good as we have gotten so far and that's generally about an hour a week. The time is usually spent discussing local issues or talking about the job. We consider it in accordance with the rules and make sure everyone understands that. However, it is all productive time. If someone is working a Q.C. meeting, they are learning the objectives of the organization.

We will do some specials occasionally. For example, we just shipped the AWACS radar and the event of the shipping turned into a tremendous show. Some of the leading Air Force people came in, including the program manager, and so did some of our top management. We took all of the employees who had ever worked on the AWACS and put them on the flightline for about an hour to watch the show. We often do things like that. We think that is good. We think identification with the product and with the organization is very important. Generally speaking, we do not have workers away from work so much that it hurts.

Comment by Dr. Schneider: I think your point about using in-place strategic planning management or planning strategies on human resource issues is excellent. I would like to add that I've been advising organizations to treat people like machines--valuable machines. For years academicians have been telling organizations not to treat people like machines, but it turns out that if you do, you will treat them better than you treat them today. It is true! Think about all the money you spend and the things you do with respect to a valuable piece of machinery. You put together task forces to choose which machinery to buy - that is selection. Then, you make sure everything is in place by the time the machinery arrives so that it will be well integrated into the system - that is socialization, training. Then, you buy a contract to keep it oiled, greased, and checked out to see that it is working smoothly and functioning well - that's performance appraisal and management by objective. The only thing you cannot do is change your accounting procedures because a piece of machinery is a capital asset. You know where people are on the balance sheet, do you not? They are literally called liabilities. If you think about that, that is really a big change we need in the difference between machinery and people.

PLENARY SESSION III

SERVICES' PRODUCTIVITY PROGRAMS

PLENARY III

INTRODUCTION

The proceedings for Plenary Session III contain summaries or overviews of productivity R&D and analysis programs conducted by various Air Force organizations. In addition, the Army and Navy representatives provide a resume of their respective productivity research programs.

Productivity Research in the Army: An Overview and Future Directions

Dr. Laurel Oliver

US Army Research Institute for the Behavioral and Social Sciences

Like the other military services, as well as civilian business and industry, the Army has many productivity improvement programs and projects currently underway. Although considerable effort has been expended in planning and implementing these projects, much less energy has been directed to conducting meaningful assessments of Army productivity programs (Oliver, van Rijn, & Babin, 1983). Accordingly, the purpose of this paper is to explore what could be done to facilitate the task of productivity research in the Army, and perhaps elsewhere. First, a brief overview of Army productivity efforts is presented. The overview is followed by a description of Army research efforts, in particular an attempt to document change in an Army helicopter maintenance depot undergoing a sociotechnical systems analysis and intervention. Finally, some suggestions are presented for future productivity research.

OVERVIEW OF ARMY PRODUCTIVITY IMPROVEMENT EFFORTS

The Army has two sources of productivity improvement efforts. Most of the formal productivity programs are located in Comptroller offices throughout the Army. Another group of efforts, which may or may not have productivity enhancement as their primary objective, emanate from the Organizational Effectiveness (OE) offices located at almost all Army installations. These two types of programs, which are briefly noted below, are more fully described in a recent paper by Oliver, van Rijn, and Babin (1983).

Comptroller Office Programs

Most Army productivity improvement programs are associated with Comptroller offices (Chart 1). The Comptroller is charged with the management analysis function (at all Army levels below Department of the Army Headquarters), and these programs typically reflect the traditional industrial engineering approach stressing efficiency with relatively little, if any, emphasis on behavioral science concerns. The Productivity Enhancement, Measurement, and Evaluation program is an exception. The Department of the Army Materiel and Readiness Command (DARCOM) counterpart of this program ("RESHAPE") includes productivity improvement programs such as quality circles and gainsharing (the Federal equivalent of industry's profitsharing) which are clearly based on behavioral sciences principles and techniques.

OE-Related Projects

The objective of the Army's OE program is to provide assistance to commanders for improving mission performance and increasing combat readiness. This assistance is supplied by OE consultants (commissioned officers, noncommissioned officers, and civilians) who use management and behavioral sciences technology to improve the effectiveness of Army organizations. Most of the interventions conducted by OE consultants are not specifically directed at productivity improvement, although productivity indicators may sometimes be used. Oliver (1981) summarized the frequencies of a variety of indicators OE consultants reported using during a six-month period (Chart 2). The three most frequently used indicators were user comments, "gut feeling," and interviews, with productivity indices such as personnel turnover, equipment maintenance, accident rate, and materials reduction much less frequently used.

ARMY RESEARCH ON PRODUCTIVITY

The Army's formal research in the area of productivity has been limited. The principal research being conducted by the Army Research Institute (ARI) involves the Corpus Christi Army Depot (CCAD), which is an Army helicopter repair and overhaul facility. The productivity intervention being used at CCAD is based on sociotechnical systems theory. Briefly, sociotechnical systems theory holds that an organization comprises two systems - a technical system involving the technological or procedural component of an organization and a social system representing the people aspect of an organization. In a sociotechnical systems approach, both these systems (technical and social) and their interactions with the environment are analyzed. The resulting design or redesign of the organization seeks to mesh the two systems in such a way that both are "optimized" - i.e., the functioning of one system is not accomplished at the expense of the other.

The intervention at Corpus Christi was originally guided by two outside consultants, who worked with a core group of 12 people who conducted analyses of the technical and social systems and developed recommendations for organizational change (Chart 3). The Depot is now on its own in implementing the recommendations. As the implementation proceeds, ARI is helping to identify and collect data that will most meaningfully document any changes which may occur.

FUTURE DIRECTIONS FOR PRODUCTIVITY RESEARCH

Research Models

Evaluation Research. Programs are frequently evaluated using an evaluation research model. This approach seeks to establish whether or not the program did what it was suppose to do. There are two types of evaluation research. In formative evaluation, the researcher monitors the ongoing program and feeds back into the system data concerning its progress. The purpose here is to inform those responsible for the program about how it is doing so that corrective action may be taken if needed. Hence, formative evaluation is often characterized by being concerned with process. The other kind of evaluation

research is called summative evaluation. This approach is concerned with the results of the program and their relationship to the intended goals. Summative evaluation is often described as focusing on outcomes. Ideally, program research encompasses both types of evaluation (one concerned with process and the other with outcome), with the evaluation researcher involved in the project from its beginning stages. A frequent complaint of evaluation researchers, however, is that they are brought into projects too late to provide meaningful input. The program is already well underway or even may have been completed by the time an evaluation is requested.

Action Research. The action research approach has been frequently used by persons seeking solutions to practical problems - for example, classroom teachers. Thus, action research tends to be conducted by practitioners rather than by researchers. The Army's OE four-step process, which is taught to OE consultants, is based on an action research model.

Practitioners who are faced with practical problems derive solutions based on their observations and reasoning. The solutions are then tested through action, the resulting findings are used in formulating further solutions, and the process can continue in an iterative manner as required. Susman's (1983) chapter on action research from a sociotechnical systems perspective contains a good description of the cyclical phases of action research.

Selection of Measures

One of the major obstacles to the successful implementation of an organizational change lies in the difficulty of measuring the effects of that change. Developing reliable and valid measures of organizational functioning can be an extraordinarily difficult task (Campbell, 1977). The more complex the system and the more numerous its interactions with the environment, the more difficult it is to measure the productivity of the system in a reliable manner.

It is difficult to know precisely what to measure. Measures of the same variables at different organizational levels may or may not agree with each other. Sometimes participants are convinced that real change has occurred, but the selected measures may not reflect change; or change may be detected only after a considerable length of time has elapsed. Many organizations, such as CCAD, have literally hundreds of measures from which to choose. Sifting through voluminous printouts is a painstaking task, and even then one may not find many appropriate measures.

Given these complications, how should productivity measures be chosen? In addition to reliability and validity, some criteria that have been suggested include objectivity, nonreactivity, availability, ease of administration or collection, ease of scoring, and specificity (Oliver & Spokane, 1983). Multiple measures are desirable and could be more frequently used than they are. It may be possible, for example, to measure a given variable in several ways. Data can be obtained from records, questionnaires, and interviews. Then, if convergence can be established, one has much greater confidence in the results. Measures that are directly tied to work group or organizational goals have a

better chance of reflecting change if it occurs. It is important to note that different measures may be inversely related. Trade-offs in quality and quantity often must be made. In any event, interventions of any type which have documentation of change built into them right from the start are more likely to demonstrate tangible results. In addition to these planned measures, however, one needs to be alert for any unintended consequences and to document these as well.

Implementation of Interventions

No matter how thoroughly a situation has been analyzed or how well a productivity improvement intervention has been planned, the possibilities for positive change are greatly diminished if the operation is poorly implemented. Two factors which appear to be crucial to the success of an organizational intervention are structuring and diffusion (James, McCorcle, Brothers, & Oliver, 1983). Structuring involves arranging the situation in such a way that the success of the operation is enhanced. That is, sources of support and nonsupport are identified and their help enlisted or opposition nullified. Outcomes are clarified and organized in a meaningful manner. Training and/or coaching of crucial actors may also be called for as well as the demonstration of overt support by principal leaders or managers. Diffusion, the other important element, involves the exchange of information concerning the productivity project. In general, diffusion should be accomplished not only within the organization or subsystem that is the focus of the productivity effort but also with respect to those other systems or groups that interact with the focal system. It is important that diffusion not be a one-way process. That is, systems must be designed not only for disseminating information but also for obtaining feedback from all parts of the organization. Constant checks need to be made to ascertain whether or not implementation is proceeding according to plan. Questionnaires, interviews, and informal contacts can all be used. Again, multiple measures of the same factors are useful in establishing the validity of observations. Information on the implementation needs to be fed back into the system to indicate the need for corrective action or to confirm that implementation is being properly conducted.

Interpretation of Data

Once data are entered, the researcher is faced with the task of interpretation. Changes may occur which are unrelated to the intervention in question. For instance, at CCAD, the size of the work force has been increasing. Since many of the new workers are relatively inexperienced, the initial result may be to decrease the per capita productivity. Unscheduled special projects may interrupt the normal work flow and make it difficult to assess the effect of these unpredictable events. Co-occurrence of other interventions, such as quality circles, may result in productivity changes. Thus it may be difficult to determine the amount of change attributable to each intervention. One way of keeping track of events which may complicate the interpretation of data is for appropriate people to record any happenings, whether or not they seem significant at the time, in a diary or journal. Such documentation may prove to be invaluable in explaining results.

SUMMARY AND CONCLUSIONS

The Army has a wide variety of productivity improvement programs and projects. Some of these reflect an industrial engineer orientation, and others are rooted in the behavioral sciences. Although evaluation research is an appropriate approach for more formal program evaluation, action research may provide a useful model for practitioners seeking solutions to practical problems in the productivity arena. Meaningful measurement of productivity changes is generally a very difficult task except in very simple systems. In addition to validity and reliability, researchers may wish to consider criteria of objectivity, availability, ease of collection, and the like in selecting measures. Other aspects of measurement such as using multiple measures, linking to organizational goals, and building documentation into training should also be considered. Interpretation of results may be complicated by the effects of co-occurring events, while the structuring and diffusion processes during implementation are of crucial importance.

REFERENCES

Campbell, J.P. (1977). On the nature of organizational effectiveness. In P.S. Goodman, J.M. Pennings, & Associates, (Eds.), New perspectives on organizational effectiveness (pp. 13-55). San Francisco: Jossey-Bass.

James, U.S., McCorcle, M.D., Brothers, A.J., & Oliver, L.W. (1983). Analysis of the impact of the US Army's Organizational Effectiveness (OE) program (ARI Working Paper No. LMTA 83-1). Alexandria, VA: US Army Research Institute for the Behavioral and Social Sciences.

Oliver, L.W. (1981). Organizational Effectiveness Staff Officer (OESO) Perceptions of the Army's Organizational Effectiveness (OE) program (ARI Research Note 83-16). Alexandria, VA: US Army Research Institute for the Behavioral and Social Sciences.

Oliver, L.W. & Spokane, A.R. (1983, April) Construct validity in career counseling outcome measurement. Paper presented at the meeting of the American Educational Research Association, Montreal.

Oliver, L.W., van Rijn, & Babin, N. (1983, August). Productivity improvement efforts in Army organizations: an overview. Paper presented at the meeting of the American Psychological Association, Anaheim, CA.

Susman, G.E. (1983). Action research: A sociotechnical systems perspective. In G. Morgan (Ed.), Beyond method: Strategies for social research (pp. 95-113). Beverly Hills, CA: Sage.

Overview of the Air Force Productivity Program

Lt Col A.R. Dahms

Air Force Manpower and Personnel

PRODUCTIVITY

IT ALL COMES BACK TO YOU!

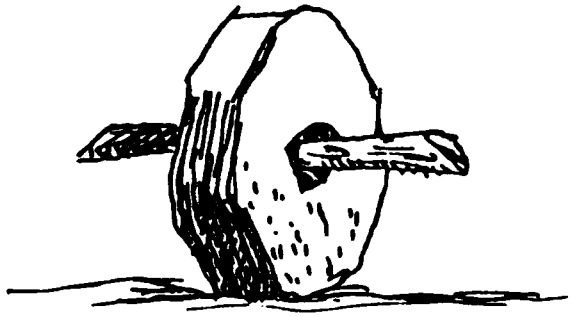
PRODUCTIVITY
IT ALL COMES BACK TO YOU!

- OVERVIEW
- PROGRAM STATUS
- FUTURE

PRODUCTIVITY
IT ALL COMES BACK TO YOU!

PRODUCTIVITY ENHANCEMENT PROGRAM (PEP)

PAST



STONE AGE

- PROGRAM
- PLAN
- MOTTO-LOGO
- DEFINITION-PRODUCTIVITY
- CONCEPT
- ORGANIZATION

PRODUCTIVITY
IT ALL COMES BACK TO YOU!

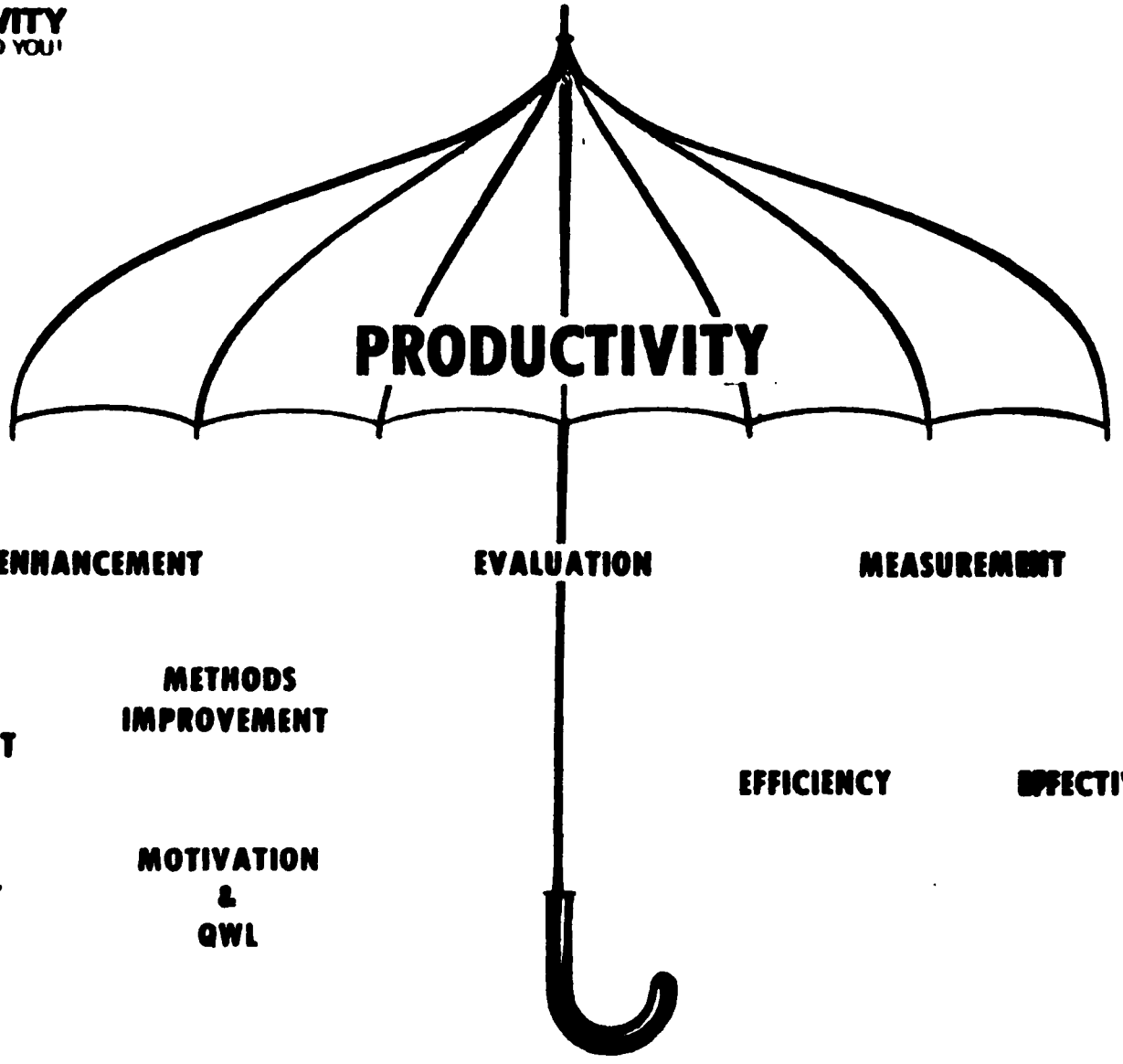
PRODUCTIVITY IS...

★ DOING THE RIGHT THINGS
AND
DOING THINGS RIGHT

★ GOOD MANAGEMENT

...EFFECTIVENESS
AND
EFFECIENCY

PRODUCTIVITY
IT ALL COMES BACK TO YOU!



ENHANCEMENT

RESEARCH & DEVELOPMENT

CAPITAL INVESTMENT

METHODS IMPROVEMENT

MOTIVATION & QWL

EVALUATION

EFFICIENCY

MEASUREMENT

EFFECTIVENESS

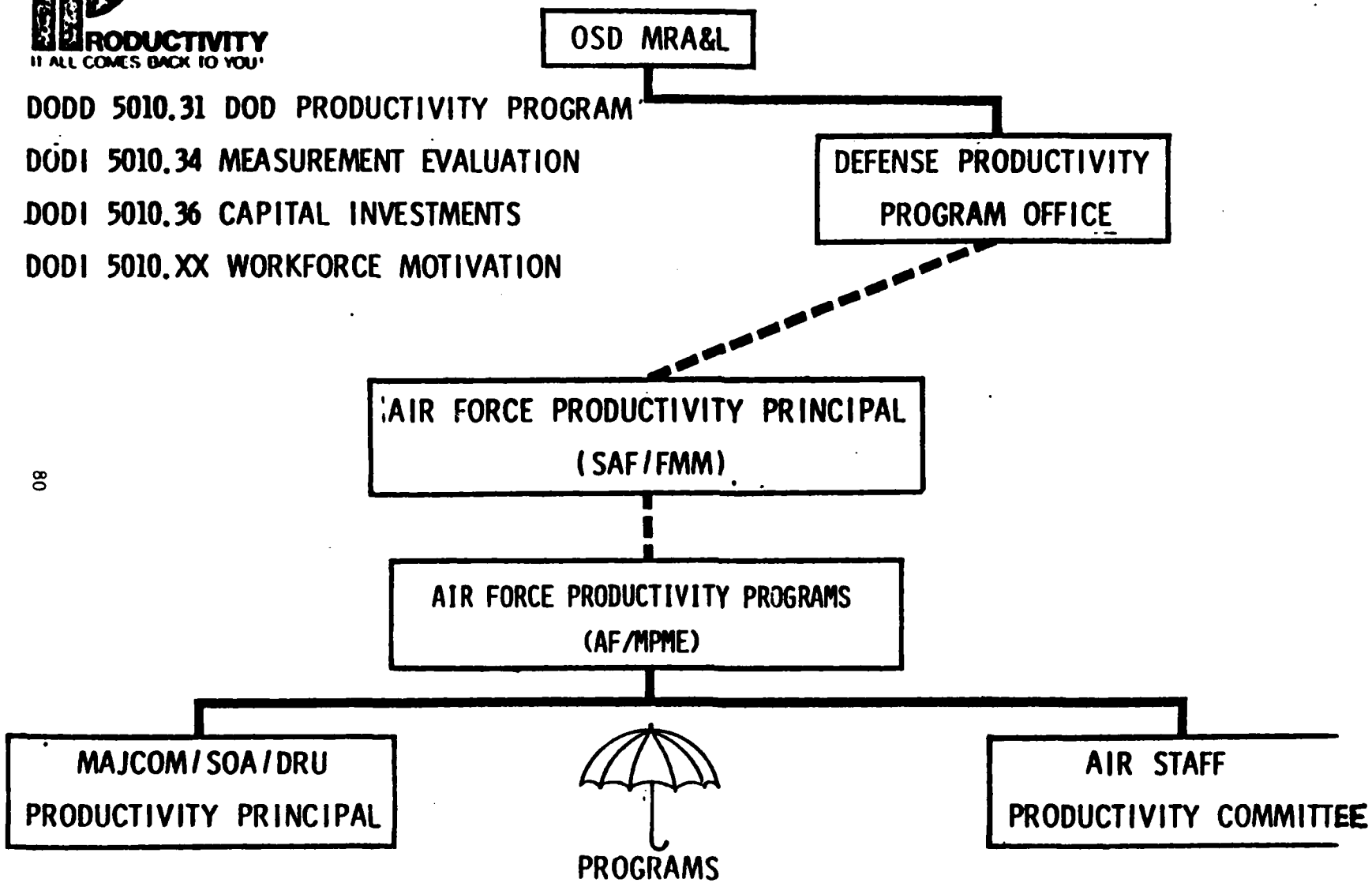
PRODUCTIVITY
IT ALL COMES BACK TO YOU!

DODD 5010.31 DOD PRODUCTIVITY PROGRAM

DODI 5010.34 MEASUREMENT EVALUATION

DODI 5010.36 CAPITAL INVESTMENTS

DODI 5010.XX WORKFORCE MOTIVATION

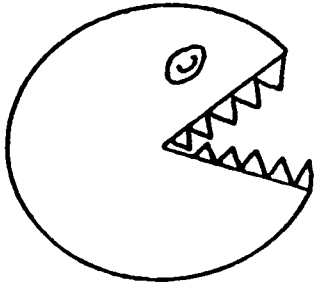


PRODUCTIVITY
IT ALL COMES BACK TO YOU!

PRODUCTIVITY ENHANCEMENT PROGRAM (PEP)

PRESENT

- AFR 25-3
- AFR 900-54
- MEASUREMENT
- PLANNING & REPORTING
- IDEA CROSSFLOW
- PLANNING, PROGRAMMING, AND BUDGETING SYSTEM (PPBS)
- INTEGRITY & MANAGEMENT IMPROVEMENT PROGRAM (IMIP)
- RESULTS

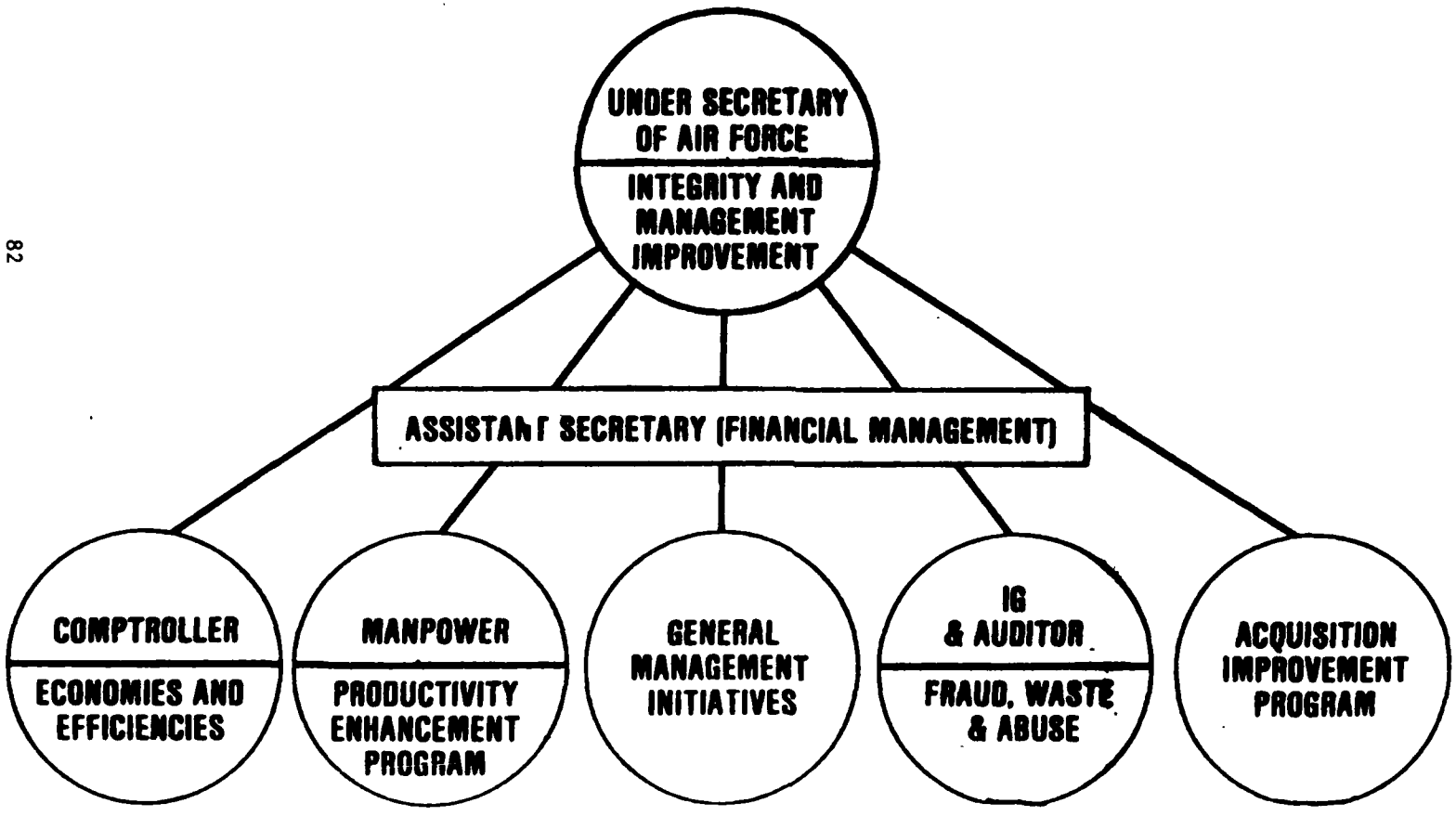


PAC-MAN AGE

INTEGRITY AND MANAGEMENT IMPROVEMENT PROGRAM

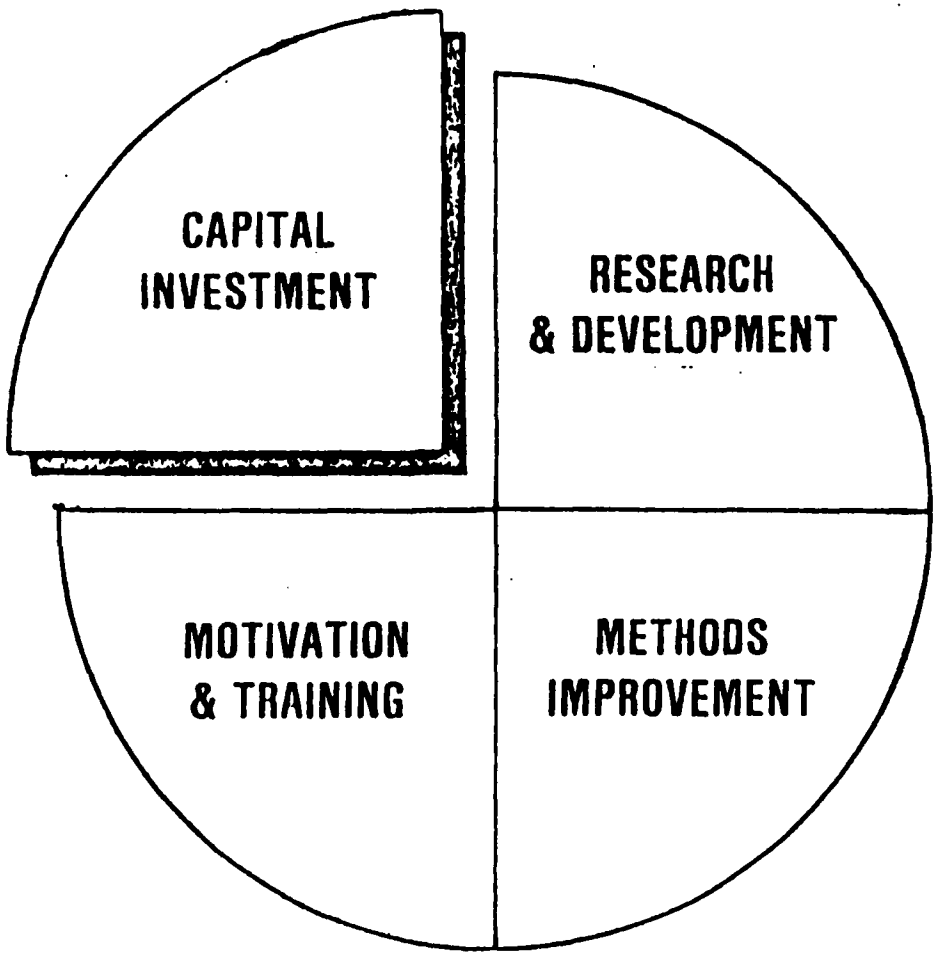
AIR FORCE EMPHASIS

- EFFORTS (PROGRAMS) REMAINS AS STRUCTURED
- TIE TOTAL PROGRAM TOGETHER



PRODUCTIVITY
IT ALL COMES BACK TO YOU!

