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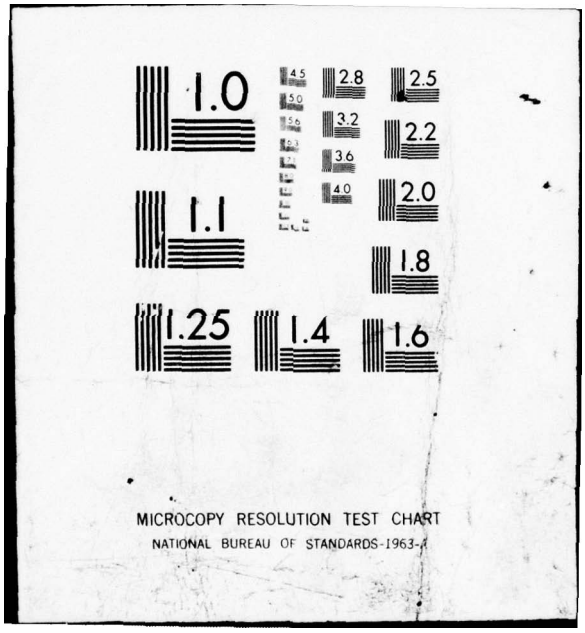
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CREATIVITY AND INNOVATION IN PROGRAM MANAGEMENT STUDY REPORT PMC 73-1

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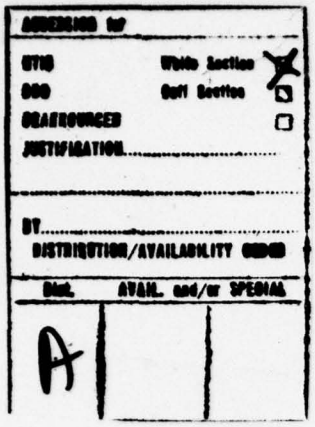

CREATIVITY AND INNOVATION

IN PROGRAM MANAGEMENT

An Executive Summary
of a
Study Report
by

Dale A. De Frank

May 1973

Defense Systems Management School
Program Management Course
Class 73-1
Fort Belvoir, Virginia 22060

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DEFENSE SYSTEMS MANAGEMENT SCHOOL

STUDY TITLE: CREATIVITY AND INNOVATION IN PROGRAM MANAGEMENT

STUDY PROBLEM/QUESTION: Analysis of the application of creativity and innovation in the weapon system acquisition process including the Program Marager's influence on those factors that result in improving that application.

STUDENT REPORT ABSTRACT:

An analysis of the current policies and processes within which a DoD program office acquires a new weapon system including recommended ways in which a Program Manager can influence his program office to produce innovative solutions to problems and requirements encountered throughout the weapon system acquisition process.

KEY WORDS: MATERIEL ACQUISITION PROGRAM MANAGEMENT PROJECT MANAGEMENT CONCEPT FORMULATION

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DALE A. De FRANK
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Class
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May 1973

CREATIVITY AND INNOVATION

IN PROGRAM MANAGEMENT

Executive Summary

Purpose

The purpose of this study is to investigate how creativity and innovation can be influenced in a program office to provide better solutions to problems and requirements encountered throughout the weapon systems acquisition process (WAP).

Results

The present DOD policies do in fact encourage innovation, inventiveness and the exercise of technical and managerial judgement in designing and producing systems. Selection of viable alternative system configurations is one of the critical factors central to the strategy underlying these policies and it is especially important in the earliest phases of the WAP (Conceptual and Validation). The Program Manager (PM) operates within this process and is responsible for the success of his program within specified cost, schedule and performance thresholds.

Since creative and innovative solutions to the problems and requirements encountered throughout the WAP are desirable and encouraged by DOD policies, the PM's resources were analyzed to determine those resources that influence creativity. It was

found that given the people and process resources, the PM can have a significant influence on the creative and innovative output of his program office via influencing the organizational environment (climate) within which these resources function. Organizational climate has a direct influence on the creative output of the organization.

No apparent conflicts were evident when comparing the potential program office climate, the motivation and effectiveness of the program office personnel, and the desirable high affilliation need motivated PM, with those organizational factors which have a positive influence on creative output in the Conceptual or Validation phases.

Conclusions

From the research accomplished, it is concluded that not only are innovative solutions to problems and requirements desired by the DOD in the WAP, but that such solutions can and should be enhanced by the PM in the earlier WAP phases by establishing an organizational climate conducive to such output.

CREATIVITY AND INNOVATION

IN PROGRAM MANAGEMENT

STUDY REPORT

Presented to the Faculty

of the

Defense Systems Management School

in Partial Fulfillment of the

Program Management Course

Class 73-1

by

Dale A. De Frank
MAJOR USAF

May 1973

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CONTENTS

CREATIVITY AND INNOVATION

IN PROGRAM MANAGEMENT*

I. Introduction

A. Background

In August 1972, the Honorable Kenneth Rush, Deputy Secretary of Defense expressed the current situation in weapons system acquisition as [1]

> "I think the weapons we actually need are in jeopardy if there are not better methods used in buying them and getting them created and built."

