

IMPROVING EFFECTIVENESS IN R&D

Edited by

RALPH I. COLE

Center for Technology and Administration
THE AMERICAN UNIVERSITY

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Preface

The prospect of improving the effectiveness of research and development is indeed a challenge worthy of our best efforts. To "highlight" the scope and to provide some means of summarizing existent expertise, The Center for Technology and Administration of The American University recently held an Institute dealing with this subject.

Eighteen papers by a distinguished group of authors resulted from this Institute. Presented in this volume, they focus attention upon many of the major aspects which are presently causing immense concern to R&D managers, whether in "big" or "little" science.

In order to improve we must know where we have been and arrive at a consensus of the best path now to be taken. Our aims, the roadblocks to overcome, the tools to be used—must all be inter-related to increase managerial visibility. To do less is to reduce our chances of maintaining our current posture in science and technology.

In Part I, the reader is given an overview of the R&D managers' role, how this differs from conventional administration, the tools presently employed, as well as those needed to make the future even better than the past; and an appraisal of administrative controls and means for their optimization. Finally, the problem of duplication of new research programs that arises from a lack of suitable and adequate reporting and retrieval means for R&D information is analyzed.

Part II treats the impact of controls upon R&D progress. The highlights: a practical case of using computers in the research administration process by those charged with Air Force contract research; an appraisal by a management consultant as to the effectiveness of R&D controls in government research; and the problems of attempting to apply "big" science controls to "little" science (big business vs small business administration).

The authors contributing to Part III deal primarily with the planning functions in R&D—more specifically, identification and evaluation of planning objectives; cost effectiveness and its relationship to R&D; and the pitfalls to be avoided in structuring R&D to enable the use of new technological concepts.

In Part IV, several practical examples of the role of systems analysis in R&D programs are given by authors who already have a deep involvement. These papers should prove of great value to those who now are tempted to apply this tool to their new operations.

One can hardly analyze effectiveness in R&D administration without investigating the government's role. This subject is carefully treated by

three noted authors in Part V. In brief, the first paper in this group analyzes with great clarity the evolution of certain specific technologies which have come to light by virtue of federal support; the second paper deals with the ACE's effort to transfer its technology to industrial firms; the final paper presents a forceful analysis of the federal government effort to disperse the sources of idea generation throughout our nation—"The State Technical Services Act."

Part VI looks at the "Creative Man." What does he demand of management? How can you recognize and evaluate him? It is hoped that the two authors answering these questions have clarified many issues of prime importance to managers.

Part VII is a plea for continuing the education of our technical people and their managers. We share the concern that much greater emphasis must be given to this problem.

In acknowledgment, it can indeed be said that we "owe so much to so few." Our well-informed speakers stimulated "thinking in depth," certainly beyond that which could have been structured ahead of time. They are to be congratulated for their giving of themselves and for their ideas. To our responsive audience we also owe a debt of gratitude for the meaningful contributions made to R&D Management Science.

RALPH I. COLE
Editor

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Contents

	Page
Preface	iii
List of Contributors	v
Part I. THE R&D ADMINISTRATIVE PROCESS	
An Overview of the R&D Managerial Problem	3
DANIEL D. ROMAN	
In forcibly commenting upon R&D administration, the author points out distinguishing "structural differences" in requirements between this and conventional management activities. The major R&D management tools are identified and related to the functions for which they are useful. It is pointed out that a GRADUATE CURRICULUM in the Management of Technology at The American University has been created to fulfill a need to better respond to operational problems. It is particularly pertinent to the R&D environment.	
Discussion	12
Optimizing Administration Controls	17
C. M. VERONDA	
Management controls may take many forms. Those believed superior are those which are deliberately designed with the active participation of the technical personnel directly involved. A case is made that this achieves "management by exception and results in optimizing management development." The author goes on to show that in the usual case additional individual motivations are required to accomplish such functions as proper program planning, organizational cohesion, etc. Examples of both well-designed and poorly applied controls are cited to make the point that, despite the fact that <i>controls</i> do not solve technical problems, they can and actually do provide a proper planning base to achieve optimization of any specified program.	
Discussion	25
Reporting and Retrieval of R&D Information	29
JOHN I. THOMPSON	
R&D managements are constantly concerned not only with the so-called "duplication" of new research programs but with the failure to really apply the results of <i>past</i> technical effort, due primarily to the non-availability of suitable information. Exposure to prior results occurs sporadically, and all too often we find ourselves repeating that which "has already been accomplished." While it is not possible to arrive at the "cost" of this duplication, there is no doubt that it would be cheaper to improve upon our "retrieval" than to continue as we are.	
Discussion	40

Part II. IMPACT OF CONTROLS ON R&D PROGRESS

Computers in the Research Administration Process 47

WILLIAM J. PRICE AND CARL S. JENNINGS

The Air Force Office of Scientific Research of the Office of Aerospace Research established an automated Management Control Data System (MCDS) in 1962, which has been integrated into organization line-management functions and is currently used in the management of basic research programs under AFOSR cognizance.