ENHANCEMENT

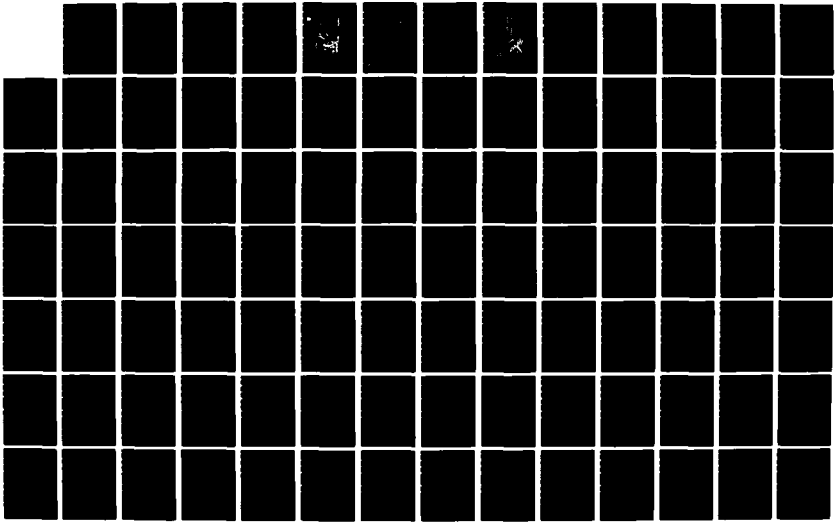


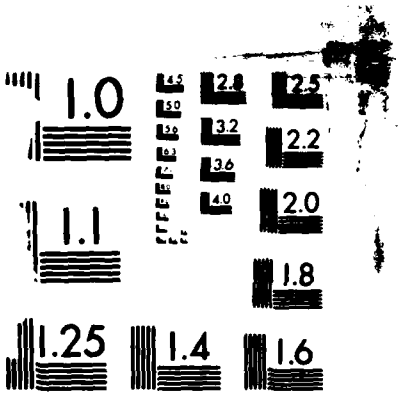
CAPITAL INVESTMENT PROGRAM COMPARISON

	FASCAP	PIF	CSIP
• SPONSOR	USAF	OSD	USAF
• PROJECT LIMITS	3K MIN 100K MAX	100K MIN NO MAX	3K MIN NO MAX
• AMORTIZATION	2 YRS	4 YRS	5 YRS
• TYPE SAVINGS	HARD TRACKABLE	HARD OR COST AVOIDANCE	SAME AS PIF
• APPROVAL	FIFO	BASED ON ECONOMIC FACTORS	SAME AS PIF
• BUDGET ('84)	$ 9.6M	$38.5M	$ 6.0M

AD-A165 918 PRODUCTIVITY RESEARCH AND DEVELOPMENT PLANNING WORKSHOP 2/3
(U) TEXAS MAXIMA CORP SAN ANTONIO W SILVA ET AL.
MAR 86 AFHRL-TP-85-10 F33615-83-C-0030

UNCLASSIFIED F/G 5/9 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A

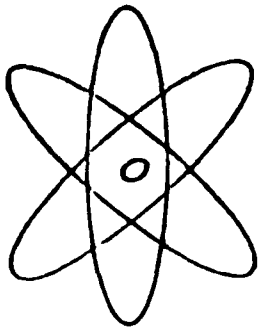
AF FY 85 PIF PROJECTS FORWARDED ($ M)

Command	#	Cost	Savings 4 YR	Savings LC	Savings MNPWR/EQ
AFSC	13	22,462.1	84,641.1	185,255.2	205.6
AFLC	7	53,708.1	380,959.0	1,751,521.9	1,016.0
TAC	6	2,618.0	19,500.8	90,552.3	(7.8)
USAFE	1	1,350.0	1,360.4	6,591.5	7.0
AFCC	2	2,431.2	6,168.1	11,615.5	7.0
SAC	2	951.7	2,058.8	2,571.4	18.0
HAF	1	7,935.4	8,026.8	20,067.0	0
AAC	1	2,163.3	18,002.8	67,510.5	0
ATC	1	681.8	994.8	3,730.5	8
MAC	1	423.4	1,047.1	1,302.7	13
Totals	35	94,725.0	522,759.7	2,140,718.5	1,266.8

PRODUCTIVITY
IT ALL COMES BACK TO YOU!

PRODUCTIVITY ENHANCEMENT PROGRAM (PEP)

FUTURE



SPACE AGE

- CONCEPT
- MANAGEMENT ENGINEERING
- PARTICIPATIVE MANAGEMENT
- PLANNING-GOALS
- MEASUREMENT
- REPORTING
- CAPITAL INVESTMENTS
- EMPHASIS

SUMMARY OF PRODUCTIVITY IMPROVEMENT RESEARCH AND STUDIES FUNDING

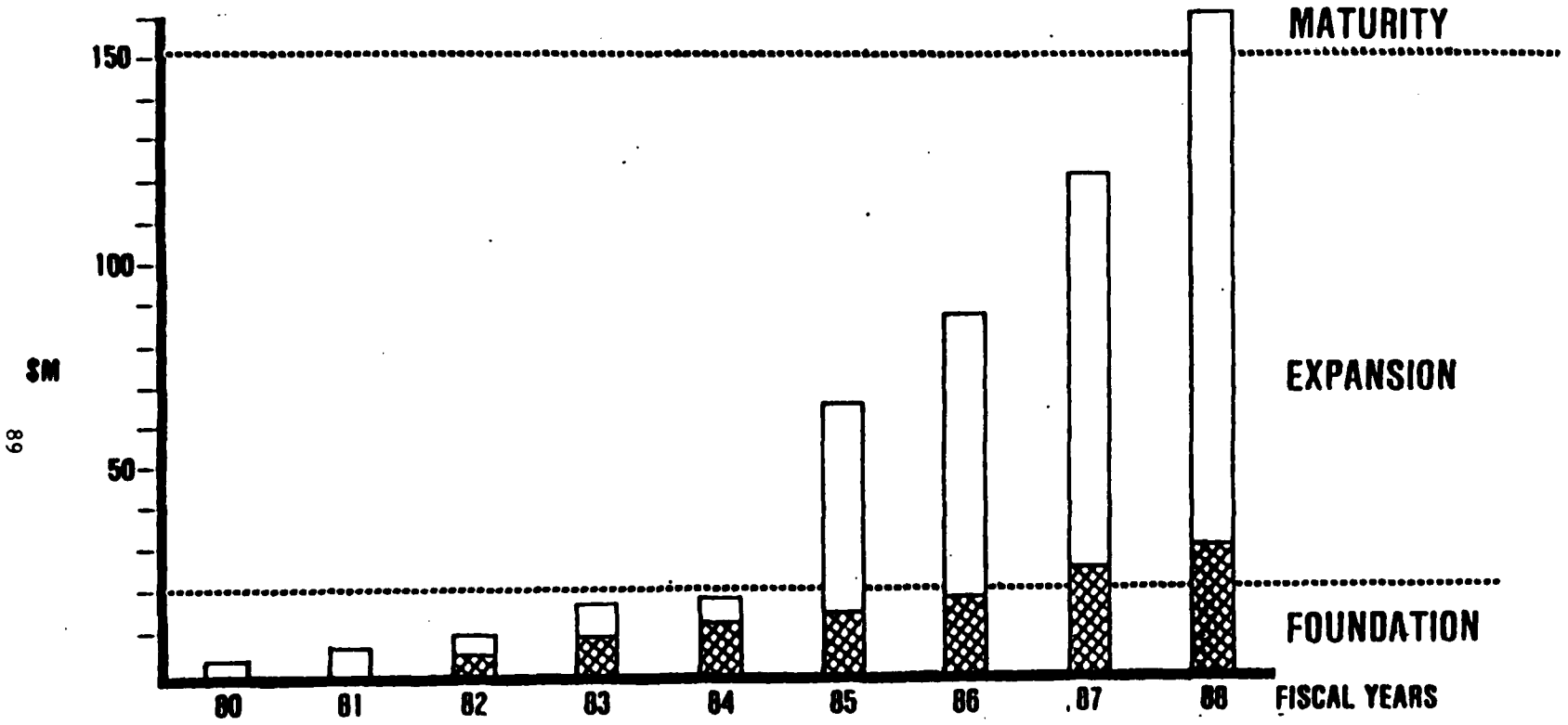
(DOLLARS IN THOUSANDS)

RESEARCH AREA:	FY 81	FY 82	FY 83	FY 84	FY 85	FY 86
1. MANPOWER MOTIVATION		5.0	86.0	151.0	155.0	90.0
2. PRODUCTIVITY MEASUREMENT	82.1	78.2	81.6			
3. TRAINING	2,300.0	3,001.0	3,920.0	7,411.8	6,407.8	
4. INCENTIVES/MANAGEMENT STRATEGIES			87.4	6.9		
5. PECI	93.0	1,400.0	940.0	250.0		
6. IMPEDIMENTS/ORGANIZATIONAL EFFECTIVENESS	118.3	184.7	799.7	662.4	624.9	
7. OPERATIONAL IMPROVEMENT/ SOCIO-TECHNICAL SYSTEMS	2,295.6	4,400.8	6,295.0	8,005.0	2,945.3	275.0
8. R&D ROLE IN PROMOTING PRODUCTIVITY IMPROVEMENT			232.0	300.0	400.0	

WHICH WILL IT BE?

PRODUCTIVITY
IT ALL COMES BACK TO YOU

A DECADE OF GROWTH



FASCAP	3.8	4.3	5.5	9.3	11.9	15.5	17.9	25.3	30.5
CSIP	-		3.9	3.9	6.0	50.0	70.0	95.0	125.0
TOTAL	3.8	4.3	9.4	13.2	17.9	64.5	87.9	120.3	155.5
OPAF	2654.8	3148.1	5406.9	5845.2	8137.1	9940.3	11421.1	13,673.7	15,547.7
% OF OPAF	.14	.14	.17	.23	.22	.66	.77	.88	1.00

SOURCES: AF/MPMZ RE AND FORECAST DEFENSE GUI FYDP

CONCEPTS UNDER CONSIDERATION

	FASCAP	PIE	CSIP
• ESTIMATING FUTURE $ REQUIREMENTS	X	X	X
• IMPROVING TIE TO FUNC REVIEWS			X
• ADDING APPROPRIATIONS	X		
• USING BEST PAYBACK VS FIFO	X		
• REDUCING REPORT BURDEN	X	X	X
• DELEGATING PROJECT APPROVAL	X		
• IMPROVING AUDITABLE TRAIL	X	X	X
• PROMOTING MILLION DOLLAR CLUB	X	X	X

UP YOUR PRODUCTIVITY

Air Force Functional Reviews

1st Lt Robert W. Hanson

Air Force Management Engineering Agency

In May 1982, the Director of Manpower and Organization, HQ USAF/MPM, directed the Air Force Management Engineering Agency (AFMEA) to develop a plan to conduct "efficiency reviews" on most Air Force functional areas, excluding direct combat. The objectives of the program are to increase efficiency, enhance productivity, and set a manpower standard based on the efficient operation at the end of each study. The concept is to incorporate the productivity enhancing techniques used in cost comparison studies into our existing management engineering program. The Air Force changed the title of the program to "Function Reviews" because the studies would be by functional area, and we wanted to do more than simply make each activity as efficient as possible. The functional review studies concentrate on identifying peacetime economies - but not at the expense of our war fighting capability. Emphasis is not only on finding economies, but on increasing the readiness posture of the total Air Force as well.

Functional review studies involve several study phases and require more than a year to complete. This paper addresses one phase of the process, the functional review workshop. During the workshop most of the productivity enhancing analysis occurs. The analysis follows a step-by-step sequence of identifying and evaluating work requirements, methods, and processes. The steps are (a) mission analysis, (b) tree diagramming, (c) activity analysis, and (d) performance analysis.

A fundamental tenet of the workshop is bringing together functional experts from across the Air Force to critically analyze and question the way they do business. Management engineers act as workshop facilitators and guide the effort through the analysis steps and solicit creative and innovative approaches to accomplish required work. The key to the success of the workshop is the fact that the functional experts themselves identify better ways to do the job.

Mission Analysis

The first step in the functional review process is mission analysis. There are three operations contained in mission analysis (Chart 1). The first is defining the mission of the function in terms of what the function is required to do, (i.e., the mission objectives). Here the functional mission statement is validated, modified, updated, or recreated to capture the major tasks required to be done. Next, the workshop participants determine the general headings of work to be provided by the function. This is done by listing many of the major tasks required to be performed and then categorizing them into several basic groups. The last operation in mission analysis is to arrange these general headings of work in the order of their accomplishment, or their "logical flow."

Tree Diagramming

Once the general headings of work have been arranged in their logical flow, further breakdown and analysis of the work are done through tree diagramming. Tree diagramming is simply breaking down work requirements into increasingly specific sub-divisions of that work. The way that the work break-out is recorded and displayed resembles an organization chart. However, the break-out is oriented "functionally," not "organizationally." The first level of the tree is formed by the general headings of work developed during mission analysis. Each subsequent breakdown is charted in boxes below the work that it supports. The facilitator begins with the first general heading of work from mission analysis and breaks it down into the steps or types of work required to accomplish it. Again, these work steps are arranged in logical flow. Each of these steps is then broken down into more detailed work requirements until the level is reached where further breakdown would identify specific processes or tasks performed by an individual. After all of the general headings of work are broken down, the tree diagramming stops and activity analysis begins.

Activity Analysis

Activity analysis evaluates specific "how to" work processes to ensure that necessary outputs are provided through efficient procedures and not wasteful ones (Chart 2). Activity analysis accomplishes this through a systematic sequence of evaluating the inputs (work generators), work processes and outputs, as well as their relationship to each other. Activity analysis begins with the work activity (last work requirement described on the lowest box of the tree diagram). This work activity should be the lowest "what" level work requirement. First, the initiator of the work to be performed is determined, that is the work generators or "inputs." The next step involves detailing the "work" or specific "how to" steps necessary to do boxes. These steps or actions constitute the "how to" method of accomplishing the work activity. The current process is listed first. Later an enhanced version is decided on. After identifying all steps for a single work activity, then all outputs produced by the process are listed. Outputs are the results of completed work. Outputs can be tangible such as widgets produced, or they may be intangible such as decisions made. Next each output of the work activity is evaluated to identify the "significant" outputs for that activity. A significant output is one (there may be more than one) which indicates that the work activity being analyzed has been accomplished. They should be the objectives of the work activity. After significant outputs are determined, the work procedures are then reassessed to identify more efficient ways of achieving those outputs. A good workshop facilitator will offer and solicit alternative approaches. Through this process unnecessary or redundant steps are identified; the experts brainstorm ideas, and good ideas piggy-back each other until a "better way" is identified. These "better ways" are recorded as productivity enhancements. Activity analysis continues in this fashion until all work activities have been evaluated.

Performance Analysis

Performance analysis is a very important step in the functional analysis process because it establishes the level of service that the function will be required to provide, i.e., the standard of living (Chart 3). First, all the significant outputs are reviewed to help identify the "critical" outputs. They are called critical outputs because how good or bad these outputs are indicates the overall effectiveness of the function. The outputs to be selected as critical are those which are indicators of major work completion. After the critical outputs are selected, performance standards are developed for each of them. Performance standards prescribe the quality expected of outputs and maximum period of time in which outputs must be completed. Performance standards describe the characteristics of properly completed outputs. They must be measurable and challenging - yet realistically attainable. Standards should clearly describe what a good output is, so when outputs are compared against it, it should be easy to determine if the outputs meet or do not meet the standard. For example, in a distribution center a standard for some type of package might be:

Package is labeled, wrapped, and stamped according to U.S. Postal Service requirements. The contents match the invoice. Shipping document is completed, and the package is forwarded within 10 workdays of the data requested.

Notice how the description specifies the particular characteristics of an acceptable package. If all of those quality and timeliness characteristics are not met, the package would not meet the performance standard. It is unrealistic to expect the performance standard to be met all the time. No one is a perfect performer, so we establish an allowable error rate for the critical outputs. To achieve this, first the number of required outputs is estimated, and then how many of the total outputs may be less than standard before the total performance becomes unacceptable is established. This allowable error rate is called an Acceptable Quality Level (AQL), and it represents the deviation from 100% perfect performance allowed before production becomes impaired. AQLs are normally identified as a percentage value of the total number of outputs expected in a given period of time (e.g., a month). If the required work is very sensitive or critical, a very small AQL should be prescribed. Conversely, a required task which does not need a continuously high level of output should be allowed a larger AQL. The results of allowing a certain amount of error must be weighed against the cost of ensuring that problems do not occur. The result is a clear performance standard with a reasonable error rate.

Summary

Functional review workshops provide an excellent environment to improve the way we do business. Mission analysis identifies the overall objectives of the function. Tree diagramming allows a systematic breakdown to major work requirements into an organized, visual set of tasks. Activity analysis provides a better way to do the work by analyzing work inputs, processes and outputs in search of more efficient work practices. Performance analysis results in standards of performance which reflect the expected level of service for the function. It also provides productivity indicators for management to

use in assessing its overall performance. After productivity enhancements are identified during the workshop phase, planning, measurement and computation phases follow which develop a functionally specific manpower standard based on a more efficient operation. The success of the total study effort is primarily due to bringing the functional experts themselves together to thoroughly analyze what they do and create more efficient and productive ways to get the job done.

Programs, Problems and Potential Research in the United States Air Force

Robert C. Ginnet
United States Air Force Academy

Introduction

While the U.S. Air Force is currently involved in both productivity research and ongoing programs for productivity enhancement, this discussion focuses only upon the latter while the former topic will be discussed by my colleagues from the Air Force Human Resources Laboratory. Furthermore, these comments will not attempt to cover in depth all enhancement programs but instead will concentrate on those which employ behavioral science principles and techniques. It is important to note that this restriction eliminates from further discussion two programs which have contributed most measurable to labor productivity enhancement. Although these programs, Fast Payback Capital Investment Program (FASCAP) and Productivity Investment Fund (PIF), achieve productivity enhancement primarily through capital/labor substitutions, they are unquestionably the best documented and centrally managed Air Force productivity efforts to date.

The data from which these comments evolved were collected in support of a joint Services effort conceived by researchers at the Navy Personnel Research and Development Center (NPRDC). This effort is an attempt to collect and discuss productivity enhancement efforts in the military which use behavioral science approaches such as quality circles, job enrichment, performance based incentives, sociotechnical systems, etc. At the outset the task seemed relatively straightforward, since the author had personal knowledge concerning three of the four suggested programs. It soon appeared to be a relatively false sense of ease, since it became apparent that these sorts of programs are not centrally managed or tracked. However, there is an established network of productivity principals throughout the Air Force who, theoretically, would be able to supply additional and current information. It was in this spirit that letters were sent to these principals and others who may have personal knowledge of behavioral science activities. The letters explained our interest and asked for their knowledge of any relevant programs having occurred within the last ten years. To add to the richness of the effort, personal interviews were scheduled with appropriate Air Staff officers and civilian researchers who might contribute their insights, such as Hackman, Powell, Vroom, Berg, and Tuttle, to name but a few.

The content of the replies, and the discussions, have led to the presentation. Specifically, this abstract will briefly present the outcome of the solicitation and a discussion of their nature. These inputs have resulted in the evolution of three areas of opportunities for further study and research. While the three areas are not mutually exclusive and arguments for considerable overlap have merit, they will be presented separately to gain the advantage of clarity and structure.

RESULTS OF THE REQUEST FOR INPUT

Replies were received from eleven major commands or separate agencies, but the variance and range in number of programs submitted were quite surprising. The total number of behavioral science efforts for the last ten years reported was 29, but the number reported by each command ranged from zero to twelve with a mean of 2.6, a median of 1, and a standard deviation of 3.2 -- a rather skewed distribution. The use of quality circles was the most frequently reported program, followed by job enrichment (in various forms). The quality of program conceptualization, control, and measurement ranged from nearly none to extensive, with the Tactical Air Command's Combat Oriented Maintenance Organization (COMO) and Combat Oriented Supply Organization (COSO) (the closest to a sociotechnical program) and the Leadership and Management Development Center's (LMDC's) Management Consultation programs as two of the better examples. While discussion of these and other programs will be possible during the symposium, the intent here is not to focus on any individual program or input but on the data as a whole. The data suggest a rather wide range of activities considered as meeting the criteria of behavioral science programs which enhance productivity. It is apparent from reading the inputs that whether or not the criterion or criteria is/are satisfied is a function not only of the program per se but also of the perceiver. It seems that behavioral science efforts in the Air Force are present or absent depending upon the lenses through which the respondent views the world. A second characteristic of the data also emerges. While some programs that were unknown to this author were reported, other programs known by the author to fully meet the required criteria were not reported by the respondents. This leads one to ask the question posed most notably in the well-known Johari window. Namely, how many programs in the Air Force are yet unknown to both this author and the respondents. These omissions are even more conspicuous if one considers additional and independent data sources. One example would be the Manager's Guide to Productivity Improvement Resources and Programs, which was compiled and written by Tuttle (1981) and published by the Air Force Human Resources Laboratory (AFHRL) and which listed many programs found in the Air Force but not mentioned by productivity principals at this time. Another data source would be the compilation of organizational development efforts in existence throughout the Air Force, published by the Director of Personnel Plans (Gregory, 1979) and used as the basis for Gregory's American Psychological Association presentation of the same subject. While not all of these reported efforts would stand up under an academic evaluation of organizational development, 48 or the 78 programs submitted specifically addressed improved effectiveness or efficiency as desired outcome variables. Many of these programs met all the requirements for submission under this current effort, yet they were not reported.

How then may we begin to explain these wide variations and omissions? Three possible (but as yet unresearched) hypotheses may be fruitful in searching for an understanding. It seems unlikely that any difficulties are attributable to lack of effort or any nefarious attempts to disguise or hide programs. Rather, these are hypotheses one might use in any realm of program study. First is the problem of knowledge. In terms of knowledge development, the Air Force has only had a formal productivity structure since 1979. This rather neonate organization should not be expected then to have amassed sufficient corporate

memory to recall programs that may have been functional prior to their birth -- in their pre-history, to use Sarason's terms. Nor would this function, which is localized within the management engineering specialty arena, be expected to have an extensive knowledge one brings to a task helps to define the lens through which the world is viewed. One's lack of behavioral science filters can impact the impressions of programs among both practitioners and observers. Similarly, the lack of an integrating network between various disciplines would contribute to limited knowledge. As will be discussed later, this decoupling may have continuing consequences if behavioral science and productivity are to endure in a supportive fashion.

The bounded or limited knowledge relates to a second hypothesis. This suggested arena recurs throughout the literature as well as in the field application. It is the unresolved problem of definition. What is productivity? Today's Air Force definition incorporates both quantity and quality; efficiency and effectiveness; doing things right and doing the right things. But this definition is relatively new, and the original focus on efficiency is often carried over as the predominant theme. Improvements in effectiveness are sometimes ignored even when they may be quite measurable. A second definitional problem is that of "behavioral science." While most academicians could probably arrive at a consensus operational definition, it is not at all clear from the data here that the surveyed productivity principals in the operational Air Force are unified on this point.

Finally, measurement seems to be a potential hypothesis or area of ongoing difficulty. While many have argued that labor productivity has poorly-operationalized terms in both numerator and denominator, it seems to be far more precise than other measures. While definitions and knowledge may be areas in which operational managers have limitations, they are often keenly aware of the difficulty of measurement. This problem is only exacerbated when one adds quality as an issue for measurement. Various Air Force examples in support of this claim are available. Fortunately, the research by Tuttle in this area seems a definite step forward.

These are only possible hypotheses to explain the variations and omissions in the current data collections. The major effort should focus on much broader and more ubiquitous potentials for needed research. While there are undoubtedly many, the interviews and informal discussions with various faculty members have resulted in three areas which would be helpful. These are (a) organizational structure, (b) implementation, and (c) issues of philosophy. While each of these could result in a full scale research proposal, they will only be highlighted here, with emphasis on unanswered questions.

ORGANIZATIONAL STRUCTURE

Air Force regulation 25-3, Air Force Productivity Enhancement Program, defines the responsibilities of at least 15 levels ranging from the Assistant Secretary of the Air Force for Financial Management down through major commands, yet the organizational structure for productivity enhancement using behavioral science research, development, implementation, and measurement remains unclear. There are structures for behavioral science research and structures for productivity

enhancement, but the integrating mechanism necessary for implementation is not well defined. Rather there are various agencies and levels of organizations responsible for these programs. While this has resulted in a lack of integration, it has provided a framework for observing organizational intra- and interactions. In some manners, the Air Force seems to mirror the larger context of productivity, particularly in its diversity. For example, if one is to attempt a comprehensive literature review on the subject of productivity, such diverse sources as the National Productivity Review, the Journal of Economic Literature, the Administrative Science Quarterly, the Journal of Applied Psychology, and the American Psychologist must be considered, merely as a starting point.