The problems being addressed by Deputy Secretary Rush are a reflection of the current tight dollar environment in the federal government and the increasing cost trend of weapon systems procured by the Department of Defense (DOD). The result of these contradicting influences was summarized recently by Dr. John Foster Director of DDR&E as [2]

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*ABSTAINER

This study represents the views, conclusions and recommendations of the author and does not necessarily reflect the official opinion of the Defense Systems Management School nor the Department of Defense.

> "In the past we have usually bought the weapon and reduced the numbers in order to stay within fixed total cost limits. As we plan ahead, we see that costs have gone so high and numbers are going so low that we are entering an era when we cannot compete with our major rivals on numbers and performance."

Given this situation, what is being done about it, and what additional steps can be taken to overcome this disparity? The DOD has taken positive steps to overcome the problem of the cost of defense by instituting new weapon system acquisition policies. Under the direction of David Packard, the former Deputy Secretary of Defense, these new policies were formulated and are delineated in the July 13, 1971 Department of Defense Directive 5000.1, "Acquisition of Major Defense Systems."

The strategy that lies behind these policies include:

Incremental Acquisition - where decisions to permit each individual system to proceed step-by-step along the development path are made one at a time.

Total Cost Considerations - where the earliest decision to start development will be made only if total costs of development, acquisition, investment, and operations of the projected system are estimated to be commensurate with the projected performance and also are affordable within realistic budget constraints.

Viable Options - will be maintained until the system chosen for operational deployment is demonstrated to be useful, reliable, maintainable, and purchasable within realistic budget constraints.

This strategy was outlined by Dr. Foster in a recent address to the AFMA-NSIA Symposium [3] where he also stated that [4]

> "We must have other options (to reducing the numbers of weapons to stay within total cost limits). For instance if we see the cost per copy of a fighter plane grow beyond the limit that will permit adequate numbers, then we will have to be able to turn to another option -- say greater numbers of a less capable fighter, or a competing design from another manufacturer, or another Service, or even to an innovative solution to the air-superiority problem that emphasizes nontraditional solutions" (underlines added)

B. Problem Identification

The purpose of this study is to investigate how creativity and innovation can be influenced in a program office to provide better solutions to problems and requirements encountered throughout the weapon system acquisition process (WAP). This study will deal with the "innovative solution" portion of Dr. Foster's suggested strategy supporting the new DOD policies for weapon system acquisition. It will also deal with the Program Managers (PM) role and his impact on the output of such solutions.

The approach taken in the investigation of the aforementioned problem was to conduct an in-depth literature survey in the areas of behavioral science, creativity and innovation, organizational climate influences, and managerial influences that could affect the problem of producing innovative solutions. This information is then used to test the hypotheses reflected in the next section.

II. Statement of Research

A. Assumptions

In formulating the hypotheses for this study, the following assumptions were made:

1. The duration of the weapon system acquisition process (WAP) for major systems is sufficiently long to require the assignment of more than one PM. eg: The Conceptual and Validation Phases have historically taken two to three years, the Full Scale Development Phase has taken three to five years, and the Production Phase has taken even longer. Allowing for some assignment overlap between PMs for efficient transition a "typical" WAP would require at least three PMs given a "normal" assignment duration of three to four years each.[5]

2. Although at present PMs are not specifically selected to match their leadership or their management style to the phases of the WAP they are assigned to manage; they could be.

3. The present selection process of program office personnel does not allow for the specific identification or selection of individuals possessing a high degree of creative or innovative ability.

B. Hypotheses

The basic assumptions listed above were used as a framework within which the following hypotheses were developed. This study will serve to test these hypotheses.

1. Organizational creativity and innovation are desirable aspects in a program office, especially during the earlier phases of the WAP (Conceptual and Validation).

2. The organizational climate in a program office has a major influence on the creative or innovative output of the office.

3. The PM can have a direct influence on the organizational climate of the program office and therefore can influence the production of creative and innovative solutions to problems encountered during the WAP of his program.

C. Limitations of the Study

The hypotheses outlined above are probably applicable to a multitude of areas in the DOD, other federal government agencies, and non-government activities. Research has already been conducted in some related aspects of this topic and where applicable will be referenced. Time and resource limitations make it necessary to limit this study to the DOD in general, and more specifically to the WAP within DOD.

D. Definitions

For purposes of this study and to provide the reader with a

baseline understanding from which we will build, included below are certain key definitions that must be clearly understood before the results of this study can be meaningful.

1. Creativity has to do with the development, proposal, and implementation of new and better solutions.[6] Put another way, it is the ability to produce something new and valuable. That something may be knowledge, facts, relationships, understanding, applications, process, products, hardware, etc.[7]

2. Organizational Climate or environment is the product of many separate components (supervisory style, morale, employee satisfaction, etc.) interacting with each other, with people in the organization, and with criterion measures of effectiveness for people and the organization.[8]

3. A creative environment is that environment which is most conducive to creativity.[9]

4. Innovation is the product of creativity.[10]

5. Productivity is one of the resultants of innovation.

III. Weapon System Acquisition Process Considerations

A. Policies and Strategies

The problem facing the DOD in weapon system acquisition under tight budget constraints is only a reflection of the many problems facing the nation and our national security. In President Nixon's U. S. Foreign Policy statement in February 1970, he said

> "Our policy must be creative: foreign policy must mean more than reacting to emergencies; we must fashion a new and positive vision of a peaceful world, and design new policies to achieve it" 11

> "Creativity: Above all, a foreign policy for the 1970s demands imaginative thought. In a world of onrushing change, we can no longer rest content with familiar ideas or assume that the future will be a projection of the present" 12

> "Full Range of Options..... I refuse to be confronted with a bureaucratic consensus that leaves me no options but acceptance or rejection, and that gives me no way of knowing what alternatives exist" 13

The proposals outlined above are reflected in the current policies of the DOD in that the entire philosophy is now based upon overall force-mix level planning to maintain a level of sufficiency within current budget limitations. One of the main

strategies to this policy lies in the creation and maintenance of viable options in the WAP until such time that we are convinced that the alternative under consideration is the best solution to our need in support of our strategy of realistic deterrance. Former Secretary of Defense Melvin Laird stated it as

> "Our goal in weapons acquisition is to achieve an optimum balance among weapons effectiveness, weapons costs, and the timeliness of entry into the inventory"

> "All of our new national security strategy planning - - all of the innovations we are putting into effect - - will be undermined if we are not able to continue the process that has been started in improving our weapons acquisition process" 14

The policy implementing directives that have been published (eg: DODD 5000.1) reflect the concept of maintenance of viable options via the establishment of the Defense Systems Acquisition Review Council (DSARC) process which reviews each major weapon system during its transition points throughout its acquisition cycle, and recommends to the Secretary of Defense (Sec Def) continuance, redirection or cancellation based on the current program status and the current need. DODD 5000.1 specifically requires the PM to prepare or update a Development Concept Paper (DCP) for each of these DSARC reviews.

> "The considerations which support the determination of the need for a system program, together with a plan for that program, will be documented in the DCP the DCP will define program issues, including....areas of major risk, system alternatives, and acquisition strategy" 15

B. PM Responsibilities

From the various implementing directives it is clear what the PM's responsibilities are in the DCP/DSARC process - not the least of which includes the identification and maintenance of viable options throughout the process. The initial establishment of alternatives is most critical in the Conceptual Phase.

> "The objective of the Conceptual Phase is to define and select the system concepts which warrant further development. Outputs are alternative configurations with the preferred configuration identified....and capable of achieving the stated objectives within reasonable cost and schedule constraints" 16

The PM therefore has as one of his basic responsibilities that of evaluating the need (usually expressed in a Required Operational Capability or ROC, in terms of the threat or a deficiency) and providing a system that satisfies that need. The process of providing such a system as previously mentioned includes detailed analysis of alternative configurations and trade-off studies to show the relative merits of the alternatives,

and is initiated early in the Conceptual Phase when the alternatives are nothing more than concepts. The process of conceptualizing alternative systems can be enhanced greatly by creative or innovative approaches to alternative selection in addition to the more mechanical iterative process of building onto what we already have. This concept is encouraged by the DOD in their policies.

> "It is the policy of the Department of Defense to encourage innovation, inventiveness, and exercise of technical and managerial judgement in designing and producing systems....to meet operational requirements, with due consideration to the limitations that must be imposed because of availability, or non-availability of resources, operational environments, and military mission" 17
> (underlines added)

The question of availability or non-availability of resources (people, money, and hardware) is important to this study in that the PM usually has limited people resources and he obtains these resources from a personnel selection system that does not allow for the specific identification or selection of individuals possessing a high degree of creative or innovative ability (assumption #3). This situation on the surface would not appear to be supportive to the PM's ability to carry out his responsibilities in the area of producing creative or innovative

solutions to problems or requirements in the WAP. This study will address this question when it tests the hypotheses listed in Section II.

C. Planning, Programming and Budgeting System (PPBS)

The PPBS is used by the DOD to aid in the establishment of overall force-mix levels and weapon system needs in light of its defense requirements to satisfy our national security objectives. It provides for the orderly analysis of national security objectives, the establishment of the force-mix levels required to achieve those objectives, the identification of force-mix level shortcomings (requirements for additional and/or new weapon systems), and the estimated costs associated therein.