There seems to be a distinct boundary in the Air Force between those who measure and track productivity and those who would be considered behavioral scientists. Clearly, those responsible for measurement are centrally located in the management engineering area. Behavioral scientists are not as clearly specialized or localized. Contracted research is the responsibility of AFHRL and Office of Scientific Research (OSR). Both the Air Force Institute of Technology (AFIT) and the U.S. Air Force Academy (USAFA) have conducted research and have been involved with implementation, as has LMDC. But there appears to be no agency comparable to the Army's Organizational Effectiveness Program (and its relationship with the Army Research Institute) or the Navy Personnel R&D Center (and its relationship with the Office of Naval Research) for centralization and continuity. Furthermore, there is no assurance (and often explicit denial) that one area will understand what the other is doing.

Another structural issue that has yet to be resolved is the current location of the productivity enhancement function. Not only are management engineering personnel often responsible for measuring and tracking productivity gains, but they are also responsible for the establishment of manpower standards. As noted in the 1980 Air Force Productivity Symposium (Short, 1981), this places the operational manager in a difficult position, because the same people who record and measure productivity gains and the resultant man-hour savings also reduce the manpower available to perform the task. If Cyert and March's concept (1963) of organizational "slack" has merit, it does not take much imagination to predict some potential outcomes under these conditions.

A final structural question involves the degree of centralization or decentralization desired for effective implementation. There are obviously differing opinions even within functions. FASCAP and PIF are highly centralized as a cursory review of AFR 25-3 will suggest. On the other hand, behavioral science efforts are highly decentralized. Whether this has been a result of the scarcity of resources or rather a failure to consider the issues of implementation is unknown. But at least one anecdotal illustration of the varied impression of the Buckstop Program would indicate that there are unresolved issues remaining. Perhaps the knowledge of the organizational theorists regarding attempts to mix structural designs across differing technologies could be adapted to this problem and applied. Perhaps trying to implement a decentralized program in a highly structured organization is not the most profitable approach. Perhaps a review of the demise of programs such as job enrichment would help answer some of these questions. At any rate, the entire area of organizational structure would seem to be ripe for study. It is

also of direct consequence for the next area of inquiry.

IMPLEMENTATION

Certainly the question of program implementation, as mentioned above, is not clear in the Air Force. Who is responsible for implementation? Does the person or agency responsible have access to the necessary skills for behavioral science productivity enhancement? At which level should they be attached to gain maximum effectiveness? How do we link research and operational implementation most effectively? All these are questions worthy of continued research but they are merely an initial level. A more stimulating question relates to the implementation of measurement itself. At least two sub-areas are worth examination. The first involves the concept of linking. At what point do we say we are productive? Are we really enhancing productivity if we save 20 man-hours/month (which we measure) while, at the same time, possibly increasing attrition and absenteeism (which we may not measure)? Our tendency has been to examine productivity enhancement in the short-run, often within six months or a year. Yet considerable behavioral science research dating back at least to the Hawthorne studies (Roethlisberger & Dickson, 1939) has shown that short term analysis may or may not be correct. On the one hand, short term measurement may be unduly influenced by the change process rather than the change, leading to false positives. On the other hand, short term measurement may miss the adaptive and constructive benefits noted in some long term behavioral science efforts. We may be focusing our efforts on that which may lead to our decline. Parallel to this and the referenced work of Tuttle is a related aspect of measurement particularly for the military: the issue of ultimate criteria for military effectiveness. While questions of work processing improvement and administrative processing efficiencies should not be ignored, the ultimate questions of military effectiveness and efficacy have perhaps received too little attention. Nor will they be easy to answer!

The second sub-arena in one which I have labeled the iatrogenic effects of measurement. Certainly any measurement system has flaws. But what are the consequences upon productivity of the measurement itself? What are the consequences upon those people who are the subjects of our measurement? There is some indication from the Orthodox Job Enrichment experience of AFLC that measurement may influence a program. There is also evidence that secondary measurement (that is, measurement not originally planned as part of the intervention but initiated separately) may, in fact, be a separate intervention resulting in its own consequences. The best intentioned programs may suffer this fate. But iatrogenics goes even further. If we implement a rigorous measurement program, what are the unintended consequences? Others suggest some serious unintended consequences of rigorous research. If those consequences can be extrapolated to behavioral science productivity efforts, we may find ourselves in a rather paradoxical paradigm.

PHILOSOPHIES

This final area is related to the other two, both directly and indirectly. Some may consider this an area too ethereal to warrant study while others could argue that it is the foundation of other problems. While it may not be an area of direct concern for those involved only in implementation, it does seem a

worthy topic for researchers with ultimate consequences for everyone. The relationship between behavioral science theory and productivity is not clear. While research such as published by Katzell, Bienstock, and Faerstein (1977), Guzzo and Bondy (1983), and Katzell and Guzzo (1983), unquestionably suggests an overlap between that which is behavioral science and that which is productivity; the magnitude of that overlap is unclear.

If one considers the roots of the two traditions, some variance is possibly suggested. One could suggest that the roots of productivity flow from that which we now call scientific management, or Taylorism. Likewise, much of what is included in the behavioral science realm has its roots in the human relations school. (Whether one accepts the traditional arguments of Roethlisberger and Dickson (1939) and Franke and Kaul (1978) or the radical review of Carey (1967) makes little difference for the sake of this argument.) These different backgrounds might suggest that measuring "manhours saved" has little to do with behavioral science in a fundamental sense. The question one must then ask is, "Where are we today?" Are we continuing to diverge from that original division or are we beginning to merge, either as a whole or perhaps through the emergence of specialties like organizational behavior?

If neither of these alternatives seems to resolve the difficulty, is it not possible that the old models are outdated? This may suggest a more radical approach. Perhaps the difficulties we are encountering are similar to those encountered by the new industrialists who attempted to see themselves through the models of agricultural society that preceded them. Perhaps the productivity models of the industrial age are not the most appropriate tools to measure effectiveness in an age of services and information.

As is the norm, research poses more questions than answers. That seems to be unusually so in this effort. It is hoped that, if nothing else, those questions may prove to be a catalyst for further symposium discussion.

REFERENCES

Carey, A. (1967). The Hawthorne studies: A radical criticism. American Sociological Review, 32, 403-416.

Cyert, R.M., & March, J.G. (1963). A behavioral theory of the firm. Englewood Cliff, NJ: Prentice-Hall.

Franke, R.H., & Kaul, J.D. (1978). The Hawthorne experiments. American Sociological Review, 43(5), 623-643.

Gregory, R.A. (1979, August). Organizational development efforts in the United States Air Force. Paper presented at the meeting of the American Psychological Association, San Francisco.

Guzzo, R.A., & Bondy, J. (1983). A guide to worker productivity experiments in United States 1976-1981. New York: Pergamon.

Katzell, R.A., Bienstock, P., & Faerstein, P.F. (1977). A guide to worker productivity experiments in the United States 1971-1975. New York: New York University Press.

Katzell, R.A., & Guzzo, R.A. (1983). Psychological approaches to productivity improvement. American Psychologist, 38, 468-472.

Roethlisberger, F.J., & Dickson, W.J. (1939). Management and the worker. Cambridge, MA: Harvard University Press.

Short, L.O. (1981, January). Air Force productivity symposium (LMDC-TR-81-1). Maxwell AFB, AL: Leadership and Management Development Center.

Tuttle, T.C. (1981). Manager's guide to productivity improvement resources and programs (AFHRL-TF-81-12, AD-A058 645). Brooks AFB, TX: Manpower and Personnel Division, Air Force Human Resources Laboratory.

A People-Productivity Partnership

Vince Luchsinger, Maj Gen, USAFR

Air Force Systems Command

I bring you the greetings and best wishes of General Marsh, Commander of the Air Force Systems Command. It's a pleasure to participate in this meeting held on a Systems Command base, hosted by the Air Force Human Resources Laboratory, a valued element of the Systems Command family.

It's a particular delight to see such a distinguished group of scholars, analysts, and practitioners devote themselves to productivity issues. I'm convinced that this type of dialogue is productive in the search for excellence in organizations.

There are three things that can emerge from this work: (a) we can articulate what we think we know about the nature and needs of our productivity challenges, (b) we can enjoy the sharing and cross-fertilization of findings and ideas, and (c) we can engage in process activity that could explore options and strategies for research and practice.

I call your attention to the evaluation of definitions of productivity. From the simple specification of output over input, our AFR 25-3, "Air Force Productivity Enhancement Program," helps track more definitive elaborations through effectiveness and efficiency and "doing the right things" related to "doing things right." Today, we extend productivity beyond quantity and labor hours.

Timeliness, quality, cost, responsiveness, readiness, and other variables factor into our concept of productivity. But we are thinking more about productivity and doing something about it.

As a contemporary topic of concern, productivity is very visible today. The trends in national productivity decreases have generated alarm. Recent evidence of upturns for whatever reason is gratifying. This may be part of the problem. In our search for quick solutions, will behavioral scientists be allied with colleagues in economics who provide explanations for behavior, but are harder pressed for strategies to help shape future behavior?

I think of four factors that contribute to productivity: people, process, product, and investment. While this meeting is largely concerned with the human component, the interaction with process, product, and investment components is important. To my satisfaction, human skill and motivation drive the system.

The productive human element is directly related to the quality of the work force, our pool of people available and willing to work, and the quality of management. The quality of management is crucial given the waterfall effect where manager attitudes, actions, and examples impact on workers as well as the job. This was well put by Dr. Deming in attributing 85 percent of productivity problems to management and system related factors.

In the current non-fiction best seller, In Search of Excellence (New York: Harper and Row, 1982), Thomas J. Peters and Robert H. Waterman, Jr. claim the best-run organizations (a) take good care of their work force, (b) focus on product quality, and (c) concentrate on the primacy of client needs.

Further, a recent productivity newsletter claimed the leading factor in productivity improvement to be (a) employee participation, (b) communications, (c) worker-management relations, and (d) training, followed by (e) process and product factors.

While this research may not meet the rigor desired by the behavioral science community, senior managers do pay attention to such findings. What does this indicate for a conference such as this? I'd suggest we be problem-sensitive but action-oriented. We have no lack of problems. Some of our problems are:

Environment complexity where we are stretching ourselves to do more;
Scarcity of resources;
Short-term orientations to fix it quick;
Motivation and value shifts in organization and society;
Largely de-centralized (for better or worse) efforts in productivity improvements;
Credibility of productivity programs.

In order to light some candles, rather than curse the darkness, some action options for behavioral scientists come to mind:

1. Recognize that productivity is basically output, but uniquely different in the pragmatics of organizations.

2. Continue our study of productivity as a behavioral science phenomenon related to other disciplines. Special attention is warranted for our old nemeses, criterion and measurement variables.

3. Emphasize long run over short run. Organization fluidity and managerial turnover cause undue concerns on "today's shift." Productivity should be a longitudinal emphasis.

4. Productivity concerns should be institutionalized. It may be corny, but productivity can be considered a part of the "American way." Institutionalization should provide continuity in productivity enhancement.

5. Commitment and involvement of senior management is crucial to successful productivity programs.

6. We need research to document productivity experience, but action research is of more value to commanders and managers.

7. Productivity researchers and facilitators must relate to managers and the management process of planning, leading, and controlling. Without credible access to decision makers and policy makers, the impact of productivity programs is thwarted.

Air Force Management Consultation Program

Lt Col Ronald L. Halsted
Lt Col Jerry R. Snow

LMDC

INTRODUCTION AND BACKGROUND

The overall goal of the management consultation process is to improve the combat effectiveness, productivity and quality of worklife for Air Force military and civilian personnel. Three objectives support this goal: (a) to promote on-site consultation assistance for all levels of supervision at Air Force installations, (b) to provide specialized seminars and workshops within the work environment to expand managerial education for supervisors and managers, and (c) to identify common leadership and management issues or problems occurring throughout the Air Force. The goal and its supporting objectives are based on the philosophy that productivity enhancement depends on improving the leadership and management of human resources in the workplace and that this enhancement should include the first-line supervisor.

The process is constructed to identify existing perceptions of the organizational leadership and its management practices. The objective is to identify strong areas as well as possible areas of concern within an organization by analyzing information gathered from a variety of sources, and to initiate solution-oriented plans to rectify the areas of concern.

The process was developed as an outgrowth of the Air Force's increasing concern about its people. The initiation of the all-volunteer military in 1973 and the subsequent shortage of manpower to fill Air Force positions led Air Force leaders to conclude it was imperative to make the Air Force more attractive relative to civilian employment. In order "to do more with less," the productivity of the Air Force personnel had to be increased.

The primary means of achieving these goals was based on two assumptions: (a) intrinsically satisfying jobs would attract and retain more people, and (b) satisfied individuals would perform more effectively and efficiently. Under these assumptions, an ad hoc group, the Air Force Management Improvement Group (AFMIG), was formed in 1975 to examine the non-technical aspects of Air Force life and provide recommendations to the Chief of Staff, U.S. Air Force, on how life in the service could be improved.

Based on the AFMIG report, the Air Force Chief of Staff initiated a new central approach to the training of Air Force supervisors. His order created the Leadership and Management Development Center (LMDC) as part of the Air University, located at Maxwell Air Force Base, Alabama. Its charter established LMDC as the focal point for providing leadership and management education to Air Force personnel. The LMDC was tasked to develop instructional material, train instructors, conduct research and evaluation programs, provide on-site consultation services, and conduct resident courses.

To fulfill its responsibilities, LMDC has approximately 170 full-time staff and faculty members in six schools, four directorates and the USAF Chaplain Resource Board. The Directorate of Management Strategies and Education contains 44 consultants who provide management consultation services to Air Force organizations.

KEY STEPS IN THE MANAGEMENT CONSULTATION PROCESS

The management consultation process consists of six sequential steps.

Step 1 - Invitation

The process is initiated by an Air Force unit commander's request to LMDC for a consulting team to visit his/her organization. To insure top management support, this invitation must originate from a major unit commander or agency chief. The LMDC consulting services are provided to a unit commander with an understanding that all the perceived attitudes within the unit will remain confidential between the consulting team and the requesting commander. Also, specific attitudinal concerns identified within an individual work group will remain confidential between the consulting team and that particular work group. This understanding is vital to the success of the process since it encourages open, honest communication at all levels within the organization.

Step II - Pre-visit

The consultation process actually begins when LMDC consultants initially visit an organization to gather preliminary information and to clarify process requirements for both the host commander and the organization's Project Officer. The pre-visit step normally takes three to five days, with the first day devoted to briefing the host commander and staff and identifying any specific concerns to address as the consultation effort progresses. The remaining time at the host organization is spent assisting the Project Officer in establishing a network of Survey Coordinators (one per subordinate unit, Deputy Chiefs of Staff, etc.) to simplify future support requirements, to insure accurate organizational charts are developed and completed prior to departure of the LMDC team, and to coordinate the visit with the applicable unions. Administrative requirements are also addressed, to include arranging for typing support, identifying a location to administer the survey, and developing a survey schedule in preparation for Step III of the process.

Step III - Data Collection

Data are collected as a joint effort between a team of LMDC consultants and the organization's Project Officer and Survey Coordinators. The Data Collection phase takes about one week, and consists of the following:

1. Administration of an open-ended questionnaire to key supervisors throughout the wing/base organization to ascertain perceptions from their position as work group leaders. Perceptions covered by the questionnaire include the current morale of supervisors' work groups, changes occurring within the work group in the past six months concerning performance or attitudes, and the supervisors' leadership style as perceived by themselves and their subordinates.

2. Interviews with supervisors are based on the responses to the open-ended questionnaires.

3. Administration of the Organizational Assessment Package (OAP) survey to a stratified random sample of personnel within each work group of the base or wing. The survey has been validated and provides an objective assessment of leadership and management factors (i.e., job, supervision, organization, climate, productivity, and satisfaction) within an organization.

Also collected are the objective measures of work used within the wing; e.g., how many vehicles are repaired in X amount of time.

Step IV - Analysis

The responses to the survey are analyzed by the consultants after they return to LMDC. Because of the large number of respondents to the survey, the answer sheets are computer processed, thus permitting analysis of the entire organization down to the smallest work groups. Results from the other data-gathering mechanisms are analyzed by the consultants and are used to give depth and dimension to the picture of the organization created by the survey results. This step normally takes about six weeks, and is accomplished at Maxwell AFB.

Based primarily on survey responses, LMDC consultants develop feedback packages for supervisors who had four or more subordinates respond in their work group. These feedback packages statistically compare an individual supervisor's work group with the total organization as well as with similar work groups in the LMDC data base. Information previously gathered from each work group, independent of the survey, is compared with survey results to verify consistency of all data describing a work group.

Step V - The Tailored Visit

During this step of the process, consultants are on-site at the organization for approximately two weeks. The visit is termed "tailored" because the consultants consider the specific needs of the organization and plan intervention strategies such as group sessions, one-on-one meetings, and special seminars and workshops directed to improve the organization. Depending on the need, consultants may be qualified to lead a variety of seminars and workshops to address problems identified in a specific workgroup or across the organization as a whole.

To initiate the tailored visit, the commander is briefed on general conditions within his/her organization as indicated by the data. Overall strengths and weaknesses of the organization are also discussed.

During the visit, groups of supervisors are given their individual statistical feedback packages and briefed on the results. Packages contain the work group's mean and standard deviation on each factor of the OAP, and a comparison of those statistics with the mean of the total organization. Feedback packages are given only to the specific supervisor concerned. After the group briefings, consultants work with those supervisors identified by the analysis as having problems and may serve as facilitators within a work group or work solely with the supervisor to resolve any problems identified. If similar problems appear throughout a workgroup, wing, or base, consultants conduct tailored seminars/workshops on such topics as conflict resolution, stress management, communications skills, recognition techniques, leadership, team building and motivation.

The feedback session and contacts with individual supervisors also serve as e foundation for supervisors to develop specific action plans to resolve pro' ıs or weaknesses within their work groups. Emphasis is also placed on .he supervisor conducting a feedback meeting with his/her subordinates to discuss the survey data and identify possible corrective measures.

Consultants work with supervisors to formulate written Management Action Plans (MAPs). These include objectives for the work group, actions needed to attain the objectives, a time frame to meet the objectives, and measurement criteria to determine objective accomplishments. Although consultants work with supervisors on the MAPs, commitment tc the final plan is dependent on the supervisor's acceptance of responsibility for the final outcome and his/her willingness to develop a written MAP.

Step VI - Follow-up

The Follow-Up Step has a dual phased purpose: (a) to evaluate the effectiveness of the management consultation process, and (b) to assess changes which may have occurred in the organization as a result of the process.

The first phase consists of LMDC mailing a survey questionnaire (45 days after the Tailored Visit) to the commander and to a random sample of the supervisors with whom consultants worked individually. The survey solicits their anonymous judgments about the performance of the consulting teams and the effect of the consulting process on the organization.

The second phase of the Follow-Up occurs about four to six months after the Tailored Visit. Consultants again visit the organization for approximately one week, and re-administer the Organizational Assessment Package (OAP) survey to a random sample of personnel. Consultants also conduct interviews with the supervisors they initially work with in developing MAPs. Consultants then determine progress made toward MAP objectives and give further assistance to individual supervisors, if necessary.

After completion of the second phase of the Follow-Up, consultants return to LMDC, analyze the second group of responses to the OAP survey, and integrate the data obtained from interviews. Follow-Up results are also compared with data obtained during the data collection phase of the consultation process. A final report is then written and delivered to the host organization commander. This report compares overall pre- and post-consultation data.

SUMMARY

The consultation program is evolutionary in nature, a program which strives to meet the needs of the Air Force Commanders. Challenges lie ahead for all Air Force leaders. The dynamic and austere environment in which we serve reinforces the necessity to improve the combat effectiveness, productivity, and quality of worklife for Air Force military and civilian personnel. The consultation program is one step in helping Air Force leaders meet these demands.

Leadership and Management Development Center

Productivity-Related Initiatives

Lt Col Lloyd Woodman, Jr.
Major Lawrence Short
Capt Jeffrey S. Austin

The Research and Analysis Directorate of the Leadership and Management Development Center (LMDC) has become involved in several research initiatives over the last several years. While productivity-related research is not our major focus, some of our work does relate to this area. The purpose of this paper is to briefly explain three such efforts: Organizational Assessment Package (OAP) revision, our current organizational design study, and some details of a study relating OAP measures with hard outcome measures.

OAP REVISION

In its simplest form, the revision consists of three major elements: OAP item and factor content, scan sheet and feedback package redesign, and an expanded work group coding system. In regard to the instrument, several additional demographic items will be added. These include items on professional military education, temporary duty requirements, family information, pay, source of commissioning, technical school training, and a revised career intent item. Attitudinal items will be expanded slightly and will be summarized by 14 factors (technically components since the "factors" were derived by a principal components analysis). The supervision and organizational climate factors did not separate and will be combined. In addition, new factors measuring job-related stress and intergroup conflict will be added and the training factor greatly expanded. Finally, the pride and job satisfaction factors did not separate and will be combined into a job pride and satisfaction factor. The 14 factors included in the revision are:

Job Performance Goals	Job-Related Stress
Task Characteristics	Supervision
Task Autonomy	Advancement
Work Repetition	Intergroup Conflict
Job-Related Training	Work Group Effectiveness
Work Support	Job-Role Pride and Satisfaction
Work Interference	Organizational Climate

The scan sheet and feedback packages will be revised consistent with the instrument revision. The scan sheet will have spaces for expanded demographic responses and space for matching code elements which now must be placed in item response positions. These codes are crucial, since they provide a way of linking OAP responses to responses on an additional survey without identifying the respondent. Scan sheets will also be color coded by type of survey to reduce possibility of coding errors.

The feedback package is a computer generated document provided to each supervisor who has four or more people from his/her work group respond to the OAP with valid information. Currently, the package provides means, standard deviations, and frequency distributions by OAP items and factors. The revised package will include several new elements including an expanded presentation of OAP attitudinal and demographic items and the possibility of a computer graphics generated display of OAP items and factors on which a work group scored lowest. This will allow both consultant and supervisor to more accurately and quickly diagnose work group problems and to propose appropriate interventions and actions plans.

Finally, the work group coding system will be expanded beyond its present format. A work group code is a unique combination of alphabetical characters and numeric digits that identifies a functional element within an organization. The code also allows direct comparison of a group with like groups in the data base from other Air Force units. The new coding system will allow more precise coding of a work group and allow groups to be specifically coded down to the lowest level of the organization. This change will greatly help the accuracy and precision of the data base in identifying and comparing specific groups for consulting or Air Force systemic analysis purposes.

The "bottom line" of the revision is the improvement of a system that was already working well. The elements that have been included should do exactly that. More precisely measuring attitudinal and demographic factors, expanding the way results are returned to supervisors, and more precisely coding all work groups down to the lowest organizational level should be an immense help to LMDC's management consultation services in our goal of helping to improve the efficiency and effectiveness of Air Force organizations.

ORGANIZATIONAL DESIGN STUDY

Since 1981, we have been involved with an AF/MPMO-directed study of organizational structures. The study addresses the relationship of organizational structure to such things as manpower requirements, productivity, retention efforts, and the use of scarce resources. Working with a team of civilian contract researchers expert in the area of organizational design and structure, we have recently completed the initial data gathering in the study. During the summer of 1983, researchers visited several maintenance and research and development organizations to look at the structure of each. The study used an interview methodology covering vertical slices of the entire organization. Interviews lasted approximately one hour and were conducted with 18-25 people per base. Information covered in the interview included job requirements, knowledge of structures, communication interactions, strengths and weaknesses of structure, effectiveness criteria, climate, center of power/influence, and environmental conditions. The final outcome of this study will be a report due in mid-November which details: types of structures used in these units, advantages and disadvantages associated with each type of structure, and a survey of non-military organizational structure literature comparing this information to Air Force needs.

PRODUCTIVITY MEASUREMENT STUDY

LMDC and a major Department of Defense (DoD) development and acquisition agency developed a workable, valid productivity indicator upon which to base critical manpower decisions. This particular agency produces highly complex weapon systems that require years of development and acquisition time and, therefore, require a relatively sophisticated objective measure upon which to measure relative requirements across differing system acquisition offices.

The measurement of productivity is not a simple process, and is particularly difficult within many military settings wherein the ratio inputs to outputs is not always practical. In this case, weapon acquisition and development do result in a measurable end product. However, these products are usually complex, time consuming, and dependent upon decisions beyond the control of local management. It is, therefore, important to provide some intermediate indicator of effectiveness.

The following describes one attempt to construct and validate a productivity measure for the purpose of aggregate manpower planning. It is important to note that this unique attempt to use the Analytical Hierarchy Process (AHP) is an extension of multi-attribute modeling.

Procedures

The procedures used to develop a productivity model followed the general process of:

1. select factors which drive the workload
2. weight those factors as to relative importance as workload drivers
3. combine the weighted factors into a model
4. collect data to establish the overall model
5. initial validation.

This procedure combined objective analytic techniques with a process that incorporates opinions (and commitment) by senior managers.

This issue of productivity measurement has had heightened attention at this organization for a three-year period. During that period, the organization had contracted with the LMDC for a continuing organizational development intervention. The immediate challenge was to determine and refine appropriate indicators of productivity. The consultation effort centered around a survey-guided development program that provided direct feedback to all levels of supervision. Strategies included structured data feedback at the individual supervisor level, 3-day seminars in the use of data for work group enhancement for all supervisors, required management action planning meetings throughout the organization over a 6-month period, and 5-day seminars targeted for project management. The survey instrument that was the catalyst that helped the supervisors produce consistent change over time was the OAP.

During the development of the previously described productivity measure, LMDC

proceeded with a planned series of data gatherings. It is these measures that were independently obtained prior to computation of the "hard" productivity measures that were correlated using data for the overall organization across time. As suggested in the literature, the organizational behavior (OAP Factors management-supervision and perception of productivity) were correlated in a lead fashion with the outcome measures (measured productivity). Specifically, Time 1 data were linked with fiscal year 1981 (1st half); Time 2 data linked with fiscal year 1981 (2nd half); Time 3 data linked with fiscal year 1982 (2nd half).

Results

In the first step, attributes were determined by senior management. Fourteen factors were identified as driving the workload of the acquisition agency. These factors were organized into old or existing contracts, new work in the current year, and out-year work. The factors were then weighted by the outlined procedure. It should be noted that the last several attributes could be eliminated without changing the final decision. However, it was decided to keep all the attributes for psychological reasons, as well as potential future changes in model area emphasis.

Based on the weighted factors, productivity measures were computed for the highest aggregated management level. These figures are shown in Table 1. As described earlier, survey data were linked with measured productivity with an approximate 6-months lead. Measures of the corresponding lead OAP survey data are shown in Table 2. Therefore, since attitudinal measures were not available, measured productivity for the first half of fiscal year 1982 is not used in this analysis. However, it should be noted that the data appear to fit with a general notion that productivity was constantly enhanced during this two year period. Pearson product-moment correlations (n=3) are displayed in Table 3. It should be noted that concurrent perceived productivity (as measured at the end of the 6-months data periods as opposed to 6-months lead) also correlates extremely well (r=.947).