The Office of the Secretary of Defense (OSD), the Joint Chiefs of Staff (JCS) and the Military Departments are all integrated into the PPBS system in a form of checks and balances. The system provides for the planning, programming and budgeting of requirements necessary to fulfill DOD's mission of national defense. One output of the PPBS is the identification of new weapons systems and upon approval by OSD, the Military Departments are charged with the development of same under the policies outlined in DODD 5000.1 and the DCP/DSARC process.

Two main considerations of the PPBS are cost and alternatives. Both of these considerations are influenced by the PM in that the program office is responsible for the cost estimates and the determination of alternative system configurations to be considered in meeting the need. The alternative configuration determination is one of the key goals of the DCP/DSARC process as previously mentioned and of the PPBS process

> "The fifth goal or end of a PPB system is the crucial step. This goal is the analysis of alternatives the final the most effective means of reaching basic program objectives, and to achieve these objectives at the least cost" 18

Again the DOD system is not unlike the NSC system in its approach to problem solving

> "The NSC system is meant to help us address the fundamental issues, clarify our basic purposes, examine all alternatives, and plan intelligent actions" 19 (underlines added)

The basic technique involved in these systems is the scientific approach to problem solving i.e., Identify the real problem, select various feasible alternatives to solve problem, evaluate the alternatives, select the best one, and implement it. The only qualifier the President and the Secretary of Defense places on this is in the implementation phase. At that point controls have been instituted to revalidate the requirement and

the selected alternative over time along with maintaining other viable options as backup alternatives.

In the WAP, the PM is central to this very issue. He has at his disposal limited resources (people, money and techniques) with which he must produce a system and satisfy the requirements of the WAP. His people resources are usually fixed in his program office, his funds are limited, and the techniques (systems analysis, etc) are only useful to the extent that they are manipulatable by his people. The question now becomes one of how can the PM influence the output of system alternatives, options and meaningful analysis given these "fixed" resources. The balance of this study will attempt to analyze this question and provide some insight into possible solutions to it.

IV Implications of Creativity on the WAP

By definition, creative and innovative solutions provide new and better ways of accomplishing objectives. Therefore, the PM must find ways to influence his organization that will produce such outputs. This is most important in the earliest phases of the WAP. i.e., The Conceptual and Validation Phases.

> "It is critical that the right decisions be made during this conceptual effort; wrong decisions create problems not easily overcome later in the program." 20

The critical decisions referenced above include a myriad of necessary and required activities the PM must accomplish in the Conceptual and Validation Phases. Many of these activities can be improved upon if creativity and innovation are included in the process of satisfying such requirements. The following listing reflects some of the more important outputs of the two initial WAP phases which can be improved upon by the program office through creativity and innovation.

CONCEPTUAL PHASE

- The identification of and description of alternate system solutions
- An identification of major risk items and action planned to address them
- A program plan which broadly defines and quantifies performance, cost and schedule objectives
- Identification of any special logistic support problems
- Trade-off analysis between system capability, cost and schedule
- Meaningful relationships between need, urgency, risks and worth shall be established
- Operational concept established
- Feasibility assessed
- Preliminary test requirements identified
- Plans established (management, advanced procurement, and preliminary production, test and logistic support)
- Development Concept Paper (DCP) prepared.

VALIDATION PHASE

- Reverification of and a broadening of viable system options
- An up-to-date statement of the operational need
- A specification of system and subsystem performance, critical physical and functional interfaces, and test requirements
- Continual risk and trade-off analysis
- A program plan for the Full-Scale Development Phase and a broad production and logistics support plans
- Initial determination of operational suitability
- Development of management information/program control systems
- Plan for laboratory involvement
- Evaluation of contracted effort
- Integration of using command
- Identification of contractor incentives
- Update DCP

From a review of the listing it is self-evident that the vast majority of these key requirements the PM must satisfy, can benefit from the application of creative and innovative approaches utilized in their resolution. The alternative of disregarding such approaches is the strong possibility of foregoing the optimum solution to the requirement which could result in increased cost or time, decreased performance or any combination thereof.

Given that creativity and innovation is both encouraged by DOD policies and that the application of same is especially desirable in the earlier phases of the WAP, the question now becomes; "How can creativity be positively influenced in the program office?" To answer this question, we must analyze in terms of the PM's resources, what the interactions of these resources are in relation to creativity.

"CREATIVITY = PERSON + PROCESS + ENVIRONMENT" [21]

Due to the present personnel selection process, the PM has little, if any, influence on obtaining those persons that have a high degree of creative ability. The process element of the model can be divided into two components - external and internal. The external component of the process is defined as the policies, procedures, the PPBS and the DCP/DSARC system, under which the PM operates. This component is relatively fixed and the PM has little,

if any, influence on it. The internal component is defined as the program office procedures and policies, relationships with functional support organizations, and the mix of military/civilian/consultant program office team, over which the PM has significant influence.

The internal process component has the same potential in it for improved creative and innovative output as the last element of the model- the environment, and can be similarly influenced by the PM as will be shown in the next two sections of this study.

The following section will deal with the organizational influences on creativity, and Section VI will deal with the influence the PM can have on the organization to result in increased creative output by the program office.

V. Organizational Climate and Creativity

Before we deal with how a PM might influence his organization to be creative and innovative, we must establish some concepts such as what a creative organization is, what environments influence creativity, and what other organizational aspects are involved such as the effect on administrative performance and motivation. An attempt will be made to interrelate these aspects to provide an understanding of what results can be expected when the PM influences his organization to this end.

A. The Creative Organization

Much has been written on the subject of the creative organization, Steiner characterizes it as [22]

> "Has open channels of communication, adhoc devices, more contact with outside sources, hetergeneous personnel policy, non-specialists assigned to problems, an objective fact-founded approach, a lack of financial and material committment to products, flexibility, more decentralization and diversification, administrative slack, time and resources to absorb errors, organizational freedom, freedom to discuss ideas, organizational autonomy, and allowances for innovation."

The organization described by Steiner obviously is the ideal and might be found in some pure basic or theoretical research laboratory environments. It would be unrealistic to think that a program office could be organized in such a manner due to time and money constraints - or would it? After reviewing

the list again we probably could - given the time-provide an argument for each and every item on the list, that a program office to one degree or another does have the potential to operate in a somewhat like manner. That would be beyond the scope of this study, but the point to be made here is that there is potential in each area and given the proper emphasis by the PM, his program office could to some degree, obtain the attributes listed by Steiner. As will be discussed later, this is a function of the need (based on the WAP phase), the emphasis the PM places on these areas, as well as the PM's management style.

B. Relationship of Environment to Creativity

From Section IV it was shown that:

CREATIVITY = PERSON + PROCESS + ENVIRONMENT

It was also shown that the PM had little or no influence on the "PERSON" and the external component of the "PROCESS" aspects of the model. Here we will discuss the internal component of the "PROCESS" and the "ENVIRONMENT" aspects of that relationship.

> "The environment component of the model appears to offer the best opportunity to bring about increased creativity..." 23

> "The literature indicated that a favorable creative environment (which includes physical, psycological, professional, and managerial aspects) should enhance the creativity..." 24

> "It seems reasonable to suppose that if an individual.....has the necessary mental capacity for creative thinking...whether or not he is actually creative will probably depend largely on...environmental factors" 25
>
> "....one can see that the element of creative thinking can be greatly influenced by the business atmosphere in which the individual works." 26

Much has been written on the subject of the environment and creativity and the overwhelming conclusion is that the environment has a major influence on creativity. The point to be made is not that the environment influences creativity, but rather what influences the environment. In the context of this study the environment and the organizational climate are synonomus. Therefore he who sets the organizational climate directly influences the creative and innovative output of that organization.

1. Environments that Influence Creativity

Michael J. Stahl conducted an in-depth literature survey to determine those organization factors that effect creativity. His findings were [27]

> "Management receptivity to new ideas, an incentive system that rewards creativity, broad job descriptions, time for independent research, open communication channels both vertically and horrizontally, freedom is scheduling work hours, freedom in choice of problem, freedom and antonomy in work procedure and methods, recognition for creative accomplishments, challenging work, stimulating

colleagues, organizational acceptance of conflict and dissent organizational acceptance of non-conformity, employee understanding of organization objectives, little administrative distractions and routine duties, excellant facilities, little fear of failure, sufficient time to **just think**, organization structure flexibility, opportunity for professional society participation, opportunity to publish, relaxed flexible controls, management encouragement of and confidence in employees, participative management, dual promotion ladders, and broad spans of control."

Again, this list of organizational factors that affect creativity represents the ideal and might be characterized by a "think-tank" type of organization. This is not what a program office is, but reflecting over the list once more one can see that the project office organization can have many of these factors available to it to one degree or another. To what degree they are available will reflect the potential of that organization in the area of creative and innovative solutions. These factors can be influenced and this is where the PM holds the key which we will discuss in Section VI.