Table 1. Measured Productivity at the Highest Aggregated Management Level by Half Fiscal Years

Year	Measured Productivity
1981-1	.392
1981-2	.444
1982-1	.497
1982-2	.488

Table 2. Organizational Assessment Survey Data at the Highest Management Level

Time	Perceived Productivity	Management-Supervision
Sept 1980	5.33	4.76
April 1981	5.62	5.31
March 1982	5.78	5.49

Table 3. Correlations Between Measured Productivity and the Perception of Productivity & Management-Supervision

Index	Correlation Coefficient
Perceived Productivity (lead)	.993
Management-Supervision	.972
Perceived Productivity	.947

Discussion

The intent here was to present a strategy for measuring productivity at a major development and acquisition organization, to provide an initial assessment of the validity of the measure, and finally, to present a methodology for determining productivity indicators in other areas that do not lend themselves to simplistic productivity measurement.

This type measurement should have direct applicability to other development and acquisition organizations. More importantly, however, is the possibility of using the modified AHP as a tool for determining productivity measurements in other "white collar" work centers. By acquiring the experience and input of the workers and management in combination with the logically designed AHP, few systems will defy quantifying, and thus control.

Extended use of the AHP in other organizations merits investigation as many managers are faced with no sound alternative. As more experience is gained with these procedures, modifications can lead to a strengthening of the process. The cost benefit of a valid productivity measurement should be obvious. What remains is the future scrutiny of the new approach that may provide the key to productivity measurement in those "white collar," hard to measure work centers.

These three examples of productivity-related research are varied in scope and application. They vary from conceptual to quantitative, from local to Air Force-wide application. All are in progress presently with major developments expected within the next year. All have one thing in common, however. They represent our efforts to help make a good Air Force better.

The Air Force Institute of Technology's Quality Circle Studies Project

Robert P. Steel

The Air Force Institute of Technology (AFIT) has been tasked with a threefold mission regarding quality circles (QCs) in the Department of Defense (DoD). AFIT performs an educational mission by offering a QC facilitator training throughout the year. A QC consultation role has frequently required AFIT staff to employ their professional expertise in the analysis and solution of problems faced by client organizations from the DoD. Finally, the AFIT staff Quality Circles Studies Project was inaugurated in 1981 to support a research component of the AFIT QC mission. The AFIT Quality Circles Studies Project was created to promote and coordinate faculty research on all facets of the QC process. The principal emphasis of AFIT investigations to date has been on evaluation research into QC benefits and outcomes.

Typically, a QC is a voluntary group of approximately 10 employees from the same work unit who employ simplified techniques of statistical quality control in the isolation and solution of work problems (Cole, 1980). Frequently, the departmental manager or foreman serves as the group leader. The groups operate in an environment of consultative management (Vroom, 1976). They have no authority, per se, to implement their solutions. Instead, their findings are presented to middle or upper management in the form of proposals for action.

Quality Circles have been widely used in Japanese organizations since the early 1960s. The recent success of Japanese firms in international markets has focused attention on Japanese management practices. The reputed quality of Japanese products has been linked in part to the efforts of QC groups. Increased sensitivity to product reputation and quality by American managers confronted with stiff Japanese competition has led to the rapid diffusion of QC principles within American industries. Informed estimates have placed the number of active QC groups in the DoD as high as 1,000 circles (Steel, Ovalle, & Lloyd, 1982).

Aside from anecdotal reports and case study findings on the merits of QCs (e.g., Bryant & Kearns, 1981), the literature, for all practical purposes, is devoid of rigorous evaluative evidence on the effects of QC programs. A few studies have attempted to incorporate the hallmarks of rigorous evaluative research (e.g., Novelli & Mohrman, 1982; Steel, Ovalle, & Lloyd, 1982; Tortorich, Thompson, Orfan, Layfield, Dreyfus, & Kelly, 1981), but even these works have suffered from a variety of serious methodological flaws (i.e., subject mortality, poor control, uneven exposure to the treatment). Well controlled longitudinal research on QCs is sorely needed, and it is to that void in the literature that our energies have been directed.

CURRENT SCOPE OF THE QC STUDIES PROJECT

QCs have been, by and large, a consultant sponsored organizational development intervention. These proponents of QCs have frequently made over-broad assertions concerning the potential accomplishments of QC programs (Dewar, 1980). However, a consensus could probably be obtained by suggesting that QC benefits derive primarily from productivity improvements (e.g., improved product quality, labor saving efficiencies, increased output) or quality of worklife improvements (e.g., improved morale, declining absenteeism, reduced job stress). Controversial relationships between affective variables and job performance criteria (Schwab & Cummings, 1970) have led us to conclude that comprehensive evaluation of QC effects should include both attitudinal/perceptual measures and independent measures of job performance criteria. The AFIT Survey of Work Attitudes was designed to solicit a variety of affective and perceptual self-report measures dealing with task, group, and organizational experiences. Respondents provide ratings on such indices as job satisfaction, organizational commitment, task characteristics, interpersonal trust, degree of participation in decision making, and the organizational communication climate. In all, combinations of the 137 items in the questionnaire produce distinct psychological dimensions descriptive of organizational states and processes (Chart 1). Many of these measures were based on instruments from the management and behavioral science literature.

Whenever conditions would permit, we have attempted to also collect some kind of performance measure. Objective measures of productivity and work quality have proven difficult to contrive. Therefore, we developed a performance appraisal instrument which has been used in some of our studies (Chart 2). Supervisors are asked to rate their employees on generic performance dimensions which were based on the conceptual work of Mott (1972). Additionally, objective performance criteria are routinely requested from client organizations.

Our evaluative research has uniformly employed longitudinal designs. Control groups have been utilized to minimize the confounding of QC outcomes with Hawthorne or novelty effects. Our preferred research design has been a Nonequivalent Control Group Design (Steel, Lloyd, Ovalle, & Hendrix, 1982) (Chart 3). Experience has taught us that pretest and posttest data matched on a case-by-case basis and analyzed with the individual as the unit of analysis, require a good deal of extraordinary administrative investment but pay substantial dividends by providing increased statistical power and scientific control.

At present, the AFIT Quality Circles Studies project encompasses eight different studies in varying states of maturity (Chart 4). Four of these studies have undergone the entire investigative cycle, and their findings have been published in the professional literature or in AFIT theses. Our methods of study have been undergoing continual refinement, and we are excited about the prospects for forthcoming papers on our research findings. With experience our methods of study have been improved, and we believe the quality (i.e., conclusiveness) of our results will also be enhanced.

The battle lines on the subject of Quality Circles are rapidly being drawn. Consultants in an advocacy role are continuing to make sweeping pronouncements on the effectiveness of the QC process. On the other hand, sentiments toward QCs in the behavioral science community appear to be increasingly pessimistic regarding the long-term prognosis for QC popularity (c.f., Lawler & Mohrman, 1983; Wood, Hull, & Azumi, 1982). Those of use involved with the AFIT Quality Circles Studies Project continue to straddle the fence between these two camps. We feel that both groups have leapt to conclusions before the facts were in. Well designed and executed research in this domain is needed before knowledgeable evaluations may be made on the efficacy and viability of American QC interventions.

REFERENCES

Bryant, S. & Kearns, J. (1981). The Quality Circle program of the Norfolk Naval Shipyard. Exemplary Practices in Federal Productivity, Washington, DC: United States Office of Personnel Management.

Cole, R.E. (1980). Learning from the Japanese: Prospects and pitfalls. Management Review, 9, 22-28, 38-42.

Dewar, D.L. (1980). The Quality Circle guide to participative management. Englewood, NJ: Prentice-Hall.

Ingle, S. (1980). Quality Circles master guide: Increasing productivity with people power. Englewood, NJ: Prentice-Hall.

Lawler, E.E. III, & Mohrman, S.A. (1983). Quality Circles: A self-destruct intervention? Paper presented at the annual meeting of the American Psychological Association, Anaheim, CA.

Mott, P.E. (1972) The characteristics of effective organizations. New York: Harper & Row.

Novelli, L., & Mohrman, S.A. (1982). Beyond testimonials: An evaluation study of a Quality Circle program. Paper presented at the annual meeting of the Academy of Management, New York.

Schwab, D.P., & Cummings, L.L. (1970). Theories of performance and satisfaction: A review. Industrial Relations, 9, 408-430.

Steel, R.P., Lloyd, R.F., Ovalle, N.K., & Hendrix, W.H. (1982). Designing Quality Circle research. Quality Circles Journal, 5, 40-43.

Steel, R.P., Ovalle, N.K., & Lloyd, R.F. (1982). Quality Circles in the Department of Defense: Some preliminary findings. Proceedings of the 24th annual conference of the Military Testing Association.

Tortorich, R., Thompson, P., Orfan, C., Layfield, D., Dreyfus, C., & Kelly, M. (1981). Measuring organizational impact of Quality Circles. Quality Circles Journal, 4, 24-34.

Vroom, V.H. (1976). Leadership. In M.D. Dunnette (Ed.) Handbook of industrial and organizational psychology. Chicago, IL: Rand McNally.

Wood, R., Hull, F., & Azumi, K. (1982). Evaluating Quality Circles, Working Paper No. 82-017, University of New South Wales.

AFIT Quality Circles Studies Project

Current Research
12 September 1983

I. Studies Completed

1. TAC AFB #1

   a. Sample Characteristics
      - N = 350
      - Civil Engineering Squadron
      - 6 Quality Circles Groups
      - Data aggregated by functional work groups

   b. Synopsis
      - Pretest-Intervention-Posttest Cycle complete
      - Survey instrument was the OAP
      - Results are reported in:

        -- Steel, Lloyd, Ovalle, and Hendrix (1982)
           Quality Circle Journal

        -- Steel, Ovalle, and Lloyd (1982)
           Proceedings of the Military Testing Association

2. USAF Hospital

   a. Sample Characteristics
      - N = 350
      - Medical Personnel
      - Data aggregated by work center

   b. Synopsis
      - Pretest-Intervention-Posttest Cycle complete
      - Survey instrument was AFIT Survey of Work Attitudes (Version I)
      - Results appear in AFIT thesis, Class 83S

3. TAC AFB #2

a. Sample Characteristics
- N = 300
- Civil engineering base supply and aircraft maintenance
- Data aggregated by work center

b. Synopsis
- Pretest-Intervention-Posttest Cycle complete
- Survey instrument was the AFIT Survey of Work Attitudes (Version I)
- Results appear in AFIT thesis, Class 83S

4. US Army Post Hospital

a. Sample Characteristics
- N = 120
- Medical and clerical personnel
- Data analyzed at individual level of analysis
- 6 Quality Circle Groups

b. Synopsis
- Pretest-Intervention-Posttest Cycle complete
- Survey instrument was AFIT Survey of Work Attitudes (Version II)
- Data analysis is in progress

II. Studies in Progress

1. US Army Civil Engineering Squadron

a. Sample Characteristics
- N = 160
- Civil Engineering personnel
- Data analyzed at individual level of analysis

b. Synopsis
- Pretest-Intervention Cycle complete
- Survey instrument was AFIT Survey of Work Attitudes (Version II)
- Posttest data collection scheduled for Oct 83

2. SAC AFB

a. Sample Characteristics
- N = 691
- Missile maintenance, civil engineering, instructional personnel
- Data analyzed at individual level of analysis

b. Synopsis
- Pretest-Intervention Cycle complete
- Survey instrument was AFIT Survey of Work Attitudes (Version II)
- Performance appraisals are being collected

3. Space Command AFB

a. Sample Characteristics
- N = 150
- Civil Engineering personnel
- Data analyzed at individual level of analysis

b. Synopsis
- Pretest complete. Intervention is in process.
- Survey instrument was AFIT Survey of Work Attitudes (Version II)
- Performance appraisals are being collected.

III. Studies Pending

US Treasury Agency

a. Sample Characteristics
- N = 150
- Operative personnel
- Data analyzed at individual level of analysis

b. Synopsis

- Initial program planning completed. Pretest scheduled for September 83
- Survey instrument will be AFIT Survey of Work Attitudes (Version II)
- Performance appraisals will be used
- Objective measures of productivity will be collected

Productivity Research of the Navy Personnel Research and Development Center (NPRDC)

Kent S. Crawford

INTRODUCTION

The Navy Personnel Research and Development Center (NPRDC) has maintained a program of research specifically devoted to the topic of productivity. Our research has concentrated primarily on Navy logistics and industrial organizations such as shipyards, air rework facilities, public works centers, and supply centers. These organizations are staffed primarily with white and blue collar civil service employees with Navy officers in key top management positions. Our methodological bias has been to emphasize action research with a focus on worker efficiency. This approach has allowed us to deal with both the content and process of organizational change as well as to translate our findings into hard cost data. The purpose of this paper is to briefly describe completed and on-going productivity projects at NPRDC. In addition, some of the problem areas that need to be addressed by future research will be presented.

COMPLETED/ON-GOING PROJECTS

Our research efforts have been and currently are directed at four major productivity areas (see bibliography). Each of these areas is discussed below.

Identification of Productivity Issues/Problems

One of our first productivity thrusts was to co-sponsor a conference on military productivity. Participants included representatives from both the academic and military research sectors as well as top level military personnel. The conference identified key productivity problem areas and generated many recommendations on how to resolve these problems (Chart 1). This conference provided a framework for much of our later productivity work.

A more recent effort in this area was aimed at identifying impediments or barriers to productivity, determining the source of these impediments, and where possible, providing recommendations for removing them. This study was conducted in five different types of Navy industrial organizations and used multiple data gathering techniques; i.e., nominal group, questionnaires, interviews. Impediments found to be beyond local control were pursued through interviews at various headquarter levels above the field organizations. Many external constraints were identified that make it difficult for workers and managers to be productive. Our major conclusions concerned (1) the need for better upward and lateral communication, (2) the need to reduce excessive controls, and (3) the need for federal employees to see visible improvements in removing the impediments. While no current research projects are directed specifically at identifying productivity issues, all of our on-going action research efforts continually surface key factors influencing organizational productivity.

Implementation/Evaluation of Productivity Strategies

The major portion of our productivity strategies research has centered on the design, implementation, and evaluation of gain-sharing incentive programs (Chart 2). This incentive research has ranged from an individual system for a simple job (key entry operators) to individual systems for more complex jobs (supply clerks, air rework mechanics) and to a group system for more complex and interdependent work (shipyard machinists). In addition, at some of the research sites, we have looked at the specific effects of performance feedback and goal setting/feedback (Charts 3 & 4). The primary conclusion from this line of research is that monetary incentives, performance feedback, and goal setting/feedback can be very effective strategies for improving productivity provided that they are used in situations that meet certain key criteria and provided that they are properly implemented and managed (Chart 5). In other words, contextual factors and management commitment can moderate the ultimate success of these strategies.

A recent study examined the impact of quality circles (QCs) in three Navy organizations. As expected, the circles addressed and solved a number of productivity problems. However, no evidence was found to suggest that participation in circles had any significant effect on job attitudes. Interestingly, blue collar quality circles attracted volunteers who were more dissatisfied with their jobs than blue collar non-volunteers, whereas white collar volunteers tended to have more favorable job attitudes than their non-volunteering colleagues. The study concluded that QCs should not be used as a means of addressing organizational problems related to poor morale and negative job attitudes.

Technological Change in Organizations

A large amount of new technology is now being introduced into many Navy logistics and industrial organizations. However, not enough consideration is being given to implementing and managing these new technologies to ensure their fullest utilization. We have just begun to conduct research in this area. One recent study examined factors affecting the successful implementation of office automation in Navy research labs. Several critical factors were identified such as the need to clearly specify the function of the technology and the need to develop strategies for overcoming resistance. An ongoing project is now addressing the implementation of a highly automated material handling facility in Navy supply centers. In one center, we are attempting to design and implement a decision support system incorporating many of the quality ideas of Dr. W. Edwards Deming. The decision support system will be supplemented by structural changes based on sociotechnical principles. Overall, this action research project will allow us to investigate techniques aimed at promoting the acceptance and effective utilization of new technology.

Organizational Effectiveness

A new research thrust for FY-84 will be concerned with the organizational effectiveness of naval air rework facilities (NARFs). The focus will be on why

three of the six NARFs seem to be consistently more effective than the other three. The project will examine (a) what NARF organizational effectiveness is, (b) what factors (e.g., management practices, productivity strategies, organizational culture) seem to differentiate the more effective from the less effective NARFs, and (c) how the corporate headquarters for the NARFs can improve the effectiveness of the overall NARF community.

PROBLEM AREAS FOR FUTURE PRODUCTIVITY RESEARCH

As a result of our on-site productivity research in numerous Navy logistics and industrial organizations, we have identified a number of problem areas that need to be addressed in future research.

What Productivity Strategies Should be Used?

Our research suggests that a number of productivity strategies such as gain-sharing, quality circles, goal setting, and performance feedback can significantly improve worker performance. However, it is not clear under what circumstances these strategies should be used. Given that organizations have limited resources and that any intervention has an opportunity cost, it is necessary to choose the strategy that has the highest probability of improving the organization's performance. It is presently very difficult to do this. We lack comprehensive diagnostic tools that are reliable and can validly link diagnosis to prescribed action. Thus, there is a strong need for contingency research that begins to develop a taxonomy of strategies linked with a taxonomy of situational factors.

Where Should Productivity Strategies be Used?

This question relates directly to the previous one. One interesting generalization that seems to be emerging from our action research projects is that it is difficult to help poor organizations. Managers in these less effective activities seem to lack both the resources and commitment necessary for successfully implementing major productivity efforts. On the other hand, more effective organizations seem to be able to work with our research teams and commit the resources necessary to make the productivity projects work. In a sense, the good get better and the bad get worse. The basic research issue concerns how to work successfully with less effective organizations. Also, do these organizations require different types of productivity strategies?

How Should Productivity Strategies be Implemented?

The final question concerns the issue of implementing change in organizations. While the organizational sciences have developed a relatively good theoretical base in the area of productivity techniques, there is clearly a lack of good theory concerning the process of organizational change. Thus, it is not clear what is the best way to implement our productivity efforts. Likewise, once productivity strategies have been implemented, it is not clear what factors are

critical to ensure the long range success of the projects. Paul Goodman at Carnegie-Mellon has begun to identify organizational actions that contribute to the successful institutionalization of organizational change. However, at present, this area remains a weak link in our action research efforts.

CONCLUSIONS

Our productivity research program at NPRDC has explored a large range of topics related to improving the productivity of Navy organizations. We have a long way to go but we are beginning to understand some of the critical elements related to the successful improvement of organizational practices. In the future, we hope to expand our methodological approaches to include a more macro focus (i.e., total organization and corporate headquarters) and a more interdisciplinary thrust (e.g., micro-economics, systems analyst, industrial engineers). In terms of content areas, we want to examine in more depth the issues of organizational effectiveness, technological change, and the relationship between quality and productivity. Our goals are ambitious but we feel that the potential payoffs to the Navy of a comprehensive productivity research program far outweigh its costs.

BIBLIOGRAPHY

A. OVERVIEW

Broedling, L.A., & Huff, K.H. (1983). Productivity enhancement in the Navy using behavioral science approaches. Paper presented at the 91st Annual Convention of the American Psychological Association, CA.

B. IDENTIFICATION OF PRODUCTIVITY ISSUES/PROBLEMS

Broedling, L.A., Crawford, K.S., Kissler, G.D., Mohr, D.A., Newman, A.R., White, M.A., Williams, H., Young, L.E., Koslowski, T.J., (1980). An examination of productivity impediments in the Navy industrial community. (NPRDC SR 81-2). San Diego, CA: Navy Personnel Research and Development Center.

Broedling, L.A. & Penn, R. I(Eds.) (1978). Military productivity and work motivation: Conference recommendations (NPRDC SR 78-15). San Diego, CA: Navy Personnel Research and Development Center.

Nebeker, D.M., Broedling, L.A. & Doherty, L.M. (1978). Military productivity and work motivation: Conference recommendations (NPRDC SR 79-6). San Diego, CA: Navy Personnel Research and Development Center.

C. IMPLEMENTATION/EVALUATION OF PRODUCTIVITY ENHANCEMENT STRATEGIES

1. Gain Sharing

Bretton, G.E., Dockstader, S.L., Nebeker, D.M., & Shumate, E.C. (1978). Performance contingent reward system that uses economic incentives: Preliminary cost-effectiveness analysis (NPRDC TR 78-13). San Diego, CA: Navy Personnel Research and Development Center.

Crawford, K.S., White, M.A., Magnusson, P.A., Mohr, D.A., & Shumate, E.C. (in preparation). A field study of an incentive system for Navy production workers. San Diego, CA: Navy Personnel Research and Development Center.

Nebeker, D.M., Neuberger, B.M. & Hulton, V.N. (in press). Productivity improvement in a purchasing division: An evaluation of a performance contingent reward system. San Diego, CA: Navy Personnel Research and Development Center.

Riedel, J.A., Crawford, K.S., & Morell, D.M. (in preparation). Development and design of a group-level incentive system for Navy shipyard workers. San Diego, CA: Navy Personnel Research and Development Center.

Shumate, E.C., Dockstader, S.L., & Nebeker, D.M. (1981). Performance contingent reward system: A field study of effects on worker productivity (NPRDC TR 78-20). San Diego, CA: Navy Personnel Research and Development Center.

Shumate, E.C., Dockstader, S.L., & Nebeker, D.M. (1981). Performance contingent monetary rewards for individual productivity: Principles and applications (NPRDC TN 81-14). San Diego, CA: Navy Personnel Research and Development Center.

2. Goal Setting and Feedback

Crawford, K.S., White, M.A., & Magnusson, P.A. (1983). The impact of goal setting and feedback on the productivity of Navy industrial workers (NPRDC TF 82-4). San Diego, CA: Navy Personnel Research and Development Center.

3. Performance Measurement

Dockstader, S.L., Nebeker, D.M., & Shumate, E.C. (1977). The effects of feedback and an implied standard on work performance (NPRDC TR 77-45). San Diego, CA: Navy Personnel Research and Development Center.

Mohr, D.A., Magnusson, P.A., & Shumate, E.C. (1977). The effects of feedback and an implied standard on work performance (NPRDC TF 77-45). San Diego, CA: Navy Personnel Research and Development Center.

Morell, D.M., Riedel, J.A., & Crawford, K.S. (in preparation). Design of a new performance measurement system for Navy shipyard foremen. San Diego, CA: Navy Personnel Research and Development Center.

Nebeker, D.M., Dockstader, S.L., & Shumate, E.C. (1981). Prediction of key entry performance using the reconceptualization expectancy model (NPRDC TR 78-11). San Diego, CA: Navy Personnel Research and Development Center.

Nebeker, D.M. & Moy, M.C. (1976). Work performance: A new approach to expectancy theory predictions (NPRDC TR TQ 76-47). San Diego, CA: Navy Personnel Research and Development Center.

Nebeker, D.M. & Nocella, J.F. (1979). Key processing performance: a method for determining operator performance standards. (NPRDC SR 79-22). San Diego, CA: Navy Personnel Research and Development Center.

4. Quality Circles

Atwater, L.E. & Sander, S. (in press). An evaluation of quality circles in Navy organizations. San Diego, CA: Navy Personnel and Research Development Center.

5. Technological Change

Sheposh, J.P., Hulton, V.N., & Ramras, S.D. (in press). An investigation of factors instrumental in the implementation of office technology systems in three Navy laboratories. San Diego, CA: Navy Personnel Research and Development Center.

PLENARY SESSION IV

THE AIR FORCE HUMAN RESOURCES LABORATORY

MANPOWER AND PERSONNEL DIVISION R&D

PLENARY SESSION IV

INTRODUCTION

Dr. William Alley, Scientific Advisor for the Manpower and Personnel Division of the Air Force Human Resources Laboratory, opened this session with a description of the AFHRL Manpower and Personnel R&D program, including the Laboratory's efforts in productivity research. This was followed by presentations from three principal investigators currently performing research for the Laboratory in the areas of productivity measurement and enhancement. Summaries of these three latter presentations are included in this section.

Organizational Productivity Measurement: Development and Field Test of a Methodology

Dr. Thomas C. Tuttle, Director
Maryland Center for Productivity and Quality of Working Life

OVERVIEW

Productivity improvement is a major national priority and an important Air Force concern. Because of the nature of the Air Force as a military organization, it is not always possible to import productivity enhancement strategies directly from civilian organizations. In fact, even the definition of productivity in military units is different in some ways from the definition in civilian organizations.

This paper describes a multi-year research program conducted by the Maryland Center for Productivity and Quality of Working Life to address Air Force productivity issues. In particular, the research focused on the definition and measurement of productivity in Air Force organizations.

Phase One of the research involved an extensive literature review supplemented by field visits to over 50 organizations. This data-gathering phase served two major purposes. It provided a thorough assessment of approaches used to measure productivity. Secondly, it provided a realistic framework for the research. Input from commanders, researchers, and civilians in the Air Force community served to define the "design criteria" for development of the methodology.

Two technical reports resulted from Phase One. Measuring and Enhancing Organizational Productivity: An Annotated Bibliography (1981), is a bibliography which resulted from the extensive literature review. Productivity Measurement Methods: Classification, Critique, and Implications for the Air Force (1981), reviews and assesses productivity measurement methods. It also provides a conceptual framework and definition for thinking about productivity in an Air Force environment and presents a methodology for generating productivity indicators in work centers where engineered criteria are unavailable. The methodology has been labeled MGEEM, Methodology for Generating Efficiency and Effectiveness Measures. As originally proposed, the methodology has five phases:

1. Decision to Measure Productivity
2. Organizational Familiarization
3. Definition of Key Result Areas (KRAs)
4. Definition of Indicators
5. Review of Indicators and Data Sources

The MGEEM is participative and makes use of the Nominal Group Technique to generate KRAs and indicators (phases 3 and 4).

Phase Two of the research involved field testing the MGEEM methodology. Eight work centers were selected in each of three Air Force functional areas, Propulsion Maintenance, Weather, and Administration. The MGEEM was independently carried out in each work center. Analyses of the results were conducted to assess: (1) the number and types of indicators developed, (2) the acceptability of the process to participants, (3) the extent to which the indicators use existing data (i.e., are cost-effective), and (4) the similarity between organizations within the same functional areas.

The findings showed that approximately 20 indicators resulted from each organization and 85-90% of the indicators were effectiveness rather than efficiency measures. The process was well received both by commanders and by "line workers." Over three-fourths of the indicators could be formed using existing data meaning that relatively little new data gathering would be required. When comparing similar organizations (e.g., two weather detachments), the similarity (overlap) of the indicator lists generated for the two organizations were low, averaging less than 20% for all pairs of organizations. Overlap for Key Results Areas (KRAs) (i.e., facets of the unit's mission) was higher, averaging approximately 45-50%. Based on the results of the field test, the methodology was revised. Another technical report, Field Test of a Methodology for Generating Efficiency and Effectiveness Measures (MGEEM) (in press), discusses the field test results and presents the revised methodology. The report concluded with a discussion of possible future steps in this line of research.

Organizational Productivity Measurement: Development and Field Test of a Methodology

Dr. Thomas C. Tuttle, Director
Maryland Center for Productivity and Quality of Working Life

Edited Transcript

I am pleased to talk with this group about some work we have been doing for AFHRL on the problems of defining and measuring productivity in Air Force organizations. The title of the contract is Organizational Productivity Measurement: Development and Field Test of a Methodology. The work grew out of the problem Bill Alley identified, i.e., although there are numerous experiments in progress, there is general agreement that there are no fully satisfactory ways of quantifying, in hard criteria terms, the results, benefits, and efforts of Air Force organizations. In addition, the meaning of productivity in Air Force organizations is not clear to many people. We have not totally solved these problems but we have made a contribution.

The organization I represent is the Maryland Center for Productivity and Quality of Working Life. It is in the College of Business and Management at the University of Maryland. Our focus is to help organizations in the state of Maryland improve their productivity and quality of working life. In the process of doing that we have a research mission to develop new knowledge in these two areas.

Today, I would like to discuss three aspects of the research program I am conducting for AFHRL (Chart 1). In order to understand what productivity means in the Air Force, we conducted an extensive review of the literature and a large number of field visits. In fact, many of you were visited by us in the early stages of this research. We listened to your comments on the meaning of productivity to SAC, TAC, MAC, and Air Force Systems Command, and how it is being defined and measured elsewhere, such as in the civilian sector, in other government agencies, and in other services. Based on what we learned, we developed a methodology, took it to the field, and tested it in 25 Air Force organizations. In any case, I would like to describe these various stages of this research.

Chart 2 depicts comments that were being made about productivity when this research started about four and a half years ago. Several of you will recognize General Davis' statement that the Air Force has always been a leader in implementing innovative methods to improve productivity and quality of working life, but that the documentation and reporting of the implementation have not always been successful. This is one of the reasons for our concern with productivity measurement. Many of you know Dick Power. In his statement on Chart 3, he expressed dissatisfaction with the productivity measurement system that exists in the Federal Government. His concern is that figures reported up the line are not always meaningful to commanders or managers in terms of decisions made in running their organizations. Measurement systems are

primarily number crunching and, though they may be useful to somebody, commanders we visited said that such systems are not always helpful to them.

The results of our research are documented in the four technical reports whose titles are shown on Chart 4. The first provides information on existing resources that were uncovered during our extensive field visits.

The result of the first phase of the research was the development of a conceptual framework, a working definition of productivity, that provided us with guidance throughout the work. We settled on the definition shown on Chart 5 which suggests that productivity deals with physical units as opposed to financial units and that, in the Air Force, it deals with the dimensions of efficiency and effectiveness.

The environment has changed since our research began and one may ask why the Air Force is still concerned with productivity. Today, productivity remains a major national priority and will probably continue to be so for a number of years. Much is going on inside the administration which drives this concern. Examples include the Reform 88 Program and Grace Commission Report. In line with General Davis' statement that the Air Force has always been a pace-setter in developing methodologies in the human resources field, I believe that Air Force research has also been ahead of much of what is being done in the private sector.

In productivity measurement, we view productivity as a facet of performance that provides information on both the efficiency with which the convergent process between inputs and outputs takes place and on the extent to which these inputs and outputs have the desired impact on the customer or the using agency. In the area of measurement, it is important to consider the different points of view involved. For instance, higher headquarters is interested in reporting results to justify budgets and planning, and for various policy concerns. Data useful for those purposes are not necessarily useful to a commander of an organization. AFHRL has an even different perspective: measure the results of organizational change programs to identify innovations that work and conditions under which they work. Here are three different perspectives, and we are generally dealing with the latter two in this research project, i.e., the views of commanders and AFHRL.

Chart 6 provides typical examples of what people we visited said about productivity measurement. The general thrust of what they said is that things are easy to measure and that we are putting a lot of numbers on things. However, there is concern that the numbers may not be right and that numbers are not necessarily being placed on the right things. In some cases, we are making too much of numbers. There seems to be a sense of insecurity about the measures. Take Strategic Air Command (SAC) for example. What is output for SAC? Is the fact that we did not have a war last night what we are trying to measure as productivity for SAC? This raises the issue of measuring productivity in units whose mission is different in peacetime and wartime.

There are a number of indicators of efficiency and effectiveness. Chart 7 shows four different forms of efficiency measures. Industrial engineering approaches to work measurement generally lead to measures of comparison between

standard hours and actual hours, such as how long it should take to do something versus how long it actually takes. This is useful in situations where there are large numbers of people doing high volume work, where the work is basically repetitive and where the input/output variability is relatively level. In situations where organizational units perform work which has more variability, however, you get into the issue of partial productivity measurement. In addition to these first two measures, efficiency measures can be considered in terms of multi-factor measures and total factor measures.

The question of which measure is appropriate is actually a function of how much control the unit commander has over the inputs. If the commander has control over labor and materials then those are the inputs that should go into that commander's productivity equation. If the commander only has control over allocating people then it would probably be just a labor partial. The measured variables should be those over which the organization has some degree of control. The result, as illustrated in Chart 8, is that efficiency measures fall into a hierarchy as we move from the individual to units in the Air Force. Thus, the work measures technique can apply up to perhaps the branch level. The partial measures come into play at the section level and extend to maybe the crew level in some cases. As we move up the organization, we get into multiple input kinds of measures. Most of what we are doing in our research focuses on this part of the hierarchy since we are working with detachments. We are really looking more at middle range measures, e.g., above the micromeasures but not as high as financial measures seen at the plant level in industry.

There are at least four forms of effectiveness (Chart 9). One is to consider the extent to which organizational goals are achieved. Most Air Force organizations have a number of goals, such as on-time takeoff rates. However, effectiveness also includes quality. One of the measures that came from our research is the compliance type quality, which is, in some ways, a trivial type of quality but which is also important from the standpoint of maintaining accuracy of paperwork. Another quality measure in maintenance operations is the number of test cell rejects. Then we get to the last two forms of effectiveness: external and internal impact. These broaden the definition considerably. External impact has to do with whether outputs produce the desired effect. For example, suppose a weather organization is tasked to prevent wind damage to aircraft. If weather personnel do not respond to severe weather warnings by bringing aircraft into hangars, then, in that sense, the weather organization is not effective. There are many factors that could intervene to determine if the problem belongs to the weather detachment or to someone else but, still, aircraft wind damage is one measure of the effectiveness of a weather detachment. Internal impact measures the extent to which the organization can maintain itself over time. I have included three examples of internal impact on Chart 9.

Based on our data, we drew up some implications which became design criteria for the methodology (Chart 10). We concluded that the people being measured should have some say in how they are to be measured. This conclusion is based on a number of assumptions. One is that no one knows a job better than the people doing it. They are in the best position to suggest appropriate measures. Another assumption is that productivity is not measured simply

because we want the numbers. We measure productivity because we want to improve it. Therefore, measures must make sense to people in the jobs being measured. They have to believe the feedback about their level of performance and be willing to do something about it. For those reasons, we believe that the people whose jobs are being measured should have some say-so.

It was evident from the feedback from the field that no one wants more paperwork, more reporting requirements. Thus, the methodology should make as much use as possible of existing information. It should not cause the creation of new data unless absolutely necessary. It was also clear that a person external to the unit being measured should be the coordinator. The amount of work involved requires a measurement coordinator. In addition, it appears that it would be difficult for anyone in the unit being measured to be fully objective. Another requirement for the methodology is that it generate criteria which are not only useful for the target organization but which also have research applicability. Similar units need to have some common measures so that comparisons can be made among them and so that research can be conducted across them.

As shown on Chart 11, the methodology has five phases. In Phase I, the measurement coordinator becomes familiar with the target organization. The organization is defined as a system with clear boundaries. People in the organization are told what is being measured and why. In Phase 2, key result areas (KRAs) are defined. KRAs are an operational definition of the organization's mission in terms of the results which the Air Force expects the unit to accomplish. Once the KRAs have been developed, Phase 3 involves developing indicators, measures which tell the commander and the personnel in the organization if the KRAs are being accomplished. Also important is the identification of resources which are used to accomplish the results. Phase 4 is the generalization of the indicators to similar organizations. In other words, if we go through the first three phases in three weather detachments, are we going to get three sets of KRAs and indicators? There needs to be a process to ensure that similar organizations agree on how to measure their effectiveness and efficiency. Finally, in Phase 5 the information is implemented to assist commanders and support research.

In the first phase, the organization is defined as a system and boundaries are placed around it. To do this, we developed the diagram shown in Chart 12. In this diagram the organization is in the box. Outside the box is whatever is driving the work of the organization. This may be regulations, higher headquarter's requirements, extra duties, or customers. The organization has resources to carry out assigned work. Various processes take place using an organizational structure to convert inputs to outputs. Outputs, in turn, have an impact on other systems. In the process of doing the work, there is interaction with external units. The diagram is helpful in at least two ways. It helps the measurement coordinator understand the system. This is the level that the coordinator needed to understand. He really does not need to understand all the nuts and bolts. The second way this diagram is helpful is in the briefings presented to members of the working groups, stepping away and looking at the organization as a picture helps them assume an abstract viewpoint. They are able to jump out of the day-to-day work and look at their organization as an abstract entity. We found this to be very helpful in the

working groups.

The process of generating KRAs involved what we call a Group A. In the case of a branch organization, this would mean the branch chief, the section chiefs who are directly subordinate to that branch chief, and, in some cases, the squadron commander to whom the branch chief reports. That provided three levels to look at the organization. In most cases, though, we only used two levels, the commander and his/her immediate subordinates. We conducted an orientation for this Group A and then went through the process of generating KRAs. First we wrote this question of a piece of newsprint pad: "What results is this organization expected to accomplish?" Then we used the nominal group technique which is a structured, consensus-seeking methodology to arrive at an answer to that question. We concluded the session with a listing, in priority order, of KRAs for the organization. Those were the objectives which the group thought the Air Force expected them to accomplish.

The next step was using KRAs to generate indicators. To do that, a second group labeled "Group B" was formed. It consisted of the commander's immediate subordinates and their subordinates. Using the branch example, this included section chiefs and operational working level people who represented the functional specialties within the branch. The section chiefs provided continuity between Group A and Group B. Group B was given a thirty-minute briefing to explain the nature of indicators. Two questions were asked of Group B. "Do you accept the KRAs generated by your bosses?" "If you do, what information does the commander need to know to evaluate whether a specific KRA is being accomplished?" It was by this process that indicators were developed. The product of Group B was a prioritized list of indicators for each KRA. Indicators tell the commander the extent to which particular KRAs are being accomplished.

The next step was to review the resulting indicators. This involved the use of a form (Chart 13) developed to report to the commander the output of Group B. We said to the commander,

> Okay, you said these are the things you want to measure. Your people say these are the ways these things should be measured. What do you think of their suggestions? Do you currently measure things in this form? If you don't, is the indicator worded properly? Do you want to change the wording? If the indicator is not being measured, is it important? Is it something that must be measured, that must be tracked, or is it something that is nice to have, but not very important?

If something was judged unimportant by the commander, then that indicator was eliminated. The next series of questions asked of the commander concerned data availability.

> If an indicator is important and is not being measured, do data exist somewhere in the organization that would allow you to track it? If such data do not exist, can they be collected? Is it worth the cost to generate new information?

If the commander said that the indicator was important but not worth the cost, we dropped it. Based on that review of each indicator, the total number was narrowed to a much smaller set.

Phase four, assessment of the generalization of measures across similar units, was not carried out during the implementation of the methodology in the target organizations but was determined later. The field test evaluated the methodology in terms of four criteria (Chart 14). We looked at how many indicators were generated and what kind of indicators are available; we wanted to know if too many indicators were generated so that an organization could not deal with them; we wanted to see if there was some balance between efficiency and effectiveness measures. We were interested in the acceptability of the process and of the indicators. We were interested in the extent to which existing data were used. Finally, we were interested in the similarity of the indicators produced by organizations which supposedly are doing similar work.

The functions studied in the field test were the jet propulsion branch of aircraft maintenance; base administration, which is really a division with four branches; and base weather detachments. In an attempt to make the results representative we visited the bases shown on Chart 15.

Chart 16 classifies the indicators that resulted in terms of whether they were efficiency or effectiveness measures. From eight work centers in administration 154 indicators were generated. Twenty-one of these were efficiency indicators and 133 were effectiveness indicators. The percentages were roughly 14% efficiency and 86% effectiveness. In all functions studied the overwhelming number of indicators were of the effectiveness type, being concerned with either quality, accomplishing goals, or having the desired impact. If one divides the total number of indicators by eight, each organizational unit had roughly 19 to 20 indicators on the average.

The acceptability of the process was judged in several ways. It was judged by the subjective comments of participants; it was judged by an independent AFIT study conducted as a master's thesis. It is fair to say that in the overwhelming number of cases, the process was quite acceptable. On the nine-point rating scale on the feedback sheet the lowest mean response for any item was very favorable, 7.2 (facilitator's behavior). See Chart 17. The ratings showed that commanders viewed the process somewhat more favorably than participants who were not commanders (Group A versus Group B). As shown on the chart, the overall measurement task was not thought by participants to be difficult. Each group was also asked to state their impression of the level of productivity awareness in their unit before and after the study. They reported somewhat higher awareness following participation in the study.

As we looked at the extent to which the indicators were formed from existing data, we were pleased to find, based on the commander's assessment, that a very high percentage of indicators could be formed from data that currently existed (Chart 18).

In the analysis of similarity, we assessed similarity as the average, pair-wise overlap between similar organizations in terms of KRAs. This was a judgmental task for commanders. When we finished the measurement process, we sent the

list of KRAs generated by each of the several similar organizations back to every commander. They were asked to rate the extent to which the KRAs in list one, i.e., for one organization, were the same as in the other lists, i.e., for all other similar organizations. Based on the number of hits, we compared the similarity index with the overlap index and that is what is recorded in Chart 19. What we found was that the average pair-wise similarity varied by function. It was highest in propulsion, lowest in administration. This conclusion is not difficult to explain. Propulsion is more homogeneous and has a narrower mission focus. It appears to have more use for measurement than administration. The weather people, on the other hand, tended to be of a more scientific bent and seem to put more creative thought into formation of indicators. They seem to be able to resist merely stating things the way they currently are. The data indicate that the overlap of the mission facets is about 50%. That means that 50% is unique to some extent.

When we take the comparison a step further to the indicators, the similarity values drop considerably (Chart 20). Participant and researcher ratings are somewhat different. The researcher ratings had a more stringent criterion for similarity. We were really picky about that. Basically, the results show that there was low similarity between the indicator sets that resulted from organizations with similar functions.

Now, what does all this mean? Our conclusions (Chart 21) are that the process is highly acceptable to participants. In the AFIT study, it was discovered that a very high percentage of respondents stated that they are still using one or more of the indicators that came from the process. The fact that they are continuing to use at least some of the indicators suggests that commanders view the process as useful. It was our judgment that the indicators adequately covered the facets of the mission, as we understood it. We can get into trouble, however, if the focus is only on one or two measures. This can distort behavior. As we all know, measurement is not just the passive recording of behavior; it actively affects behavior. So we were concerned with the extent to which the mission was adequately covered, and we have checks and safeguards against distorting mission performance as these measures were used. Another conclusion is that use of existing data provided evidence that the process is cost-effective.

In our recommendations for modifying the methodology, we suggest that each group session be followed by a "sanity check." A sanity check involves getting participants back together and asking if it all makes sense. We found that when this is done, some changes occur and that participants are happier with the result. In subsequent uses of the methodology, we feel that timing needs to be stretched out a little bit more. There needs to be more incubation time between sessions. We did the complete measurement process for a target organization in one week. Finally, to make the measures useful for research purposes, we concluded that a refinement of the technique is needed to distill a common set of indicators from those developed by this methodology which applied to all organizations while maintaining each organization's uniqueness. It is desirable to have a common set of indicators for similar functions and then to have each organization add its own unique concerns.

I was asked to say a little about what would be some next steps or what have we learned that would have application for the Air Force research program. It is clear that this measurement process is very useful. It is a methodology for productivity measurement that can be implemented today and would be useful in a unit.

Some years ago, the National Center for Productivity and Quality of Working Life published a document called Improving Productivity: A Self-Audit and Guide for Federal Executives and Managers (Washington, D.C.: U.S. Government Priority Office, 1978). That guide made a distinction between two types of organizations, those that are direct-result systems and those that are indirect-result systems. A direct-result system is an organization that converts inputs to outputs which are results (Chart 22). In our study, there were some direct-result organizations. For instance, in administration there is a reprographic shop which reproduces documents and does printing. There is also a mail-handling organization. With these outputs there are some quality considerations but very little intervenes between output and impact. The output is the impact. In such organizations, efficiency is much more important that effectiveness. Therefore, efficiency should be given high concern. What you want to do is continue to meet the quality requirement, which is an effectiveness indicator, at the minimum possible cost. You want to improve the methods of that organization so as to improve its efficiency, i.e., to do more at less cost. So this is one type of system and there are many such systems in the Air Force.

Another type is an indirect results system (Chart 23). There is an input, an output, and then a logic track which indicates what the result will be provided certain things are done. For example, a weather commander says, "I am going to do televised weather briefings to flight crews because I can handle more people at less cost." This is an assumption that says that televised weather briefings will be as effective as face-to-face briefings in terms of decisions that flight crews make. So there is a lock link that presumably can be verified by measuring both the results and the efficiency of the input/output process. In that type of system, efficiency and effectiveness both take on roughly equal weights. Both are important.

I think there is another system that was not mentioned in the guide from the National Center for Productivity, but which is frequently found in Air Force organizations. This is an unknown results system (Chart 24). This is an organization that has a stated peacetime mission but whose real mission is a wartime mission. Unless we have a war, we really do not know what the results of this organization are. So we must rely on surrogate ways of assessing results. The surrogate involves simulating wartime performance. It is assumed that good performance in the simulated wartime environment will lead to good performance in an actual wartime situation. In that kind of organization, effectiveness rises to the force and is clearly more critical than efficiency. It certainly came through to me when I visited Air Force organizations that were not performing their wartime missions during peacetime. While they are not unconcerned about efficiency, they are very worried that in the name of efficiency they are going to be stripped so thin that they will not have the organizational slack about which Bob Ginnett talked.

It is helpful to think about organizations in this taxonomy. It suggests possible modifications in our methodology. In any organization there exists a mix of those three types of systems, but there is usually a predominant mode. We should adapt the measurement methodology to incorporate these ideas. Of course, the next logical step would be to demonstrate that we can, in fact, generate a common set of indicators across similar units. There are various ways that could be done. One would be to develop a generic model of an Air Force organization that corresponds to each of the three systems. Then, based on the data collected, identify some generic KRAs, perhaps some generic indicators, and steer the groups toward a common outcome. Another approach is to allow independent variability, then bring it back together through some consensus-seeking technique. These are two approaches to developing a common set of indicators.

Bringing people together as we are in this AFHRL workshop, is very important. AFHRL has always had a tremendous capability and has made a substantial impact on the Air Force, but, as General Davis pointed out, impact is not always fully credited out in the field. The kind of contacts being made here will promote not only better research but greater appreciation in the field for the good work being done. Hopefully, this will promote the transfer of the technologies that exist. In the private sector there are many examples of cooperative research in which one organization will bring in individuals from other organizations to carry out interventions. They are all trained, they use the same methodology, and results are all shared. It seems to me that some sort of model like that has some applicability in the Air Force with AFHRL serving as the focal point but drawing on the productivity principals of the Commands as a way of getting results to organizations. It seems that this is a way to increase the impact of research and to improve the two-way communication process. There are probably going to be some barriers because of such things as travel budgets, but those things can be overcome.

QUESTIONS AND ANSWERS

Question: It strikes me that in order to use packages like the one you are developing you have to go beyond the acceptability of the commander to actually producing tools that are useful for him to achieve organizational and personal objectives. One of the things we have to start doing is move these nice, neat, methodological packages off the shelf and put them into use.

Answer: This is related to the need for higher levels of awareness at the higher levels of command. That is going to help you get ahead, but that is not enough. Out in the civilian sector there has to be some middle person between the researcher who generates the information and the user. I think there has to be a translator in between. That role is played by technology extension services like the agricultural extension services. Technical reports do not do it. I am happy to see AFHRL has gotten some funding in the 6.3 area because that is an effort to go the next step to possibly doing some of the packaging. It seems to me that the product has to be put in a more usable form. There has to be some incentive for the commander to want to have that package, and there has to be someone there to hold the hand of the commander to help him get it

off the ground. Then there needs to be some documentation that "Commander A" did it, things got better and he got promoted. Those kinds of success stories do not hurt.

Comment: Our wing commanders are not proactive. They are not looking down the road. They are not necessarily concerned with what they can do today that would possibly improve productivity six months down the road or a year down the road. They are concerned with what they can do today to meet the results they need tomorrow. You can go in and show them all the neat, nice packages you want, but if you cannot show them instantaneous results the program will not be accepted. Another problem is that the wind is a big complex organization and in 99 out of 100 locations, commanders are primarily concerned with one little aspect of it, the operational flying squadrons. Those are not easily measured by any terms you can come up with in productivity. It is gut-feeling measurement. You can show that wing commander all you want on how to improve productivity in the supply squadron or the transportation squadron but if you cannot show him something that can get his "C" ratings for his flying squadrons up you are not going to make any points with him.

Question: To what extent was the lack of comparability of indicators due to the emphasis that was placed on using data which was already available?

Answer: That was a factor. We made some predictions before looking at the similarity results as to how they would order themselves based on criteria such as the use of current measurements and the heterogeneity of the organization. We predicted that weather would have the highest similarity and it did. They had the highest use of available data and the detachments were within the same command. I do think another source of low comparability was the unreliability of the facilitator's behavior. We had two different facilitators so we tried to control this a bit. We had one facilitator working purely in propulsion, another was working purely in maintenance and then we split administration. There were differences in our procedures. Some of our recommendations for revising the methodology consist of ways of reducing facilitator steering.

Question: How do you gain acceptance without doing some intervention work at much higher levels of the Air Force?

Answer: I guess the first rule of the commander is to keep those things for which any inspector is going to look. I think what we are really finding is that commanders keep these things anyway in some form or another. What this process is trying to do is to make those informal methods like the "gut-feeling" more explicit so that everybody will know the criteria by which the commander is judging the organization. That is really a boost to productivity when everyone understands what the commander really wants. I think it is that kind of process that will evolve. I am saying that an organization has different bodies that it is addressing, e.g., the commander or the inspector. They are all looking for things and you had better have them. But those are not necessarily the things you need to make that organization most effective. You would want to have those latter things, also. The real crux of the issue

is who gets access to that data. Is the commander permitted to have all the numbers so that no one sees them but him? If that is permitted, we might also have some major problems in terms of productivity improvement.

Question: Does that particular situation exist widely in the industrial world?

Answer: There are various gradations of that. I have seen various organizations who have tried to put that in as a footnote of special attention.

Comment: Westinghouse, as a corporation, measures its business units in a very formally structured way. They measure them on financial performance and on productivity. Within the individual businesses, it is the general manager's responsibility to operate his unit the way he sees fit, as long as he meets those measures that are formally published. The corporation shows its interest in what that unit commander or general manager is doing when he presents his profit plan at the corporate level. He talks about productivity, quality, performance. They do not measure him at the corporate level on his personal improvement plan; they measure him on his formal indicators. He is allowed to have as many informal systems running in his organizations as he may use.

Comment: I think the informal systems are not exclusive of Westinghouse. A system that encourages managers to improve will have managers who will know what is happening; otherwise they will not know what to improve. So you get that cycle going and the informal systems start.

Comment: A change is occurring in industry. The traditional incentive system for top management in many corporations has generally been an annual incentive plan. You are rewarded for your performance for that year, which has led to all the short-range thinking we see prevalent in this country. Westinghouse is changing that today. Incentive plans are now for one and three years based on improvement. So managers will be given time to improve. Other corporations are starting to move in that direction.

Comment: Some organizations I have heard about are carrying that a step further, especially where movement among units is frequent. That is, your bonus for 1983 will be paid in 1988 based on how the unit you are in in 1983 is doing in 1988. So you see you stretch out the time horizon. That allows managers to do the kinds of long-range things that they think are going to promote the long-term benefits and deters the short-term raping of the unit which makes managers look good while they are there.

REFERENCES

Tuttle, T.C. (1981). Productivity measurement methods: Classification, critique, and implications for the Air Force (AFHRL-TR-81-9, AD A105627). Brooks AFB, TX: Manpower and Personnel Division, Air Force Human Resources Laboratory.

Tuttle, T.C. (1981). Manager's guide to productivity improvement resources and programs (AFHRL-TP-81-12, AD A058645). Brooks AFB, TX: Manpower and Personnel Division, Air Force Human Resources Laboratory.

Tuttle, T.C., Wilkinson, R.E., Gatewood, W.L., and Lucke, L. (1981). Measuring and enhancing organizational productivity: An annotated bibliography (AFHRL TR-81-6, AD A102515). Brooks AFB, TX: Manpower and Personnel Division, Air Force Human Resources Laboratory.

Tuttle, T.C., Wilkinson, R.E., and Matthews, M.D. (1985). Field test of a methodology for generating efficiency and effectiveness measures. Brooks AFB, TX: Manpower and Personnel Division, Air Force Human Resources Laboratory.

Enhancing Productivity in Air Force Organizations Through Feedback, Goal-Setting, and Incentive Systems

Robert D. Pritchard, Ph.D.
University of Houston

Overview

The overall purpose of this research contract is to field test the productivity enhancement procedures of feedback, goal-setting, and incentives in an operational Air Force environment.

The effort has a long history of background research that has led up to the current effort. In the past 12 years, we have done a series of research projects under AFHRL sponsorship that have tested and evaluated the three productivity enhancement procedures of feedback, goal-setting, and incentives. This work has been conducted in laboratory and field settings and has shown that these interventions are effective techniques for enhancing productivity. In addition, a great deal has been learned about how to design and implement these systems. We are now ready for a full-scale field test of these procedures in an operational Air Force environment.

The specific objectives of the project are (a) field test the three interventions to see how well they work to increase productivity, how well people like them, and the relative merits of the three systems; (b) implement the systems in more complex jobs than have been used in the past so that the results will be generalizable to the type of jobs that are present in the Air Force; (c) since the project will deal with organizational productivity, develop a way of measuring organizational productivity; and (d) develop practical manuals that describe the design and implementation of the three systems so that operational Air Force managers can have a guide to facilitate instituting these systems in their own organizations.

The actual research will be done in seven major phases. The first is to select organizations for which the productivity enhancement systems will be developed. Next, a productivity measurement system will be developed for each organization. The third phase will be to collect baseline data. The fourth phase will be to generate and implement the feedback system for each organization. The fifth and sixth phases will be to generate and implement the goal-setting and incentive systems. The final phase will consist of analyzing the data and writing the reports. The entire project will take 40 months to complete.

At the present time the project has been under way for approximately six weeks. We have obtained formal approval from the Commander of the 67th Tactical Reconnaissance Wing to conduct the project at Bergstrom Air Force Base. His Deputy Wing Commanders have suggested possible branches in their units in which we could do the project. We are currently in the phase of selecting the organizations that will be used.