2. Organizational Climate and Organizational Effectiveness

When the organizational climate is influenced to increase creative and innovative output, what other considerations must be accounted for so that the overall organizational effectiveness is not impaired. This question was dealt with by Edgar Schein in an article on organizational effectiveness, where he evaluated criterion for such effectiveness in light of the various behavioral science theories. He stated the following passages:

"Bennis proposes the following three criteria of (organizational) health - adaptability, a sense of identity, and the capacity to test reality. A fourth criterion is a state of integration among the subjects of the total organization... ..which is central to the work of Argyris" 28

"McGregor has argued in a similar vein for the integration of personal and organizational goals, Blake and Mouton argue for the integration of concern for production and concern for people." 29

"I have tried to argue for an approach to organizational effectiveness which hinges upon good communication, flexibility, creativity, and genuine psychological committment....the argument is that systems work better if their parts are in good communication with each other, are committed, and are creative and flexible" 30 (underlines added)

From this no apparent conflict is evident between organizational effectiveness and organizational climate tailored to increase creativity and innovation. In fact this referenced article indicates that the two are complementary.

3. Motivation and Organizational Climate

Given that creativity is desirable and that organizational climate and the internal component of the process which can be construed as a part of the "environment", does influence creativity and does not degrade overall organizational effectiveness; then we must address the question of motivation and organizational climate. A detailed study by Titwin and Stringer [31] of the Harvard Business School on this topic is discussed herein. They subjected the

McCleland - Atkinson theory of human motivation to the concept of organizational climate. The authors also trace the concept of climate back to the work of Kurt Lewin and illustrate its relationship to various other theories of individual behavior, management, and organization including those of Douglas McGregor, Blake and Mouton, etc.

They conclude that the major implications of the study revolve around two primary findings

> "First it seems clear that distinct organizational climates can be created by varying leadership styles, and second, once created the climates seem to have significant, often dramatic, effects on motivation and correspondingly, on performance and job satisfaction" 32

From this referenced study it appears that there is no conflict between organizational climate from a positive motivation standpoint versus a creativity influenced environment standpoint.

VI Management Influences

Up to this point we have been discussing the need for creativity and how it can be influenced by the organizational climate. We must now turn to the aspect of how to influence the organizational climate itself, which is the key to testing the third hypothesis.

A. Manager Selection

As we discussed in Section II a typical major weapon system acquisition cycle is sufficiently long to require the assignment of more than one PM. This point has also been made by Jay Berkowitz, DSMS Class 72-2 in his Student Study Paper [33]

> "The total process may take from 7 to 10 years. The tenure of the PM is normally 2 to 3 years. Therefore, several PMs can be selected during the total acquisition process, possibly to coincide with the specific phases. A program manager could carry his program through a DSARC at which point another PM could begin his tenure."

Berkowitz concludes that during the Conceptual and Validation Phases a high n-Aff (affiliation) type PM is desirable, whereas in the Full-Scale Development and the Production/Deployment Phase, a high n-Ach (achievement) type PM is desirable. [24] Accepting that, the question now becomes one of whether or not a high n-Aff type PM would be likely to provide that necessary influence to the organizational climate of his program office which could result in increased creativity and innovation? To answer this question we must again look at some key organization factors which influence creativity and compare them to a high n-Aff motivated PM.

FACTOR [27]	HIGH n-AFF CHARACTERISTICS [35]
1. Freedom & Autonomy in Work Procedures & Methods	1. Organization Loosely Structured
2. Little Fear of Failure	2. High Risk Taking is Required
3. An Incentive System that Rewards Creativity	3. Reward System Inadequately Defined
4. Organ. Structure Flexible	4. Matrix Command Structure
5. Broad Job Descriptions, Freedom in Scheduling Work, Choice of Problem, & Autonomy	5. Ambiguous Environment
6. Organ. Acceptance of Conflict	6. Conflict Environment
7. Management Encouragement of & Confidence in Employees	7. Delegate Aurhority to Subordinates
8. Management Receptivity to New Ideas	8. Innovation/Creativity Desired

In comparing these two lists all high n-Aff characteristics support all organizational factors which positively influence creativity with the exception of the third item (an incentive system that rewards creativity versus a reward system that is inadequately defined). If we compare it to the eighth item on the list however, it becomes clear that if a high n-Aff desires innovation and creativity, then the lack of an incentive system that rewards creativity might not represent a major incongruity.

From this it would appear that in the earlier WAP phases a high n-Aff motivated PM would be the logical choice and the result could be an organization whose climate enhances the desired creativity and innovation if properly influenced by that PM. An interesting supportive point made by Berkowitz is that [36]

> "Resultant creativity and innovation in the program is directly related to the degree of risk-taking that a PM can tolerate."

B. Managerial Influence on Organizational Climate

Now that we have outlined the need for creativity in the WAP and that the PM can directly influence the organizational climate which in-turn directly influences creativity, we must now deal with the question of how the manager influences the environment.

First the manager can provide for those organizational factors which support creativity in his program office as outlined in Section V. More specifically however the PM can introduce and support various techniques that stimulate creative thinking to aid in the satisfaction of the required activities encountered in the

Conceptual and Validation Phases of the WAP.