Of special concern is the productivity measurement system. The system that we have developed is based on a combination of the productivity measurement work done by Thomas Tuttle for AFHRL, and the conceptual work done by Naylor, Prichard, and Ilgen. The system will be based on objective data and will cover all major aspects of the productivity of the organizations. It will provide productivity information at molecular levels such as work group and will have the capability of being aggregated to the entire organization. A single index of productivity for the entire organization will be developed. In addition, the system is flexible in that when the mission of the organization changes, the productivity measurement system can change to reflect this.

Another advantage of the productivity measurement system is that it will enable us to specify to the personnel in the organizations the strategy that they should use to enhance their productivity. This will be done by specifying the tasks that they should devote their energies to, and the relative importance of each task.

The findings of the research should have important applications. To the extent that the three systems do enhance productivity, they could be implemented elsewhere in the Air Force. This should be facilitated by the series of practical manuals that will come out of the effort. These manuals could be distributed to Air Force managers by AFHRL, could be used in the Professional Military Education Program, or could serve as a resource tool for LMDC.

Another major area of application is the use and expansion of the productivity measurement system. This system could be used in other sites, and the technique is capable of being used with larger organizations. It would be possible, for example, to get a single index of productivity for an entire wing or even larger organizational units.

Enhancing Productivity in Air Force Organizations Through Feedback, Goal-Setting, and Incentive Systems

Robert D. Pritchard, Ph.D.
University of Houston

Edited Transcript

I wanted to talk about a project that we are just getting started. This chart (Chart 1) provides an overview of my presentation. I will discuss the overall objective of the project, its history, events that led up to where we are now, and the productivity measurement system. I am very excited about the measurement system and I think it has much potential. I will wrap up my presentation with applications of the findings that may be helpful to you in your task at this Workshop.

OBJECTIVE

The basic objective of the project (Chart 2) is to conduct an operational field test of a productivity enhancement system which includes feedback, goal-setting, and incentives. The focus is on the effectiveness side, the degree to which organizations meet their objectives. There will also be an attempt to express productivity as efficiency, in the sense of an output/input ratio. Feedback involves formal, written reports given to incumbents and supervisors, that summarize productivity data. These reports are made on a regular basis and are relative to the individual's group and the entire organization. Goal-setting is face-to-face, sit-down interaction between incumbents and supervisors where quantitative goals based on actual productivity are set and are periodically reviewed. Incentives are some kind of program of non-financial rewards or benefits that are based on productivity and are known to be available to the people.

HISTORY

Work I have done over the last 12 years under AFHRL sponsorship has culminated in this project. It started with laboratory work to redefine incentive systems. Then we tried several incentive systems at Chanute AFB in a technical training environment. For several years, I have been developing feedback systems and trying them out in simulated organizations. I have worked out many problems concerning the different ways of getting feedback and have field tested some of them in a civilian organization. Much work has been done on goal-setting by more people than just me, but I am using goal-setting as a productivity enhancement tool. In the field test that I have referred to, in a civilian organization, we tried integrating feedback and goal-setting. The results of this line of research can be summarized by saying that incentives can have an impact on productivity under certain circumstances. Feedback works rather well, given the relatively inexpensive nature of developing feedback systems.

Goal-setting also works quite well. By going through this long series of research projects, we have learned much about how to do these systems, how to implement them in field situations, and now we are ready to do this next project, which is to take the three systems to an operational Air Force environment, try them as an integrated whole, and see how well they work.

PROJECT DESCRIPTION

Specific Objectives. The kind of research that has been done in the areas I have described has tended to use very simple jobs, e.g., an individual keypunch operator. For the most part, jobs in the Air force are more complex in that they include a variety of different tasks and they require numerous interrelationships between people, units, and organizations to successfully accomplish tasks. For example, in a maintenance crew in a propulsion division there are a series of specialists who have to work together to repair or modify an engine. It is very difficult to assess what one individual is doing in terms of contributions to the team effort. If we want to do research that is going to have an impact on the Air Force, we have to do it with complex jobs. If we deal with complex jobs, that leads automatically to the notion of organizational productivity. The idea is that all aspects are interrelated... the individuals are interrelated to get the work done, the units are interrelated, and so on up to more complex levels. Therefore, we have to deal with organizational productivity, so one of the tasks we have in this project is to measure organizational productivity and use it in these three systems.

In thinking through the process of this project, we wanted to get the results implemented. A specific activity of this project is to develop practical manuals for operational managers. These manuals will be step-by-step guides... how you go about developing a goal-setting system, examples of what types of things have been done in the past, what are the issues that have to be addressed, what are some of the problems that might come up, and some potential solutions. All these things together led to the specific objectives shown in Chart 3.

In field testing of the productivity enhancement systems we want to know how well they work, how well people are going to like them, how well they are going to be accepted, what are going to be some of the problems in implementing them in an Air Force environment, and, hopefully, some of the solutions to those problems, as well as the pros and cons of these three systems.

As a second objective, we want to use organizational jobs in the Air Force that fit the kind of general job the Air Force has in terms of complexity.

For our third objective, we want to develop a method of measuring organizational productivity. If we could solve that problem, the project would be worth it just to be able to do that. We have some real good ideas on that.

Finally, we want to develop some practical manuals that operational managers can use to try these systems if they desire.

Desire and Present Status. The basic design of the project is summarized on

this chart (Chart 4). The first step of the project is to select organizations. Once they are selected, we will develop a productivity measurement system for the organizations. This includes collecting baseline data with which we can compare results of the intervention as well as design and implement the feedback, goal-setting, and incentive systems.

The plan for the 40 month effort is to first put the feedback system in all organizations, then add to that the goal-setting system, and, finally, add to that the incentive system.

The project formally started six weeks ago, so we are not very far downstream. We have obtained approval from the Commanding Officer of the 67th TAC Reconnaissance Wing at Bergstrom AFB to do the project. In addition to that, his Deputy Wing Commanders have also supported the project to the extent that they have come forward to suggest specific organizations in which they are interested. We are in the process now of beginning to select the organizations.

PRODUCTIVITY MEASUREMENT SYSTEM

Systems Criteria. This chart (Chart 5) identifies the major criteria for a good productivity measurement system. The first criterion is objectivity. The measurement system must be based on objective data and rely as little as possible on subjective inputs.

Validity is a necessary criterion in any measurement system. This validity must be comprehensive and relate to the entire work operation. It must not be diminished by the process of integrating the relevant productivity indicators.

Another extremely important characteristic of a productivity measurement system is that it should result in a single number. The system should provide subindices as well, so that the organization can get specific feedback on what they are doing on specific parts of their job. Thus, we want to have a system that will operate on a molecular level and can be aggregated to broad organizational levels. Such a system has great potential for motivating people when they get information about their work, but it also has to be cumulative to broader unit levels so as to provide organizational-type data.

One of the things we forget is that in the military the mission changes from time to time. For instance, take the extremes of peacetime and wartime military situations. We want a productivity measurement system that is adaptable to change. We do not want to structure the measurement for one situation and then start all over again if we have another situation develop. Less degrees of change are much more common than peacetime-wartime extremes, but things do change and the system has to be adaptable.

Finally, it would be very nice to be able to take a productivity measurement system that is dealing with effectiveness (the degree to which the organization can meet its goals) and be able to express it as an output/input efficiency ratio. Thus, these are the guidelines that are driving our attempts to develop this productivity measurement system.

Developing Productivity Measurement System. How do you do it? The basic idea is taking Tom Tuttle's work on key results areas (KRAs) and indicators and relating those directly to organizational effectiveness. It is very difficult to talk about this in the abstract, so I have prepared a concrete example on Chart 6.

Let us say we are trying to develop this productivity measurement system for a propulsion unit. The first step would be to identify KRAs. We find that there are three KRAs for this organization: (1) adequate number of quality engines ready to meet mission requirements, (2) adequate inventory of supplies and materials, and (3) safety requirements are met. The next step would be to identify indicators. Now, let us say they come out to be these: For the first KRA, adequate number of quality engines, there are two indicators: the number of completely inspected engines that are ready for installation (they are sitting in a hangar ready to be put on an aircraft), and secondly, the number of engine-error aborts. An error-related engine abort is an engine malfunction on a sortie. So the number of those would be an indicator of whether the unit has quality engines. For the second KRA, adequate inventory of supplies and materials, there are two indicators: number of bedstock items below the reorder point and the number of backordered items. And, finally, for the third KRA, safety, the indicator is the number of formal hazard reports.

The third step, and this is where the breakthrough that Tom Tuttle has made is combined with my conceptual notions, is to identify contingencies. Contingencies involve determining the relationship between the amount of the indicators; e.g., the number of completely inspected engines and how important or effective each amount is for the organization. In our example, we have identified KRAs and indicators and now we need to get the relationship between effectiveness and each indicator. We collect data over a period of time on the number of inspected engines that are ready, maybe per month, or per week, or whatever unit of time makes sense for that indicator. We then plug into a chart (Chart 7) the number value we actually get from these data, which is, in fact, a range. This range is a little broader than the actual range that has occurred over the last six months. We go back to the manager of that organization and say, "Okay, what I want to do is discover the relationship between how many quality inspected engines are ready and effectiveness." He will look at me and say, "I do not know what you mean." Okay, then I would ask him to think about effectiveness as a zero point which is meeting expectations, not great, not bad, but it is just okay. As we go higher into this positive range, there are greater expectations, which is really more and more superior performance; as we go below it, there is more and more inferior performance. Then I would ask, "For your group to be meeting expectations, how many engines should they have ready?" We would sit down and talk about it, and one person might say, "Well, there really ought to be three" and another might say, "In this situation, we really need more than that." Through a group discussion they would come to some consensus. Let us say they said four. We would put a point on the graph where four engines and zero effectiveness intersect. The process would continue by asking, "What if you don't have any engines ready?" They would say, "Now that is a bad deal. That is a real problem because we do not have any back-up, and that is serious." "Where would you put that?" "Well, I

would put that at maybe minus seventy." You continue that process to where when you were finished, you would have a curve as shown in Chart 7.

Now, I have made up these contingencies, and those of you who have had experience with maintenance are quite aware that I have made up the contingencies. This exercise is the job, of course, of the managers of that organization. They would be doing it. However, I think the graph in Chart 7 is a realistic picture of what a contingency might look like. What we could do is go through each one of the indicators and, using the same process, generate a contingency for each one of them.

Let us say we did that and it came out looking like these graphs (Chart 8). Again, talking about our propulsion group, we have three KRAs: adequate number of engines, adequate inventory of supplies, and safety. The engines KRA has two indicators: the number of available engines, which is the one I showed you, and the number of engine-error aborts. For the number of engine-error aborts, they say one per month is the appropriate unit. It is okay...it is not great, it is not bad. If they hit zero, that is very good. If they get more than one, the curve starts dropping off fast, and if the aborts get down to five, that is very bad and big trouble.

One of the important features of these contingencies is that they can be interpreted relative to each other. In general, the steeper the slope, the more important that particular thing is. As I have drawn it, without studying the organization in any detail, it seems like it is a lot more important to have engines that have a very low engine-error abort than it is to have a number of engines around. In other words, the ultimate thing is that you want those planes to fly without trouble. The process of developing these contingencies is a way for the management of those organizations to talk about how important these things are. The importance is built in once they do the contingency. And the contingencies may be non-linear or they may have different slopes. If an indicator is unimportant, its contingency curve will be flat, so there would not be any purpose in working with it. Obviously it is very important to get these things done well and we have to go through many iterations to accomplish this.

Continuing on, the indicators for the adequacy of supplies and materials are important but they are not as important as the indicators for the other KRAs. They do not have as much slope. This also makes sense. We might find that this is going to be quite a different type of contingency from the safety area, where zero hazard reports is adequate. That is what you expect. Anything less than that is very bad.

Through this process we have gotten agreement on KRAs, indicators, and contingencies. We come back a couple of weeks later to see how stable they are by going through the same steps. With these contingencies all we have to do is take the actual data for the organization for the given month, and if they have four engines, they can get zero--adequate performance. If we are looking at the number of engine-error aborts, we can find the overall effectiveness score by adding the contingency which gives us overall index as to how well the organization is meeting this KRA. It automatically adjusts for importance of these two factors, it covers the non-linearity of these two factors, and it is

very simple to add those up. The biggest payoff, though, comes in when you add up all three KRAs in a simple linear fashion, and that gives you an overall measure of effectiveness. Let me show you an example (Chart 9). Using our contingency charts we have computed the effectiveness of the propulsion unit for a given month. We see that the total effectiveness for two KRAs is positive but for the final KRA (safety) the effectiveness is a strong negative. This results in an overall effectiveness rating of minus 10, slightly poor.

This kind of information would be feedback to the working groups. They could look at it, study it; they could see where they are doing relatively well and where they are doing relatively poorly. They know a number of new things now. They know the important things they are supposed to do on the job. They know how to show how well they are doing, and they have an absolute reference in terms of how well they are doing. They know now they are not only doing 6 units, but whether 6 units is good or bad because that zero point is in there. They can see how this effort on their part fits into the whole of the organization. There is a great deal of peer pressure developing. Accountability is clearly there, so this thing has a great potential for working. That is the feedback part. The goal-setting part would occur when they take this total effectiveness score or the sub-scores and sit down with supervisors and set goals on that basis. The incentive system, then, would be based on that total effectiveness score.

There are two more advantages to this system. One is that going through the process of developing these measures will have positive impact to the degree of ambiguity and role conflict. To go through this you are essentially defining the role of the organization in a group setting and thereby clarifying it.

Another advantage is that contingencies provide given values for each one of the indicators. What we can do is look at what would happen in terms of total effectiveness if we increased one unit on each one of these activities. If we had four engines ready this month what would happen if we had five next month? What would happen if we went from one engine abort to zero and so on? What we would have is the ability to rank-order the priorities for how personnel should change their activities to maximize productivity. So what we could do is, very simply, give each group, each month, Productivity Enhancement Strategy Information (Chart 10). What it says is if you want to increase your overall effectiveness, the first thing you do is go from one engine- related error abort to zero. If you do that, you will gain 80 units in effectiveness. Second best thing you can do is go from one hazard report to no hazard report; you will get 40. You can go on down the line, down to going from five ready engines to six which will not gain anything for you. Put yourself in that situation. You are in that propulsion unit, and you have a report that tells you how you have done last month on all the important parts of your job. You have an absolute basis for seeing how you are doing. You can compare this with what you have done before, but now, in addition to that, you have a blueprint that is going to give you some information concerning what you should do in terms of strategy to increase your productivity. I would love to have that information on my job.

If you have to slip, what are the best and worst things to slip on? This is the positive side; if you do better and you want to increase your productivity,

do these. So, obviously, we can use those same contingencies to do the reverse. What Chart 10 says is if you are going to slip, the worst thing you can do is to go from one hazard report to two, because that would be 40 effectiveness units lost. This would continue on to where there would eventually be some zeros. If you had, say, for a given month, six engines ready and you only needed five, then you would be going from six to five which is zero loss. So if you have to let something slip, let it be that.

APPLICATION

I see the application of this methodology in two ways. One is in the area of the manuals I referred to earlier. They will contain very specific information on how to do these things - goal-setting, feedback, and such. Let me take the goal-setting manual as an example. What I want to put in these manuals will be the background of goal-setting, what it is, the logic for why it works, some examples of some specific programs where it has been used, how they worked, and a step-by-step plan for developing such a system. For example, under what conditions should the goals be individual or group? Should the goals be set by the supervisor, the incumbent, or both? How should I handle the actual goal-setting process? What should I do if someone does not want to set a goal? These are very specific things that I, as a manager, heard about in management courses but I really do not know quite how to do it. So, that would be one way these manuals would be used. In addition, the Air Force should incorporate these manuals into the professional military education programs so that people going through the programs can see the manuals and at least know of their existence.

Another application is LMDC as a distributor of the technologies. LMDC visits bases and I am sure their consultants run into situations where someone is saying, "Sure, I would like to try this stuff, but how do I do it?" LMDC does not have the resources to help develop the programs for those people but giving them these manuals is going to help to get these things tried.

I am obviously very excited about this productivity measurement system. In theory, it is perfectly feasible to generate one index of overall productivity for the entire Air Force, using this system. It would mean an enormous amount of work and there would be many practical problems that would have to be solved. However, we must be more realistic. If we talk about the propulsion unit, the next step would be to do it for the entire maintenance group, and then for the entire wing, and so on. In theory, this can be done in broader and broader bases. There are two ways you can go with it. One to pick the organization with which you are going to work, look at the KRAs for that organization, and stop there. You can do that, and it would look something like what I have been talking about except it would be applied in a bigger organization. As an imaginative information tool, it can be very handy. But, if you take the next step, which is the time-consuming part of going all the way through the various higher organizational levels, then you have an enormously powerful motivation system, not just an imaginative information system.

QUESTIONS AND ANSWERS

Question: Does not the additive function of the contingencies assume that they all have equal importance?

Answer: No, it does not. That is why these contingencies are so important. The contingency itself is where the importance of the information comes in. For example, let us say you have three engines finished. Now what this says is that if you go up to four, you add on maybe 10 points. To go from one to zero in the area of engine aborts, you go from zero to plus 80 and that is much more important.

Question: Long term, after your operation, would it not make sense to come down the organization with it? In other words, you would go into the wing commander and say, "What are your KRAs?" He would say he needed an adequate maintenance complex and operational flying squadrons that can do this and that. Then you take each of those and develop your KRAs from that, and then you do down to the chief of maintenance and you build his KRA so that it fits what the wing commander's perception of importance is. Then continue right on down. That way, there would be no question.

Answer: One of the implications of the findings was exactly that.

Question: This is obviously fascinating, very creative thinking of the scenario you were suggesting. If you have 40 or 50 indicators in a real situation that might generate some problems, and I wonder how you would take care of that. The problem is one of correlation among the indicators. Unless you took that into account somehow, you would have the possibility of overweighting those indicators that were intercorrelated with each other.

Answer: That is a good point, and it is something that we have thought about. If we do the process correctly, we will cover that <u>because correlated indicators will have flatter functions</u>. Also, if we have one indicator feeding two products, then the combined ones will be flatter than just one.

Question: Going back to safety, if you have one hazard report, that is bad. If you have six, it is no longer that same amount of "bad," it is a whole lot more than "bad." That is something that is moderated because of history. I do not see how that is built into your system.

Answer: Going from five to six being much worse than going from one to two suggests that contingency is actually changing and not the non-linearity of it. If the contingencies change quickly and often, that is a problem. One of the things we have to look at is how stable they are. The system has to be able to allow for systematic changes because they are going to occur, like the extremes of peacetime-wartime. I was going to go back through the criteria and talk about how this meets them all, but I am not going to have time. Let me just touch on it because that is important. If we go from a peacetime to a

wartime situation, one of the things that is going to happen is that you are probably going to want a lot more engines flying around. You need more back-up capability. What you could do is simply sit down and change the contingencies. Everything else still works. So the system is flexible for the kind of change I am talking about. We have to change, everybody agrees, and we sit down and do it. Now the kind you are talking about is much more difficult. If it is changing month by month, due to the level of that indicator, if you will, for that month, that is a problem. We have to determine how stable the indicators are.

Question: What about changing the contingencies among your supervisors as your decision makers and managers change from level to level?

Answer: It depends on how much change there is. Let us say we have a new officer who comes in. It seems to me that that person has an obligation to review the contingencies. It is his shop now, and it is his job, in essence, to review the contingencies. That is what his job is really all about.

Question: I do not agree with what you are saying right there. Does that not lend itself to some major coming in and taking a look at the previous three months and saying, I want to do better, so I will change my contingencies and I know how this scoring is going to work. Can he not affect that from that standpoint?

Answer: Yes, the procedure can be gamed. If you understand well enough, you can say that one hazard report is not worth 20 points, it is worth 60 points. The check on that is whenever there is a change, you can go back to your past data to recalculate the data and that is your new baseline. So if someone were to do that, there would be no changes in productivity.

Measurement and Assessment of Situational Constraints in Air Force Work Environments: A Brief Summary

Thomas A. Watson
Air Force Human Resources Laboratory

Edward J. O'Connor and Joe R. Eulberg
University of Texas at Dallas

Lawrence H. Peters
Southern Illinois University

The impact of situational constraints on performance and other work outcomes has recently received attention in the civilian literature. Peters and O'Connor (1980) developed a conceptual model specifying the hypothesized influence of situational constraints on the performance and affective reactions of job incumbents. They presumed that under highly constraining conditions workers would exhibit a decrement in performance. They also posited that constraints would have a differential impact on performance depending on task-relevant abilities and motivation, arguing that constraints would have a greater impact on the performance of highly able and motivated employees than on their less able and less motivated counterparts. Constraints would place an artificially low ceiling on the performance of capable personnel. Peters and O'Connor further argued that incumbents generally, and especially those who are very able and highly motivated, would experience job dissatisfaction and frustration in the presence of situational constraints. Later, O'Connor, Peters, Rudolf, and Pooyan (1982) extended the model to include propensity to leave. Not only would employees experience constraints, they would also leave or intend to leave. Initial research has provided some support for these hypotheses (see O'Connor, Peters, Pooyan, Weekley, Frank, & Erenkrantz, 1983; Peters, Chassie, Lindholm, O'Connor, & Kline, 1982; Peters, O'Connor, & Rudolf, 1984).

In addition to developing a conceptual model, Peters, O'Connor and their colleagues also developed an initial classification of constraints. Peters, O'Connor, and Rudolf (1984) identified the following eight situational constraints which, if inadequate in either quality or quantity, could adversely affect performance: (1) Job Related Information, (2) Tools and Equipment, (3) Materials and Supplies, (4) Budgetary Support, (5) Required Services and Help from Others, (6) Task Preparation, (7) Time Availability, and (8) Physical Aspects of the Work Environment. Other constraint taxonomies have also been developed and are reviewed by Eulberg, Peters, O'Connor, and Watson (1984).

A few investigators have begun to examine factors inhibiting performance of productivity in military settings (Broedling, Crawford, Kissler, Mohr, Newman, White, Williams, Young, & Koslowski, 1980; Kane, 1981; White, Atwater, & Mohr, 1981). However, the current research and development (R&D) represents the first effort to measure and assess constraints within multiple Air Force

specialties (AFSs). It is sponsored by the Air Force Human Resources Laboratory (AFHRL) and is being conducted for AFHRL by the University of Texas at Dallas. The primary purposes of this R&D are (1) to develop a taxonomy of situational constraints found in Air Force work settings, (2) to develop objective measures of these constraint dimensions, (3) to validate the constraint measures against work outcomes, and (4) to test the adequacy of the Peters and O'Connor conceptual model within the Air Force context. This program of survey R&D commenced in August 1981 and was scheduled for completion in January 1984. The work consisted of four phases which are summarized below. More detailed documentation is provided in O'Connor, Peters, Eulberg, and Watson (1984).

PROCEDURES AND RESULTS BY PHASE

Phase 1

The first phase involved development of a taxonomy of situational constraints applicable to a wide range of Air Force work settings and specialties. An open-ended questionnaire was used which employed a critical incident methodology to generate specific instances in which situational variables were cited as an explanation for poor performance. Surveys were sent to 956 Air Force enlisted personnel assigned to 12 bases dispersed throughout the continental United States. Only 256 persons returned usable surveys, providing 357 critical incidents. The low response rate was probably due to the open-ended nature of the survey which required respondents to write in responses. Critical incidents were summarized by two independent raters and discrepancies were reconciled by a third independent judge. Three additional judges then sorted the summaries into categories on the basis of perceived similarity of content. After each judge developed his own category system independently, the judges met to reconcile differences. Each category was then defined based on a summarization of the incidents within it. To verify the common nature of incidents within categories, 14 additional judges sorted the 357 incidents back into their 14 original categories. Items were sorted into their original categories 83% of the time.

The Phase I content analysis resulted in the identification of 14 situational constraint dimensions. With two exceptions (Red Tape and Transportation), these constraint dimensions were very similar to those previously identified in the civilian literature (Eulbert, Peters, O'Connor, & Watson, 1984). Seven of these dimensions were unidimensional while the remainder were multidimensional and were divided into subdimensions. These constraints and their subdimensions are as follows:

1. Tools and Equipment
   a. Not Enough Equipment
   b. Damaged Equipment
   c. Poorly Designed Equipment

2. Training
   a. Other's Training Inadequate
   b. My Training Inadequate

3. Materials and Supplies
   a. Unavailable Materials and Supplies
   b. Wrong Materials and Supplies

4. Job Relevant Information
   a. Unavailable Information
   b. Wrong Information

5. Planning/Scheduling of Activities

6. Time
   a. Not Enough Time
   b. Time Delays

7. Cooperation from Others
   a. Poor Cooperation
   b. Untimely Cooperation
   c. Cooperation Hard to Get

8. Personnel

9. Physical Working Condition

10. "Red Tape"

11. Forms

12. Policies and Procedures
   a. Insufficient Notice
   b. Inconsistent Policies and Procedures
   c. Incorrect Policies and Procedures

13. Transportation

14. Job Relevant Authority

Phase II

Phase II involved development and evaluation of an objective questionnaire to measure the Phase I constraint dimensions. The Phase II questionnaire was mailed to a larger sample than was used in Phase I. A total of 3125 Air Force enlisted personnel (125 personnel randomly selected from each of 25 bases around the world) received copies of the survey. Usable questionnaires were returned by 1352 persons. During this phase, 57 items were developed to measure the 14 dimensions. Unidimensional constraints were measured using three times per dimension, while those which had been subdivided were measured with two items per subdimension. Using a five-point graphic scale ranging from "Not At All Accurate" to "Completely Accurate," respondents were asked to indicate how accurately each item described their present job. A "Does Not Apply to My Job" option was also included. Items consisted of statements such as "I frequently must work with faulty or damaged tools and/or equipment" (Tools and Equipment, Damaged Equipment), or "I am often not able to do my job well because I am not allowed to make those job decisions I can make best" (Job Relevant Authority).

A principal components analysis with varimax rotation was conducted using the original 57 constraint scale items. Items for nine of the 14 constraint dimensions identified in Phase I loaded together onto components as expected and an interpretable set of 11 rather than 14 components was produced. While the a priori dimensions were not completely reproduced, the 11 empirically derived components represented a logical pattern of results consistent with the Phase I categorization, and with earlier civilian findings. For example, on the first empirically derived component, items originally written to measure the Time constraints were loaded with items originally written to measure Job Relevant Authority and Cooperation of Others. They merged into a new dimension which reflected performance constrained by Lack of Services and Help by Others.

Since the pattern of loadings from the principal components analysis provided results consistent with the 14 a priori dimensions, separate principal components analyses were computed for the items comprising each a priori dimension. Each analysis resulted in a single component solution on which all a priori items on the same dimension had high loadings. Internal consistency reliability coefficients for each dimension were high, ranging from .70 to .91. Since these latter analyses provided support for the original taxonomy, the research team decided to refine the 14 original scales for use during subsequent phases. An iterative approach was used. Items with the lowest loadings were deleted from and, if necessary, added back into the set of items comprising each dimension, depending on whether or not recomputed reliability coefficients fell below acceptable levels. This reduced the number of items comprising the total constraint scale from 57 to 42.

Preliminary construct validation of the constraint measures against criteria other than performance was also accomplished during Phase II. Individual dimension scores and total constraint scale scores were computed using a summative procedure and correlated with general and dimensionalized satisfaction, frustration, locus of control, supervisory culpability, and reenlistment intentions. These results provide a representative overall view of the validity of the constraint measures using criteria other than performance since a worldwide sample, not partitioned by AFS, was used. The overall constraint scale correlated -.07 with reenlistment intentions, .44 with frustration, -.28 with general satisfaction, .14 with supervisor satisfaction, -.28 with pay satisfaction, .14 with locus of control, and .37 with supervisory culpability. All coefficients were significant at $p < .001$ except reenlistment intentions ($p < .05$). In all but two instances, highly significant correlations were also observed, in theoretically appropriate directions, between dimension scores on all Phase II validity criteria except reenlistment intentions.

Phases III and IV

Phases III and IV of the effort were conducted simultaneously and will be described concurrently. These final phases involved on-site survey administration to airmen at the following four locations: Bergstrom, Carswell, and Dyess AFBs, and at Wilford Hall USAF Medical Center at Lackland AFB. These sites provided sufficient numbers of personnel, and their Texas location minimized travel expenses.

During Phase III and IV, focus was shifted from a broad spectrum of respondents to personnel in specific AFS to make occupation-specific comparisons and to examine the generalizability of findings across jobs. During Phase III, between 59 and 100 incumbents and 25 to 40 supervisors were surveyed in each of the following AFSs: Aircraft Pneudraulic Systems Mechanic (423X4); Fire Protection Specialist (571X0); Fuels Specialist (631X0); Materiel Facilities Specialist (645X0); Personnel Specialist (732X0); and Security Specialist (811X0). Phase IV involved a larger sample of 282 job incumbents and 67 supervisors in a single AFS: Medical Service Specialist (902X0). Both phases were designed to validate further the refined constraint measures against affective and reenlistment plans criteria as in Phase II. However, the impact of additional variables was also examined; most importantly, performance, work motivation, and ability. Phase IV differed slightly from Phase III in scope and purpose. The Phase IV sample was larger to allow an in-depth examination of a single AFS, to test interaction hypotheses, and to perform utility analyses should constraints be found to have the expected negative impact on performance.

During these phases, nine questionnaire instruments were used to elicit different types of information from different categories of respondents. During Phases III and IV, subordinates received a USAF Work Questionnaire (a refined version of the Phase II questionnaire) focusing on constraints and worker reactions to them. This survey contained the reduced 42-item set of constraint scale items. Phase III supervisors rated the performance of each subordinate in the sample using a Specific Performance Scale tailored to the major job duties performed by incumbents in the AFS. (Separate scales were developed for each Phase III AFS.) These supervisors also received a short version of a USAF Performance Questionnaire which asked for general performance-related information about the jobs of the employees they had just evaluated. In addition to filling out a Specific Performance Scale, Phase IV supervisors received a longer version of the USAF Performance Questionnaire which contained sections gathering information useful in a utility analysis.

Results of the Phase III/IV investigations were mixed and often contrary to expectation. The severity or overall magnitude of constraints experienced was lower than anticipated. Mean total constraint scores were below the scale midpoint for all seven AFSs investigated. Means (on a 5-point scale) for each AFS, in descending order of severity, were as follows: Materiel Facilities Specialist, 2.19; Security Specialist, 2.14; Fuels Specialist, 2.12; Aircraft Pneudraulic Systems Mechanic, 1.95; Fire Protection Specialist, 1.95; Medical Services Specialist, 1.79; and Personnel Specialist, 1.75. These constraint scores differed significantly ($p < .001$) across the seven specialties, with the first three differing from the last four.

Analyses evaluating hypothesized direct relationships between constraints and performance, motivation, affective reactions, reenlistment plans and thoughts of leaving produced varied results. With regard to correlations between the total constraint scale scores and various performance measures, few significant correlations were observed. For constraint dimension scale scores, a pattern of results differing across AFSs emerged in terms of both number of significant associations between the 14 constraint dimension scores and five performance measures of the Specialist AFS. Signs varied greatly. Contrary to expectation, they were mostly or completely positive in the Fire Protection, Fuels, and

Medical Services AFSs. Only in the Aircraft Pneudraulic Systems, Materiel Facilities, Personnel, and Security Specialist AFSs did they mostly or completely produce the hypothesized negative correlations between constraints and performance. However, the magnitude of these correlations never exceeded .40.

For all AFSs, except Aircraft Pneudraulic Systems, correlations between constraints and two of four motivational variables showed consistent, theoretically appropriate relationships. Personnel reporting higher constraints experienced less personal control and competence. However, significant correlations were seldom evident between constraints and measures of internal work motivation and effort. Constraints consistently related to affective reactions in all AFSs. As hypothesized, airmen reporting higher levels of constraints reported lower satisfaction, and greater frustration. Significantly, theoretically appropriate correlations between constraints and reenlistment intent or likelihood were few and weak. However, a moderately positive relationship between constraint scores and thoughts of leaving was found in all but the Materiel Facilities and Security Specialist AFSs. Moderator regression analyses (Cohen & Cohen, 1983) were used to test interaction hypotheses. In only five instances were significant interactions observed and these were only for satisfaction outcomes. Of these, none accounted for more than two percent of this variance. Constraints apparently did not interact with ability and motivation in predicting performance outcomes.

SUMMARY

In the present investigation, 14 constraint dimensions were identified in Air Force work settings. A valid and reliable instrument was developed to measure these constraints and can continue to be used for either R&D or diagnostic purposes. The severity of constraints was found to be relatively mild across the AFSs investigated. Constraints tended to decrease satisfaction and increase frustration, decrease antecedent aspects of motivation, and increase thoughts of leaving. However, contrary to expectation, constraints tended not to influence performance outcomes, and did not interact with ability and motivation in the prediction of performance.

REFERENCES

Broedling, L.A., Crawford, C.S., Kissler, G.D., Mohr, D.A., Newman, A.R, White, M.A., Williams, H., Young, L., & Koslowski, T.J. (1980, October). An examination of productivity impediments in the Navy industrial community (NPRDC TR-81-2, AD-AO 92 80815). San Diego, CA: Navy Personnel Research and Development Center.

Cohen, J. & Cohen, P. (1983). Applied multiple regression/correlation analysis for the behavioral sciences (2nd ed.). Hillsdale, NJ: Erlbaum.

Eulberg, J.R., Peters, L.H., O'Connor, E.J., & Watson, T.W. (1984). Situational constraints upon performance: A selective review of relevant literature (AFHRL-TP-83-48, AD-A138330). Brooks AFB, TX: Manpower and Personnel Division, Air Force Human Resources Laboratory.

Kane, W.D. (1981). Task accomplishment in an Air Force maintenance environment (80-0146, AD-A101 10819). Air Force Office of Scientific Research.

O'Connor, E.J., Peters, L.H., Eulberg, J.R., & Watson, T.W. (1984). Situational constraints in the Air Force: Identification measurement and impact on work outcomes (AFHRL-TP-84-10, AD-A149316). Brooks AFB, TX; Manpower and Personnel Division, Air Force Human Resources Laboratory.

O'Connor, E.J., Peters, L.H., Pooyan, A., Weekley, J., Frank, B., & Erenkrantz, B. (1983). Situational constraint effects on performance, affective reactions and turnover: A field replication and extension. Working paper, The University of Texas at Dallas.

O'Connor, E.J., Peters, L.H., Rudolf, C.J., & Pooyan, A. (1982). Situational constraints and employee affective reactions: A field replication. Group and Organizational Studies, 7, 418-428.

Peters, L.H., Chassie, M.B., Lindholm, H.R., O'Connor, E.J., & Kline, C.R. (1982). The joint influence of situational constraints and goal-setting on performance and affective outcomes. Journal of Management, 8, 7-20.

Peters, L.H., & O'Connor, E.J. (1980). Situational constraints and work outcomes: The influences of a frequently overlooked construct. Academy of Management Review, 5, 391-397.

Peters, L.H., & O'Connor, E.J., & Rudolf, C.J. (1984). The behavioral and affective consequences of performance-relevant situational variables. Organizational Behavior and Human Performance, 25, 79-96.

White, M.A., Atwater, L.Y., & Mohr, D.A. (1981). A practical methodology for identifying impediments to productivity (NPRDC TR-81-18). San Diego, CA: Navy Personnel Research and Development Center.

WORKING GROUP SESSION II

AIR FORCE PRODUCTIVITY

RESEARCH AND DEVELOPMENT NEEDS

WORKING GROUP SESSION II

SUMMARY

During Working Group Session II, participants were divided into three groups. Each group was assigned a facilitator and tasked to review and critique the R&D initiatives developed in Working Group Session I and to supplement them as required. Upon conclusion of these sessions, facilitators met to summarize results in terms of productivity R&D initiatives. The list of nine initiatives, shown below, represents an integration of the input from Workshop participants with the ideas generated in discussions in Working Group Session II. The list was presented to a meeting of all participants for their review and comment during the concluding session of the Workshop.

Initiatives

1. Conduct a systems analysis of the Air Force Productivity Program.

2. Determine the criteria commanders use to assess unit capability and how these relate to measures of productivity developed through research.

3. Identify/Develop reward and incentive systems for improving productivity.

4. Identify/Develop productivity measurement methodologies and criteria.

5. Investigate/Describe relationships among organizational characteristics, productivity and enhancement techniques.

6. Determine relationship between quality and productivity.

7. Identify/Develop methodology for determining the utility (cost) of behavioral science techniques for enhancing productivity.

8. Determine relationship between job performance and commitment to the organization and the Air Force.

9. Identify technology and knowledge transfer and implementation systems.

PLENARY SESSION V

SUMMARY/CONCLUSIONS

PLENARY SESSION V

INTRODUCTION

The closing session began with a review of the initiatives which resulted from the working group session on the previous afternoon. With only minor modifications the initiatives were accepted by the participants. During the discussion, however, a tenth initiative was proposed and accepted. This proposal was: Identify factors that impact the institutionalization of Productivity Enhancement Programs. Following a review of the R&D initiatives, participants were asked to rank them in terms of importance. Finally, General Luchsinger and the three consultants provided concluding comments.

Included in this section of the proceedings are: (a) the list of the ten R&D initiatives presented in the order of merit determined by participants; and (b) final comments by General Luchsinger, Dr. Katzell, Dr. Schneider, and Mr. Zimmerman.

R&D INITIATIVES

(In Rank Order)

1. Conduct a systems analysis of the Air Force Productivity Program.

2. Determine the criteria commanders use to assess unit capability and how these relate to measures of productivity developed through research.

3. Identify/Develop reward and incentive systems for improving productivity.

4. Identify/Develop productivity measurement methodologies and criteria.

5. Investigate/Describe relationships among organizational characteristics, productivity, and enhancement techniques.

6. Identify factors that impact the institutionalization of productivity enhancement programs.

7. Determine relationship between quality and productivity.

8. Identify/Develop methodology for determining the utility (cost) of behavioral science techniques for enhancing productivity.

9. Determine relationship between job performance and commitment to the organization and the Air Force.

10. Identify technology and knowledge transfer and implementation systems.

Concluding Comments

Major General Vince Luchsinger

The expense of this kind of conference is sometimes frowned upon, but I have a good feeling that this one will have a payoff. I would agree with what Charlie Weaver said about the network. We are a network among other networks and I think we need to sustain that. The list of names, addresses, and phone numbers will be among the most important things we get from this workshop. I'm very interested in staying in touch with you because we can help each other in many ways.

In a research sense, much of my concern relates to really understanding what we know because, as Ben Schneider said, we have a vas repertoire of information. The problem is whether we always truly understand what we know, especially in the behavioral sciences. I think that gets us down to impact, and I think impact comes about through institutionalization. I think institutionalization is a very important function. Since we have useful enhancement strategies to offer, out of behavioral sciences or wherever, we need to build these into the system in order that they can make a contribution. Institutionalization rests on the decidability and validity of what we have developed. We need to offer tools to help get the job done in whatever terms users think about, be it productivity or quality.

About 20 years ago, when there was concern about productivity, the Air Force put an item on the Officer Effectiveness Report (OER) called resource management. It was suppose to reflect the effort one made toward productivity. Has that addition had any impact on the reward systems? OERs and Airman Performance Reports (APRs) drive the promotion system so that this piece of paper says something about a person...that he or she does or does not do something about resources or productivity. I'd like to drive that same approach toward the Social Actions program. No one wants to get a bad mark on the OER item related to social actions or equal employment opportunity. I think we need more institutionalization, as well, in the productivity enhancement arena.

Lastly, to follow on what Ray Katzell said, I think we're basically trying to help people manage better through the implementation of various kinds of theories of management. One reason I stay in academics as a university professor is that I am interested in how to develop better thinking among managers. My hypothesis is that everyone has a theory of management. One's theory may be poor, but it is used as a cognitive basis for how to get things done. I also believe that everyone, even if they never took a psychology course or organizational behavior course, has a motivation theory, and they operate on that theory as they are involved in pragmatics. So, as we get down to the pragmatics of organizations...how things actually work...given elements of power, elements of politics, elements of what really makes things go, what really drives the system...I think that pragmatics depends on how we can be

influential in effecting manager's theories of management. This occurs when one is trying to imprint minds (at the Academy) of cadets about how they can influence minds and behaviors. I think that's our bottom line...how we get down to putting all we think we know to work.

I think the contributions we can make together to a synergistic principle can have considerable impact. I have some bad feelings about the poor job we've done, and know we can do better. I see a lot of hope because of the tremendous talent we have in this room, and we have many brothers and sisters out there in the real world who feel as we do but who haven't had the good fortune to be here. I think that if we can hang in there together, we can do a good job. I see many signs that things are getting better. As I was telling Rodger Ballentine a few minutes ago, we do business the way we can and have to. I had an occasion to talk to an Assistant Secretary about doing things my way when given the chance. The feeling I came away with from this conversation was that people in positions of responsibility have silver bullets to spend. How willing do you think they are to spend silver bullets on productivity when they have a lot of other things that people want? Are they willing to exert good will, or whatever they have to offer, to influence the system in the direction of our interests? I think we can touch people in positions of responsibility through research and development. We can influence commanders in the field to be smarter about how they manage and to get involved in the kinds of quality programs with which we are concerned. We give commanders much information, but we have to find out where they can use it. So, do stay together and God speed in your efforts.

Concluding Comments

Dr. Raymond Katzell

Colonel Ballentine, I am going to broaden my concluding comments to address not only the agenda, but also reactions I have to the three days that we have been here together. I want to say that I am very favorably impressed with the scope of the research that is going on in the Air Force and in the other Services. The examples I have heard in detail impressed me with their quality. I think good quality work is being done. I addition, the plans for continuing research are attuned to contemporary thinking in the field. Things are up-to-date. You are not plowing furrows that have been plowed years back and given up as infertile. I refer, specifically, to the general overview by Colonel Dahms, to the projection for productivity research, to the research program at the Air Force Academy, to the contractors' research being done under the supervision of AFHRL, and to other examples that were cited over the last few days.

There is obviously a need for improving the impact of what is being done. What is being done is good, it is timely, it is relevant, but the real concern is its effectiveness in changing the system and improving the system. One of the things you are aware of is the need for some cooperation and synergy among the research efforts themselves. To some extent, their effectiveness is being lost by the fragmentation and relatively low level of communication. So, the whole is a little bit less than the sum of the parts. But even more serious seems to be the recurrent concern with the acceptance and diffusion of productivity enhancement in the operational Air Force. I get the distinct impression that the results of Air Force research are not being applied very much, nor is the extensive research base outside of the military which has been developed over a number of years. There is a whole world of behavioral science research. And I, therefore, would suggest that this problem needs top priority, at least as much priority as doing additional research in the context of productivity improvement. Incidentally, this problem is not unique to the Air Force. If it makes you feel any better, you are not alone in failing to utilize to an optimum degree the know-how that exists in the field. This is true of other branches of government, and it is true of private industry as well. So it is a problem we all face, but that doesn't really excuse us. We need to do something about it.

I have a few other suggestions. I think it would be useful to do research on conditions of acceptance and resistance to productivity enhancement programs. For example, where efforts have been made to make productivity advancements, identify circumstances associated with their acceptance and rejection. I think we can learn from these examples to shape our strategies, to capitalize on the positive cases and avoid the negative ones. I think that in the area of institutionalization it is important not only to identify circumstances of program acceptance, but also to learn about circumstances associated with maintenance or discontinuation. We know many cases in the behavioral science field where worthwhile programs were accepted but were relatively short-lived. One of the reasons for this is that they simply were not appropriate or they were not well implemented. And there are other circumstances, such as those involving cost factors. We do not understand this process very well - the

institutionalization and de-institutionalization of productivity improvement efforts.

I also endorse the suggestion made by General Luchsinger and others in their remarks that greater emphasis be given to action research in the research mode. We tend, as a discipline, to think of research in terms of the physical science model of research, where the object of research is inert and passive. and we put it under the microscope and see how it behaves. With the operational human systems, that is not a good model. It is often an explanation for why the findings of research are not always valid or if they are, why they do not get much acceptance. Action research is a vehicle which our experience suggests generates more acceptance, less resistance, and more involvement and, therefore, more commitment to utilization and implementation.

Beyond action research, there is another strategy to bear in mind concerning implementation. It is to make more use of demonstration projects, rather than just controlled experiments. In many areas, we already know what will work. It seems to me that commanders at operational sites are likely to be more receptive to the testing of a previously researched and validated behavioral science technology than to the disruptive effects of "Let us do an experiment, "with controls, randomizations, and measurements ad infinitum. So instead of saying "Let us do an experiment, a controlled experiment," within certain areas of technology, let us say "Look, let us apply something in a try-out, which we have some good reason to believe is going to work in this situation." We try it that way because we predict that if we do this, it will work well. Pritchard's field research study is a good illustration of this kind of study. I think you will find more acceptance of that approach than to one involving proposing an exploratory experiment. This is another way of saying that there should be more emphasis on developmental research in contrast to exploratory research. This does not mean not to do innovative or exploratory research, but it is worth putting more emphasis on developmental research.

I have another thought on how to upgrade the application and implementation of research. I notice the Air Force already has an institutional vehicle for action research and demonstration. I am referring to the consulting arm of the Leadership and Management Development Center (LMDC). It is an institutional vehicle devised to help field institutions cope with their problems. I also notice that staff and budget restrictions are holding them back from servicing all of the requests that they get. They also have an active stable of only about half a dozen remedial programs; again, presumably because of staffing, budgeting, etc. Without knowing what that half-dozen programs are about, I can guess that it is short of the potential of various techniques that could be put at the disposal of the field. I hear heads nodding from people associated with LMDC, so I guess I am not off base there. It seems, therefore, that there is an opportunity for expansion here, and I am not sure where organizationally that expansion should take place. The idea of having one or more consulting groups whose mission is to help management do a better job is a good way to start action research and demonstration projects.

Assuming that such programs of consultation, demonstration, and action research are as successful as we all think, then it seems to me that still another needed stratagem is to promote the benefits more widely throughout the Air Force. I do not know what your promotional channels would be, but I have learned something about this problems from my private consultation work. Many private consultants of industrial officials get their bag of tools more widely accepted through publicizing the positive cases where they have helped solve problems and come up with meaningful information. It seems to me that you should be borrowing from that approach to actually publicize with booklets, leaflets, brochures, bulletins, and whatever other vehicles you have.

With respect to substantive suggestions, I think the list we developed in this Workshop is excellent and will keep you out of mischief for quite a long time. I think it promises to develop some useful things. I just have a couple of additional comments. I think it would be worth paying attention to evaluating existing and new incentives that are applicable to the Air Force, particularly non-financial incentive. This is an expansion of what we have heard reported by Pritchard and by Steel, where various kinds of programs and activities that might better turn people on to their work and make them more productive are being tested. But there are others that are worth further inquiry. These include education, career ladders, better use of the promotional system, and so on. Maybe we should examine some incentives that have been traditionally used, but may not be cost-efficient and should be replaced by better incentives that are feasible. It is not a matter of adding incentives, but of fine-tuning and getting a more effective set.

As you well know, the improvement of incentives or rewards available for organizational members can help improve job satisfaction and quality of worklife but that does not necessarily improve productivity or performance. To do that means that the incentives and rewards have to be linked directly to performance, and unless those linkages exist, incentives are not going to be very helpful in increasing productivity. So I think it would be worth investigating systems for allocating rewards and benefits to improve their association or their linkages with individual performance, group productivity, and organizational productivity.

How does one relate reward allocation more directly to merit? That is another side of the promotional issue that Dr. Schneider discussed. My suggestion is not only to see what people's perceptions are, but to improve the system so that they allocations of rewards is made more equitable. Research could be designed to examine this issue. For example, it may well be that the information used by promotion boards is not the best with which to form judgments of merit. Maybe the first thing that leaps out at evaluators from an applicant folder should not be the applicant's photograph but the recent record of attainments. Perhaps the photograph should be in the back of the folder. That is a superficial example of what I mean, but you know you can key the sequence of information so that people can make decisions based on the relevant facts rather than the irrelevant facts. How people process information, individually as well as in groups, and how they make decisions based on information are also well reported in research. The results of this type of research could be expanded and applied to the problem of promotion decisions.

Such an application might be a way of improving the linkage between promotional awards and merit.

I have a habit that has become ingrained in me. When I confront a problem, I try to think the unthinkable. When I was reflecting on this habit, I was thinking of what unthinkable thing I could think about as far as the productivity enhancement program. And the unthinkable thing that occurred to me was that maybe we should not even be thinking about productivity enhancement. Do not get me wrong. I do not think that the basic idea lacks merit, but what strikes me is a couple of things. One is how we hae heard time and again how productivity is a no-no word. That should cue us that there is something strange about it. Notice also that we do not find people flocking when we hang out our shingle and say we are in the productivity improvement business. Why are they not flocking? If we were handing out money they would come, but they do not come when we say we are dealing with productivity. That also is a cue. The thing that strikes me is that productivity is a result, and people generally, when they want to adopt something, want to adopt something they can do. They do not want to adopt something that is the outcome of what they do. So we have such things as training, selection, and maintenance. These are independent variables. They are something that you can grab on to and do something about. Productivity is a dependent variable. It is a result of a lot of things that we do or do not do. We are not using a right label because managers say productivity is what they are trying to do all the time. That is their main concern, to run a tight ship and to have an effective operation. So what is this gimmick about productivity all of a sudden? Maybe we should be talking more about management improvement rather than about productivity enhancement programs. Maybe we should identify particular kinds of programs and not necessarily call them productivity programs, but call them by the names of the independent variables, that is, the treatment or the intervention that would be used. Maybe it pays to talk about incentive programs or human resource management programs or things of this sort. Maybe such titles would better connote that these are the things that we are going to teach you or that will help you do better. The consequence will be that you will do a better job of management and therefore your productivity will go up. What should be at the front end is what we would intervene with or what we would help people do better, rather than what we are selling, namely the outcome. Anyway, that was my unthinkable thought. On that note, I will sit down.

Concluding Comments

Dr. Ben Schneider

I am forced to agree with much of what Dr. Katzell said. He has a way of capturing a host of important issues. However, I do have a couple of other rather isolated themes that I would like to address. One is the political issue of promotion within the Air Force, and there is no getting around the politics of promotion and productivity. Those are critical issues but they should not stand in the way of our thinking about what the residuals might be. So I would like to make a distinction here between research and what Dr. Katzell talked about as development.

In the private sector, and also in the military, I think, R&D is almost one word, so that when we say it, we think about it as one thing. It would be interesting to know what everybody thinks about when we say R&D. I make the distinction. I treat it as two different concepts. The one concept is research and the other concept is development, and I try to make sure that I keep the two of them separated because we need them both. I think there is a tendency, from what I have heard here in the last few days, for the Air Force to think about development, but not to think about research. I can point specifically to one chart that was put up where there was a very small dot representing the relative amount of funds spent on 6.1 projects. If it takes between 12 and 15 years, which is a kind of normal time range between the initiation of a research project and the potential outcome and utility to the Air Force, then that says if we want something by 1989 or 90, then we ought to start something now. So I think that it is critical that a clean distinction be made between development and research and that both kinds of efforts go on.

Development issues should pay more attention to political concerns. I am not using the term political concerns negatively at all. Another word for political is realistic...you know, the everyday, realistic concerns of people and what drives them. The group or unit is going to pay attention to the development of those realistic or political concerns. I also think we have to pay attention to some substantive concerns that some people may not be familiar with, especially those which are driving the realistic concerns. I think the Air Force has to conceptualize itself as not knowing everything, as not knowing everything that they should be doing research on, but potentially being able to specify many of the things on which they need development.

Even with the list of items that have been generated by the group, which I think is an excellent list of potential development concerns, I would encourage the Air Force to develop what I call an open window policy on its research concerns. By an open window policy, I mean allow the researchers and the larger research community to suggest things that the Air Force might want to do research on because there are people out there whose names we have never heard of, who have not written 17 books, who have not published 97 articles, and who may have some good ideas about research that might pay off for the Air Force in

the long run. Now the only way you are going to be able to find out about that is to say something like, "The Air Force is interested in sponsoring research that might have long-term productivity payoff. If you are interested in doing some basic research that might have some long-term productivity payoff, submit a proposal. We are not going to tell you what we are interested in, why we are interested in it, or anything because, remember, we do not know everything! Now what we are interested in is something that is different from what we are sponsoring." Then you can give them a list of your developmental efforts. But again, I am trying to make this a very clear distinction. It is not that they are separate, but I am trying to make a very clear distinction between the kinds of efforts the Air Force might want to sponsor. Right now it is overly emphasized on the development side and consequently cuts off your potential for making long-term contributions through research.

Now I am going to switch to another topic and talk about something Kent Crawford said in passing, something about the agricultural extension service. I think the Air Force needs the equivalent of an agricultural extension service for behavioral science. And I am now following up on the thing that Ray Katzell said. We do have an arsenal of useful technology for making improvements in the ways organizations function. In some sense, psychologists and other behavioral scientists are trained to be very skeptical. You know, every behavioral scientist is from Missouri, you have to show them. Well, we have a collection of things we can show. Look at Dr. Katzell's chart. That is one summary. Even if, as he said, it is phony because only the positive results get published, we do have an arsenal of goodies that can be used. We have not been marketing them well because we do not have the people with master's degrees or the training sufficient to be marketers who are interested in research. They are interested in making change. They are interested in developmental phases.

So I would send off a whole bunch of my principals, you people, to some program for the equivalent of an academic year...three, four courses each for three credits. If you really work hard, you could do that in about four months and you can train a bunch of people, principals, to know what is available, how to use it, and how to respond to someone when he says he has a problem. You can say, "Okay, let me go back to my chart in my office. Given this kind of problem, here are some kinds of solutions we can try. You know, we have that. We really do have that. Now we do not have every one of the answers, or the miniscule kinds of things that Dr. Katzell or I might want to do research on, but I think on the research side of things we do have it. We just have to use it. But principals cannot use what they do not know about. My understanding is that the principals are appointed, frequently not for a lot of good reasons and frequently given the job as an added responsibility. It is just sort of an added thing, and that is probably not as appropriate a it should be.