The basic concept behind the applicability of these techniques in any organization (with the people resource as "given") is that everyone has some degree of creative ability and through proper orientation this innate creative capacity can be utilized.[37] The techniques for orienting and bringing forth creative ability are well documented and were summarized by Whiting as [38]

> "A positive attitude is established...Unusual ideas are sought...through Analytical Techniques (checklist, attribute listings, and the input-output technique), Free Association Techniques (brainstorming, buzz sessions, and the Gordon Technique), and Forced Relationships Techniques (listings, catalog, and focused object techniques)"

An example given by Whiting of one of the simplest and most commonly used analytical techniques is the checklist [39]

1. Put it to other uses
2. Adapt
3. Modify
4. Magnify
5. Minify
6. Substitute
7. Re-arrange
8. Reverse
9. Combine

Whiting summarizes his article by stating that [40]

> "Creativity is encouraged by a permissive atmosphere-this is an organizational climate in which freedom of expression, mutual trust and respect are present. Once management becomes aware of this more organizations will take steps to see that such an atmosphere exixts"

C. Other Managerial Influences on Creativity and Innovation

Other influences the PM has in promoting creativity within his program office are in the areas of communication and group problem solving. Denis Pym in a recent article compares innovation and the "one best way".[41] He suggests that the traditional or mechanical structure (one best way) contrasts directly with the scientific or progressive structure (innovation) and that "only one best way" produces a situation where effective performance cannot be maintained in changing conditions and that organizational climate is important for the manager to foster to overcome the "one best way" syndrome.

Another aspect of influencing the organizational climate that was eluded to earlier (Section V. B. 1) and is included at this point for emphasis is that of communications. Harold Leavitt proved through experimentation that two-way communications, although somewhat slower than one-way, resulted in more accuracy and a greater number of ideas were exchanged.[42] This directly supports the previously identified technique of increasing creativity through association.

One final aspect of this study (although this does not mean that the list is in any way fully exhausted) is in the area of group problem solving. The question here concerns whether or not the output from a group can be considered to be more creative or innovative than that produced by an individual, and if so would provide another factor

for the PM to consider. N. Maier at the University of Michigan reports that the key to group problem solving hinges on developing a style of discussion leadership which maximizes the group's assets and minimizes its liabilities. [43] He further states that

> "....the potential for group problem solving can be exploited and if its deficienceis can be avoided, it follows that group problem solving can attain a level of proficiency not ordinarily achieved"

As to group versus individual problem solving and creativity Maier concludes [44]

> "If liabilities inherent in groups are avoided, assets capitalized upon, and conditions that can serve either favorable or unfavorable outcomes are effectively used, it follows that groups have a potential which in many instances can exceed that of a superior individual functioning alone, even with respect to creativity."

This then would lead us to conclude that to further influence creativity in his program office, the PM should encourage group problem solving after recognizing the important role the discussion leader plays and provides for that requirement. This group problem solving process capitalizes upon the total pool of information and provides for greater interstimulation of ideas while enhancing innovative creativity.

VII Summary and Conclusions

A. Conclusions

From the research and findings reported herein, certain conclusions have been drawn are summarized below.

1. Current DOD policies encourage innovative solutions to problems and requirements encountered in the WAP.

2. Current strategies supporting the DOD policies include the identification and maintenance of viable options throughout the WAP.

3. The PM has a direct responsibility via the DCP/DSARC process to identify and maintain viable options throughout the WAP.

4. The most critical phases of the WAP from a decision-making standpoint are the earlier phases (Conceptual and Validation). The many required outputs identified in these phases (ref Section IV) can be improved upon by utilization of creative and innovative approaches in the development of those outputs. The alternative to not encouraging the use of such approaches is to forego a possible optimum solution at the expense of increased cost or time, decreased performance, or a combination thereof.

5. Two methods used in the process of satisfying the various required objectives in the Conceptual and Validation phases of the WAP are to modify existing hardware, techniques or procedures; or combining that with new innovative solutions to satisfy the objectives. The latter method is the desired

approach.

6. Creativity is the process of producing something new and better, therefore, it can play a direct role in the production of innovative solutions to the stated requirements.

7. Creativity is composed of the elements of people, process, and environment. A PM has little or no influence on the selection of people from the standpoint of creative ability, or in the external component of the process element which was defined as the policies, procedures and systems within which he must operate.

8. The PM does however have a great opportunity to influence the internal component of the process element and the environment (organizational climate) within which his program office operates.

9. An organizational climate which influences creativity and innovation positively, does not reduce its organizational effectiveness and does not impair the motivation of its people with respect to the achievement of its goals during the earlier phases of the WAP.

10. In the Conceptual and Validation phases of the WAP, a high n-Aff motivated PM is desired and is not contrary to the requirements for an organizational climate which influences creativity and innovation.

11. Many organizational climate factors directly influence creative and innovative output of the program office, and most of these factors can be provided for to some degree by the PM.

Before any attempt is made at influencing the organizational climate of his program office however, the PM should have a plan of action which would include the following steps:

a. Decide what kind of climate is most appropriate given the nature of his workers and the jobs to be done.

b. Assess the present climate.

c. Analyze the climate gap, if any, and establish a plan to reach the desired climate.

d. Take concrete steps to close the gap.

e. Evaluate his effectiveness in terms of his plan.

The PM should also realize during this process that the thing that counts in organizational climate is how the program office perceives the climate, regardless of what the PM thinks it is!

To support the steps outlined above an extensive list of organizational factors are included below. These factors all have a positive influence on the creative output of an organization and as such, if instituted, will provide that organizational climate which enhances such output. The list can be used in evaluating the present climate versus the proposed or desired climate and provides the PM with those factors that can aid in closing the gap between the two.

Organizational Factors That Have a Positive Influence on Creative Output

- Avoid detailed task supervision
- Positive management receptivity to new ideas
- An incentive system that rewards creativity
- Broad job descriptions
- Time for independent effort
- Open horizontal and vertical communications
- Freedom in scheduling work hours
- Recognition for creative accomplishment
- Challenging work
- Stimulating collegues
- Organizational acceptance of conflict and dissent
- Organizational acceptance of non-conformity
- Employee understanding of organization objectives
- Minimize administrative distractions and routine duties
- Good facilities
- Minimum employee fear of failure
- Administrative slack time - to just think
- Support for professional society participation
- Relaxed flexible controls
- Management encouragement and confidence in employees
- Participative management
- Dual promotion ladders
- Broad spans of control
- Use of ad hoc devices
- Encourage contact with outside sources
- Non-specialists assigned to problems
- Lack of committment to "one way"
- More decentralization and diversification
- Adaptability
- Sense of identity to organization and goals
- Management acceptance of risk
- Employ group problem solving (with effective leader)
- Use two-way communication (face-to-face)
- Management with high tolerance for ambiguity
- Encourage flexibility, imagination and innovation
- Discourage strict adherence to rules and procedures
- Stress overall evaluation of final product of effort
- Attitude of constantly seeking new and better ways of doing work
- Do it the old way, only if it is the best way.
- Avoid elimination of all conflict and cross purpose actions
- Avoid elimination of all friction
- Use Administrative Guides rather than Admin Directives
- Defer judgement and action
- Manage by objectives
- Use consistency in dealing with subordinates

- Make consequences of innovation in relation to goals visible
- Increase availability of information to support remote associations
- Discourage middle managers use of authoritative style of management
- Freedom to make suggestions and complaints
- Jointly selected tasks against organizational goals
- Encourage autonomy in carrying out tasks
- Open door policy
- Freedom of expression, mutual trust, and respect must be maintained
- Minimize crash approach to problem solving especially in those areas which have a vital and long-run effect
- Enthusiasm for change
- Desire for new experiences
- Openness to more than one course of action
- Employ techniques to orient and bring forth creative ability
    A. Analytical
        - Checklists
        - Attribute Listings
        - Input-Output Techniques

    B. Free Association
        - Brain Storming
        - Buzz Sessions
        - Gordon Technique

    C. Forced Relationships
        - Listings
        - Catalog
        - Focused Object Technique
- And, and understanding that great profits may result from increased efficiency, and also that equally great profits may result from creativity and innovation.

In summary then,

CREATIVITY IN PROGRAM MANAGEMENT IS:

- the process from which innovation is the product

- the production of new and better solutions

- supported by current DOD policy

- supportive to the strategy of identifying viable options

- most important in the earlier critical phases of the WAP

- a desired technique in the production of solutions to problems and requirements encountered in the WAP

- composed of the elements of people, processes and environment
- mainly influenced by the PM via the internal process and environment elements
- not contrary to the desired high n-Aff PM (in the earlier phases of the WAP)

B. Tests of Hypotheses

1. Hypothesis # 1 - Organizational creativity and innovation are desirable aspects in a program office, especially during the earlier phases of the WAP.

TEST: Conclusions # 1, 2, 3, 4, 5 & 6 support this hypothesis.

2. Hypothesis # 2 - Organizational climate in a program office has a major influence on it's ability to develop creative or innovative solutions to problems.

TEST: Conclusion # 9 supports this hypothesis

3. Hypothesis # 3 - The PM can have a direct influence on the organizational climate of the program office, and therefore can influence the production of creative and innovative solutions to problems encountered during the WAP.

TEST: Conclusions # 8, 10 and 11 support this hypothesis.

C. Recommendations

For the earlier phases of the WAP, PMs should be selected with due consideration given to choosing those with higher n-Aff motivations. Also, those PMs should be made aware of recent research that has shown

that organizational climate can be influenced by the manager to increase the probability of his program office producing more creative and innovative solutions to his problems which is especially desirable in the earlier phases of the WAP.

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