I would like to reemphasize something I said earlier about LMDC as a program of outstanding potential from what I have heard. It is a well-worked-out methodology, with well-thought-out tools, and apparently they are getting more calls than they can handle. Certainly, if you are looking for a compliment, it would be that someone wants more of your services than you are able to give. That is the ultimate in validity. So what I want to do is encourage you

various folks to let it be known how important that program is...I mean, through brochures or some other form of publicity. It is through this kind of network from a meeting like this, that information like that can get out. I would also like to reestablish what Dr. Katzell said once again, and that is the use of the program as a source of validity for data for developmental projects. I see what LMDC does as development, not research. That is great, but those demonstration projects can be codified more than they have been, and certainly publicized more than they have.

There is only one research topic that I have not seen mentioned. This concerns the number of constituencies that the Air Force is designed to please. The decisions made and the services provided by Air Force personnel impact on various groups. They may be non-coms or officers, civilian service employees or legislators, or the community in general. I think a broadening of the horizon of the multiple constituencies that the Air Force is designed to serve might help illuminate what you want to understand or pay attention to concerning the organizational effectiveness of the unit. I think that is a researchable project. I think it would generate some useful information. As decisions are made, we need to ask ourselves what are the implications for all these different constituencies we have to serve if we make this decision the way we are thinking of making it? And if you have never done it, I think you will be amazed at how many different constituencies a particular decision might impact. That is the only other research that I propose.

Now, one last point. With all the things Dr. Katzell and I have said, and all the problems about doing something that you have all agreed on, I would like again to reinforce something that Dr. Katzell said: Every organization that I have worked with that is concerned with productivity goes through these developments that you are going through. You are going through a stage of becoming concerned about productivity. One of the neat things about all of this is that you are all here, and in a sense we are talking about the converted, the committed. That suggests something positive about the potential role of these efforts. I take that as a good sign for what might happen, given some of the things we have talked about before. Thank you.

Concluding Comments

Mr. Charles Zimmerman

Whether I talk to the academic sector, the private sector, or the public section, I sense a growing need to improve. Why is that? Since we are the most productive country in the world, why do we have to improve? It is because we have threats. The private sector deals with threats occasionally, but the Air Force deals with threats continuously. We all have threats which convert to challenges to improve. Those of us on the civilian and military sides run different operations, but both need to improve. Currently, there is a ground swell in this country for improvement, so you in the Air Force are definitely not alone. Every branch of the service is involved in it; the academic community is involved in it; we are all in this thing together. Since we are all in this together, I suggest that we share more and try to work together.

The threat in the industrial sector comes mainly from the East, from Japan, but it also comes from other countries, including West Germany and South Korea. In the face of this threat we have a systemic problem, and it may be that you have some systemic problems, too. Our systemic problem in industry is that we view our whole process as compartments of a process. Let me explain. We view research and development, design, and production as separate products of our process. In operation we compartmentalize the process. We throw things over the wall at each other. You may often do the same things. You do not view things as a single, continuous process. Today, the Japanese (and specifically the Japanese in the computer world where they are driving hard toward a fifth generation system) view manufacturing as one process, one system. They do not compartmentalize as we do. Where it takes us ten years to go from research to that end item that falls out the back door, they are literally cutting that time by two-thirds to a half. There is the challenge we face. That is where the quality commitment I keep talking about is important. If you took a process, laid it out on a chalkboard and drew quality from the beginning to the end of that product, that is the quality commitment. That is the quality issue.

I encourage you to examine the problems of feedback through your system. For instance, in this Workshop, productivity principals are feeding back information to research people. I encourage more of that. Feedback must also come from the line operating people that productivity principals represent. You need their feedback. You will never know if you are researching the right things unless your line operating people are involved in the process through feedback. One reason why the results of your research do not always get implemented is that line operating people never understood why you were doing the research in the first place. We have the same problem in industry. General Luchsinger talked about networks, and he is right. I am involved in broadening that network in my own role and, believe me, the network out there is sizable. We cannot let tradition keep us from expanding our networks and building relationships that are going to help us improve.

Between the services it appears that there are many similar functions. There are the Air Logistics Centers in the Air Force, the Navy Air Rework Facilities in the Navy, and repair depots in the Army. Everybody seems to be doing the same kind of job. In one service we may have a manager doing a very excellent job in improving an area, and in another service we have a manager wrestling with what he should be doing. Such situations point to the need to network information.

A wealth of knowledge is available to you in the services from us in industry. If you do not want to go directly to industry, you have the Air Force Contracts Management Division which is involved with industry all the time examining and taking note of what we are doing. They should be sharing information with you. You have many service personnel in industry, so you are not sheltered from the private sector. I certainly would recommend that you explore how you can better obtain information on improvement technologies through Air Force plant representative officers. I know that there have been problems between the operating commands, air logistics commands, and management commands. We have the same sort of things going on in Westinghouse. In any case, we have a national challenge on our hands, and I think we have to break some traditions. I think we are going to have to encourage more through networking with the public private, and academic sectors.

I do not know if I have helped you pinpoint research efforts, but I felt the need to share these thoughts with you. Thank you.

Productivity R&D Initiatives:

Description, Comment and Consolidation

Dr. Willie Silva

Workshop Chairperson

Reviewing the recorded tapes of the Workshop proceedings reinforced my general perception of the entire Conference, that the result was indeed worth the effort. The effort provided the Air Force Human Resources Laboratory with a directory of R&D initiatives which represent a valuable integration of the needs of users with the imaginations of researchers.

I believe, however, that the contribution of the Workshop goes beyond merely providing a list of initiatives. Through this Workshop, AFHRL provided not only a valuable forum, but a process which created the networks frequently called for in the discussion. Furthermore, the discussion provided a vehicle through which productivity managers could air problems and gain insight concerning solutions. The Workshop also gave researchers and analysts an opportunity to display their "wares" and to have them tested through questioning and critique. It seems clear that the Workshop has had a motivating effect on the participants and that this motivation will have a favorable impact on their productivity efforts. Thus, there seem to be many favorable outcomes of the Workshop that go beyond its primary objective.

The Initiatives

In their present form, the R&D initiatives suggest a broad array of potential research and development activities. While it is not the purpose of these proceedings to suggest R&D activities to be undertaken by task scientist, it is important that the major thoughts and ideas relevant to the identified research initiative be documented. What follows, therefore, is a statement of the suggested initiatives and a summary of the thoughts and ideas associated with each.

1. Conduct a systems analysis of the Air Force Productivity Enhancement Program. (PEP). Among the initiatives identified, this one was by far the most important to Workshop participants. This initiative comes from a feeling shared by most of the participants that there is a need to conduct an in-depth evaluation of the current PEP and to assess its overall utility. The issues of roles, structure or organization, understanding/participation, personnel manning, and tools mentioned in the Working Groups Session I are relevant to this evaluation and assessment. It was also widely agreed that there should be an Air Force wide survey of Air Force members and productivity managers concerning such topics as knowledge, understanding, and commitment to the program, and perceived utility. Training of productivity managers was also discussed as an important dimension of such a systems analysis. The systems analysis initiative would look at processes, products, and personnel. It was regarded by Workshop participants as a very ambitious undertaking.

2. Determine criteria commanders use to assess unit capability and how these relate to measures of productivity developed through research. The basis for this initiative is the knowledge that commanders make judgments concerning the capability or effectiveness of their organizations. These judgments are based on criteria which may include readiness status (C-status), IG or ORI evaluations, aircraft sorties or in-commission rates, and proportion of qualified personnel. What is needed, according to the advocates of this initiative, is to capture, describe, and quantify these criteria. Accomplishment of this step would permit a follow-on effort to determine the compatibility of commander-driven criteria with criteria generated in productivity research. Inherent in this sort of reality research-based methodology for generating criteria is the belief that more optimal criteria will be developed - criteria that meet operational needs, that are acceptable to commanders and managers.

3. Identify/develop reward and incentive systems for improving productivity. This initiative is the result of the perception that the incentives currently available to reinforce participation in the productivity programs may not be fully adequate motivators. There was a feeling among Workshop participants that behavioral science technology contains readily available reward systems which should be adaptable through research to the productivity programs of the Air Force. Two ideas run concurrently within this initiative and are important in providing the proper perspective. The first idea is that there is a need to identify or develop techniques through which people are encouraged to be more productive in their work. Second, there is a need to develop incentives which will encourage personnel to participate in the current institutionalized PEP program. Issues in this area which require

additional investigation include monetary vs. non-monetary incentives, group vs. individual rewards, constraint variables, and linking incentives to performance and rewards to merit.

4. Identify/develop productivity measurement methodologies and criteria. This requirement is not unique to this Workshop. Thoughts and ideas associated with it are known to anyone concerned in any way with productivity. Better measures of productivity are needed. Also needed are practical measures that can be readily applied to the work situation. Measures are needed that are more universal in scope, that can be applied across jobs and organizations. Also needed is a shopping list of potentially relevant criteria. Users do not seem satisfied with currently available measurement methodologies and criteria and are searching for something better. They are not sure what is available and wish to be better informed.

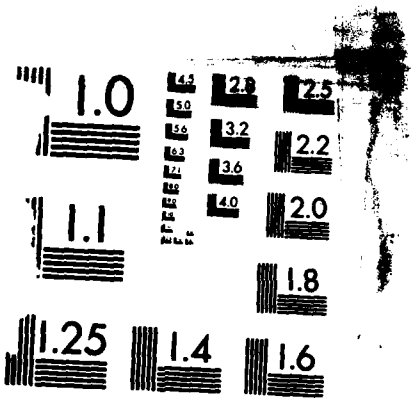
5. Investigate/describe relationships among organizational characteristics, productivity, and enhancement techniques. There is need for a methodology which will select optimal intervention strategies for productivity enhancement for specific productivity problems that may arise. This is one of the major concerns addressed by Dr. Raymond Katzell, i.e., how do we find the correct solution for a given problem or the right medicine for a particular illness? Workshop discussions affirmed that there is no universally applicable productivity enhancement technique and that a descriptive system is needed which matches a specific enhancement technique to a specific productivity problem which will be most useful in the context of relevant situational variables and organizational characteristics. Participants called for research to develop a descriptive system to help make this match.

6. Identify factors that impact the institutionalization of productivity enhancement programs. The reluctance to participate in or the lack of commitment to productivity enhancement programs is of concern to Workshop participants. The difficulty of establishing and maintaining a viable productivity program is the issue. There is need to know not only why such programs succeed but also why they fail. What is the process of institutionalization or organizational change? What are the circumstances of acceptance or rejection? If, as General Luchsinger states, to have impact the productivity program must be institutionalized, then the need is clear. However, the factors involved in the institutionalization process are diverse and, therefore, this initiative overlaps with others, including reward systems and enhancement techniques.

7. Determine the relationship between quality and productivity. This initiative is related to the issue of measurement. How is quality assessed so that it may be used as an indicator of productivity? The quantification of quality is a problem which has puzzled evaluators in the past and is obviously still puzzling today. By the very nature of the Air Force mission, there are work situations with outputs which do not lend themselves to quantification. Such outputs, however, may be amenable to assessment in terms of quality of work performed. Workshop participants called for a methodology for assessing this quality. Dr. Crawford indicated that a future research effort at NPRDC will be in this area.

AD-A165 918 PRODUCTIVITY RESEARCH AND DEVELOPMENT PLANNING WORKSHOP 3/3
(U) TEXAS MAXIMA CORP SAN ANTONIO W SILVA ET AL.
MAR 86 AFHRL-TP-85-10 F33615-83-C-0030

UNCLASSIFIED F/G 5/9 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

8. Develop methodology for determining the utility (cost) of behavioral science techniques for enhancing productivity. This initiative is a direct complement to Initiative 5, identify/develop productivity measurement methodologies and criteria. While Initiative 5 would provide the capability to select the enhancement technique most applicable to a given problem and organization, this initiative would provide an assessment of the payoff which would result from the implementation of a specific enhancement technique. Supporters of this initiative indicated that there is need to be able to indicae the expected payoffs or utilities of behavioral science tools. Commanders raise questions about the costs and benefits of enhancement strategies. Productivity managers should be able to provide the answers. Work described by Dr. Katzell which attempts to place dollar and cents values on specific techniques is applicable to this initiative.

9. Determine relationship between job performance and commitment to the organization and Air Force. This initiative supports research in progress at the Air Force Academy. Basically, this work investigates the extent to which productivity is influenced by organizational commitment. The research at AFA evaluates how personnel, organizational, and job characteristics relate to commitment and how these, in turn, impact the productivity and retention of personnel.

10. Technology and knowledge transfer and implementation. This initiative is more a request for information than for research. It reflects a need to remain current on the various productivity enhancement programs available. Users are asking to share in the armamentarium of arsenal of useful technology about which Drs. Katzell and Schneider spoke. What is envisioned is a management information system which would identify productivity enhancement programs and provide information on their success, implementation, equipment required, etc. - a directory of available productivity enhancement techniques.

Consolidation

The proposed R&D initiatives represent a montage of varied needs and expectations. While the Workshop process provided a means for legitimizing these various needs, they must be evaluated from the perspective of compatibility with the AFHRL functional mission.

R&D in the Department of Defense is generally divided into the six categories shown in Table 1. These categories provide for a spectrum of technology studies beginning with theory (6.1) and ending with operational systems development (6.6). AFHRL's behavioral science R&D effort is currently funded primarily in categories 6.1, 6.2, and 6.3. Thus, in a pragmatic sense, only the initiatives proposed in this Workshop which fit into these categories would be viable candidates for further consideration in the AFHRL planning process. Such a perspective may be necessary if AFHRL is to optimize the use of its limited resources.

Productivity programs in the Air Force may benefit most from R&D efforts which integrate the resources and capabilities of the numerous organizations represented at this Workshop. From this perspective, the initiatives can be categorized in terms of (a) those which should be the responsibility of an

agency other than AFHRL, (b) those which could be the responsibility of either AFHRL or another Air Force agency, and (c) those which are consistent with AFHRL's mission and should be the responsibility of AFHRL. Decisions about placing initiatives in the categories are not obvious and there is overlap. For even a single initiative there may be components which should be the responsibility of another Air Force agency. Table 2 and what follows attempt to make decisions about placing the initiatives into the three categories of responsibilities:

Initiative 1 (System analysis of the Productivity Enhancement Program) and 10 (Technology transfer and implementation) should not be the responsibility of AFHRL. The methodology and measurement technology for these efforts are readily available and similar efforts have been conducted by various Air Force agencies on different types of programs. In the strictest sense this is not research and AFHRL would require funding in possibly the 6.5 R&D Category (see Table 1) in order to participate. The recommendation against AFHRL responsibility for these initiatives should not be interpreted as a de-emphasis of the importance of these projects. Initiative 1, in particular, was viewed by Workshop participants as a high priority effort, and it is strongly recommended that the Air Force manager for the PEP, i.e., AF/MPME, take the steps necessary to initiate the study, possibly through a working group which would include representatives from several agencies.

Initiatives 2 through 8 have dual purposes. Modification of the initiatives into parts a and b, as shown in Table 2, illustrates their dual character. An important portion of each proposal, shown as part a, calls for review of available technology, identification of what is relevant, and delineation of appropriate applications. As described by several of the Workshop participants, this work is already being done to some extent by such organizations as the Air Force Academy, LMDC, and AFIT. They should be encouraged to continue and possibly broaden their efforts.

The other portion of Initiatives 2 through 8, shown in Table 2 as part b, seeks to investigate and develop additional technology. This area may have the greatest utility for AFHRL. In fact, the AFHRL productivity research program is structured so that these components of the initiatives are compatible with it. The work described by Drs. Tuttle, Pritchard, and O'Connor clearly relate to the initiative issues of criteria development, enhancement techniques, measurement methodologies, and incentives. Current AFHRL productivity research and the related research proposed in Initiatives 2 through 8 may be grouped under three somewhat overlapping project headings:

1. Productivity Measurement Methodologies
2. Productivity Enhancement Techniques
3. Productivity Reward and Incentive Systems

This initial categorization could be further refined to include project descriptions which would encompass the needs identified during the Workshop while at the same time considering the functional responsibilities of AFHRL (TABLE 3).

Research concerning Productivity Measurement Methodologies (Project I) would address issues derived from Initiatives 2, 4, and 7. These include:

Criterion Development - What productivity criteria are available? Are these criteria standardized? What are the utilities of these criteria? Are there operations-relevant criteria? How can these criteria be measured? Can criteria be readily applied? Do certain criteria apply across organizations and at various levels within organizations? Are general (marcro) criteria available? Specific (micro) criteria? Under which conditions should each be used? are techniques available for quantifying criteria? Should qualitative criteria be used? If so, how?

Methodology Development - What measurement methodologies are available? Are there both macro and micro methodological approaches to measurement? When should each be used? Does measurement have to be intrusive? Are there unobtrusive techniques? Are there interdisciplinary approaches to measurement, and how can they be applied in military environments? Can methodologies be standardized for ease of application?

Quality Measurement - How can quality be addressed? Do situational quality measures exist? Is there a relationship between quality and productivity? If so, how can it be measured?

Initiatives 5,6, and 8 would support Project II, Productivity Enhancement Techniques. This research would include the following concerns:

Technology Development - Which technology development techniques are relevant to Air Force needs? Are there appropriate macro and micro strategies? When are such techniques applicable? What are the appropriate situational variables? How can these variable be determined and measured? How can techniques and situational variables be combined into operational diagnostic/prescriptive approaches? Do various constraints moderate the techniques? What utilities or payoffs are associated with the techniques? Can these be quantified?

Institutionalization - What conditions are associated with the acceptance and rejection by organizations of enhancement programs? How can these conditions be manipulated? Can processes for effective organizational change be identified? How can these processes be used? Is action research an effective strategy for institutionalization? If so, how can it best be used?

Project III, Productivity Reward and Incentive Systems, incorporates Initiative 3. This research would address the questions of how to encourage individual productivity and participation in institutionalized productivity programs. Among the issues involved are the following:

Which monetary and non-monetary incentives and incentive systems are most effective? Which should be used under various situational conditions? What are the most effective individual and group incentives and when they be used? Do certain incentives apply differentially to military and federal service environments? Which organizational environmental constraints are associated with various incentive techniques? What are the links between incentives and performance, between rewards and merit?

Concerning Initiative 9 (productivity and commitment), this research is presently being conducted by the Air Force Academy. The research appears to be progressing satisfactorily and a program is planned to continue the work.

In summary, the research and development proposed by the AFHRL Productivity R&D Planning Workshop provides a challenging agenda for the future. To succeed, many Air Force agencies must participate and strive to integrate their varied talents toward a single focus: Air Force productivity enhancement. The benefits are obvious. All agencies must play a major role if the overall effort is to succeed. This Workshop is a visible commitment to that end.

Table 1. Program 6 - R &D Categories

Within DOD, Program 6 - Research and Development - is structured into six Research categories as follows:

6.1 Research - includes scientific study and experimentation directed toward increasing knowledge related to long-term national security needs. It provides fundamental knowledge for the solution of identified military problems. It also provides part of the base for subsequent exploratory and advanced developments.

6.2 Exploratory Development - includes all efforts directed toward the solution of specific military problems, short of major development projects. This type of effort may vary from fairly fundamental applied research to quite sophisticated breadboard hardware, study programs and planning efforts.

6.3 Advanced Development - includes all projects which have moved into the development of hardware for experimental or operational test.

6.4 Engineering Development - includes those development programs being engineered for Service use but which have not yet been approved for procurement or operation.

6.5 Management and support - includes R&D effort directed toward support of installations or operations for general R&D use.

6.6 Operational Systems Development - includes all efforts directed toward development, engineering and test of systems, support programs, vehicles and weapons that have been approved for production and Service use. It is not an official category and is only used as a term to describe R&D costs in other programs.

Table 2. Initiative Implementation Responsibility

OUTSIDE AGENCY	OUTSIDE AGENCY/AFHRL	AFHRL
1. Systems Analysis	2a. Identify available commander criteria	2b. Relate commander criteria to research
10. Technology Transfer	3a. Identify available reward system	3b. Develop reward system
9. Productivity and commitment	4a. Identify available measurement methodologies	4b. Develop methodologies
	5a. Identify available organizational characteristics and enhancement techniques relationships	5b. Determine these relationships
	6a. Identify available institutionalization factors	6b. Determine institutionalization factors
	7a. Identify available quality measurements	7b. Develop quality measurements
	8a. Identify available utility measurements	8b. Develop utility measurements

Table 3. Potential AFHRL Productivity Program

PROJECT I: PRODUCTIVITY MEASUREMENT	PROJECT II: PRODUCTIVITY ENHANCEMENT TECHNIQUES	PROJECT III: PRODUCTIVITY REWARD/ INCENTIVE SYSTEMS
2&4 Criterion Development	5 Tecnique Development	3 Systems Development
-operations-relevant criteria	-macro vs. micro strategies	-monetary vs. non-monetary
-application	-situational variables	-group vs. individual rewards
-macro vs. micro	-diagnostic/prescriptive approaches	-civilian vs. military
-quantitative vs. qualitative	-constraints	-constraint variables
2 Methodology Development	6 Institutionalization	-reward and merit
-macro vs. micro	-acceptance/rejection variables	
-unobtrusive	-application/implementation strategies	
-interdisciplinary	-processes for organizational change	
-standarization	-action research	
7 Quality Measurement		
-quantification		
-quality/productivity relationship		

APPENDIX A

LIST OF WORKSHOP PARTICIPANTS

Participants in the
Productivity Research and Development Planning Workshop
Air Force Human Resources Laboratory
Brooks Air Force Base, Texas
20 - 23 September 1983

CMSGT Rene Anzaldua
HQ AFCOMS/DO
Kelly AFB, TX 78241
Autovon: 945-8528

Major Gail Arnott
HQ ATC/XPTT
Randolph AFB, TX 78150
Autovon: 487-6534

Captain Jeffrey S. Austin
LMDC/AN
Maxwell AFB, AL 36112
Autovon: 875-7034

Jerry Bonin
HQ AFCOMS
Kelly AFB, TX 78241
Autovon: 945-8528

Dr. Kent S. Crawford
Navy Personnel R&D Center
San Diego, CA 92152
Autovon: 933-6935

Major Thomas R. Cunningham
HQ Air University
Maxwell AFB, AL 36112
Autovon: 875-7944/5165

Lt Col A.R. Dahms
HQ USAF/MPME
Washington, D.C.
Autovon: 227-4817

Ms. Dee Davies
AFMEA/MERP
Randolph, AFB, TX 78150
Autovon: 487-6866

Mr. Robert Denton
HQ AFMPC/MPCYPR
Randolph AFB, TX 78150
Autovon: 487-2849

Major John O. Edwards, Jr.
HQ ATC/XPTT
Randolph, AFB, TX 78148

Lt Col James Ferry
SA-Air Logistics Center
Kelly AFB, TX 78241
Autovon: 945-7491

Captain Fred Gibson
AFMPC/MPCYPR
Randolph AFB, TX 78150
Autovon: 487-2849

Major Robert Ginnett
Yale School of Organ & Mngt.
Box 1A, New Haven, CT 06520
203-272-6608

Major Robert A. Gregory
HQ USAFA/DFBL
Colorado Springs, CO 80840
Autovon: 472-3860

Lt Wayne Hanson
AFMEA/MERP
Randolph AFB, TX 78150
Autovon: 487-2030

Lt Col Ron Halsted
LMDC/MC
Maxwell AFB, AL 36112
Autovon: 875-7095

Lt Roger Hawkins
HQ MAC
Scottt AFB, IL 62225
Autovon: 638-2903

Captain Richard J. Heyser
HQ AFMPC/MPCYXX
Randolph, AFB, TX 78150
Autovon: 487-5926

Dr. Raymond Katzell
New York University
6 Washington Place
New York, NY 10003
212-598-2643

Major Richard Kierbow
AFMEA/MERP
Randolph, AFB, TX 78150

Mr. Robert Leckliter
HQ TAC/XPMP
Langley AFB, VA 23665
Autovon: 432-5174

Lt William Long
HQ ATC.XPMMS
Randolph, AFB, TX 78150
Autovon: 487-2337

Maj Gen Vince Luchsinger
HQ AFSC
Andrews AFB, MD 20334

Lt Col James Oates
AFMEA/MERP
Randolph AFB, TX 78150

Dr. Edward O'Connor
School of Management at
University of Texas
214-690-2091

Dr. Laurel Oliver
Army Research Institute
Alexandria, VA 22333
Autovon: 234-8293

Dr. Roger Pennell
AFHRL/ID
Lowry AFB, CO 80230
Autovon: 926-4388

Dr. Lawrence H. Peters
Southern Illinois Univ.
Carbondale, IL 62901
618-453-3307

Dr. Robert D. Pritchard
University of Houston
Houston, TX 77004
713-749-1835

TSGT William Proffitt
HQ ATC/XPMMS
Randolph AFB, TX 78150
Autovon: 487-2337

Mr. Al Reese
HQ AFLC
Wright-Patterson AFB OH 45433
Autovon: 787-2275-7771

Colonel W. E. Rosenbach
HQ USAFA/DFBL
USAF Academy, CO 80840
Autovon: 259-2514

Dr. Benjamin Schneider
University of Maryland
College Park, MD 20742

Major Lawrence O. Short
LMDC/AN
Maxwell AFB, AL 36112

Lt Col Jerry Snow
LMDC/MCC
Maxwell AFB, AL 36116
Autovon: 875-7095

Major Hugh Spivey
HQ USAF/MPME
Washington, D.C. 20330
Autovon: 224-0771

Dr. Robert Steel
AFIT/LSB
Wright-Patterson, AFB OH 45433
Autovon: 785-4549

Mr. Stanley Stepnitz
HQ AFSC/MPME
Andres AFB, MD 20334
Autovon: 858-5652

Dr. Thomas C. Tuttle
University of Maryland
College Park, MD 20742
301-454-6688

Major L.K. Vaughn
HQ AFMPC/MPCYXX
Randolph AFB, TX 78150
Autovon: 487-5926

Mr. Frank Wing
XRSP
Kelly AFB, TX 78241
Autovon: 945-7591

Mr. Charles Zimmerman
Westinghouse
PO Box 1693 MS4445
Baltimore, MD 21203
301-765-7102

Lt Col Lloyd Woodman
LMDC/AN
Maxwell AFB, AL 36112
Autovon: 875-2303

AFHRL WORKSHOP STAFF
BROOKS AFB, TX 78235

Dr. William E. Alley
AFHRL/MOT
Brooks AFB, TX 78235
Autovon: 240-2244

Dr. Nancy Guinn
AFHRL/MO
Brooks AFB, TX 78235
Autovon: 240-2244

Lt Col Rodger D. Ballentine
AFHRL/MODP
Brooks AFB, TX 78235
Autovon: 240-3648

Dr. Charles N. Weaver
AFHRL/MODP
Brooks AFB, TX 78235
Autovon: 240-3551

Colonel Tom Bronzo
AFHRL/CC
Brooks AFB, TX 78235
Autovon: 240-3605

Mr. Larry W. Wolf
AFHRL/MODP
Brooks AFB, TX 78235
Autovon: 240-3551

MAXIMA COORDINATORS

Ms. Sandra Lightfoot
Administrative Coordinator
8301 Broadway, Suite 212
San Antonio, TX 78209
512-821-5845

Dr. Willie Silva
Workshop Chairperson
St. Mary's University
One Camino Santa Maria
San Antonio, TX 78284
512-436-3314

END
DTIC
4-86