A brief history of the origin of the AFOSR MCDS is presented along with administrative considerations and system design criteria which have led to the present configuration of the operational system. The AFOSR MCDS is described from management's point of view as opposed to the computer-system engineer's point of view, with emphasis on management concepts essential to successful automation of management processes. Management experience gained through four years of MCDS operation is reflected in basic rules enumerated as essential to the success of any automated management control data system.

An Outsider's Evaluation of R&D Management

Controls in Government Research 67

JAMES R. POWERS

The extent to which control contributes to or detracts from the R&D effort, from the core work of the organization is treated in some depth. It is pointed out that management controls of Government R&D may be viewed in the light of the ways in which they interact with and facilitate or detract from the process of transfer from the basic *IDEA* into *HARDWARE*. The coupling required is a dynamic process requiring freedom and support of functioning and movement (rather than inhibition and stasis). Linking the disparate elements requires close "entente" between the project conceivers, the technical people; resolving the technical difficulties in the light of current knowledge without continually putting off till "tomorrow" what you should do today and having a *flow* of funds adequate for the job at hand.

Improving Administrative Control for Small Company R&D 75

RUSSELL W. HENKE

The author treats the peculiar problems facing small industrial enterprise in entering into Research and Development. He discusses the attitude of small business management towards what they regard as "not immediately productive work" (R&D). Some practical solutions to small business R&D operations are cited, such as joining "teams of research," talent pools, better use of consultants, joint industrial research programs, joint government research projects, the role of research institutes, and many other provocative suggestions.

Discussion of Papers in Part II 86

Part III. THE PLANNING FUNCTION IN R&D

Identification and Evaluation of Planning Activities 101

JOHN T. NEWMAN

In the usual application of "cost-effectiveness" principles, one seeks to obtain maximum effectiveness at the least cost. The author points out that in the case of R&D planning this can result in a major

flaw, since in his opinion we should solve our problem "by means no better than that which is required." In other words, after agreeing upon an objective, the solving resources should be utilized for that purpose and for that purpose alone. The project should be ended at that point in time. It is not intended that this action should restrict R&D planning in any harmful way. It is, of course, through our gathering of data in the planning stages that one is enabled to quantify effectiveness and costs.

Discussion 107

Cost Effectiveness—Its Relationship to R&D 109

WILLIAM N. BRESWICK

Heretofore the relationship between C/E and R&D that has been stressed most has been the attempt to apply this analysis to R&D in the same manner as one would to *production* or *operations*. Unfortunately, R&D does not lend itself to this form of comparison. One thing is for certain: research activities are inherently indeterminate, and the forecasting of neither costs nor their outcome has led to too much past advancement in our managerial acumen. There is a new relationship between C/E and R&D which holds much promise. This concerns the possibility of applying "program planning" to the budget operation of major non-defense activities in our federal government. The key to this concept is the stressing of "output orientation" in decision making. As this is taking place, it is becoming more and more clear that many aspects of non-defense research are closely similar to research conducted within the DOD. It is therefore predicted that there will arise new types of C/E which will involve *inputs* as well as *outputs* utilizing non-quantitative measures.

Discussion 121

Modifying R&D Programs to Take Advantage of

New Concepts 125

EVERETT T. WELMERS

As complexities and costs of R&D programs grow, it becomes more and more difficult to justify modifications thereto and implement them in a timely manner. On the other hand, rapid advances in technology can only yield real improvements in working mechanisms if these new concepts are put to work. One thing is sure: Up-to-date program status information and the implications of what changes might accomplish have become more and more vital. To cope with this situation it is of utmost importance that the initial structuring of the program permit adequate visibility and flexibility throughout all cycles to the end that modifications be made when opportune. It therefore is to our advantage to adapt such tools as "systems analysis" to the entire R&D process.

Discussion 141

Part IV. ROLE OF SYSTEMS ANALYSIS IN R&D PROGRAMS

The Role of Systems Analysis for R&D Progress 145

ROBERT F. ROBINSON

This paper discusses solutions to the problems encountered in the guidance of R&D managers. More particularly, the form that this guidance takes is in formalizing the system concepts, identifying critical technologies, and outlining the needed test and study programs. A case is made that the evaluation (over-all) can be viewed in terms relating the *cost* to the *effectiveness* which results. This is called the *cost/effec-*

tiveness ratio and can indeed in certain circumstances provide a better insight for optimizing the design.	
Discussion	158
Technical Facilities for R&D	165
AUGUSTUS C. JOHNSON	
A strong case is made that the technical facilities required for major R&D programs are today highly specialized, have long procurement lead times, rapidly become obsolete, and above all are extremely expensive to acquire. Particularly is this so for government R&D, be it "in-house" or by contract. The author discusses the "systems approach" to the planning, construction, and subsequent utilization of technical facilities. Illustrative examples are cited which treat the need to consider the immediate establishment of an over-all "Technical Facility Register or Registers" within the aerospace community.	
Discussion	173
Part V. THE FEDERAL GOVERNMENT AND PROGRAMS TO IMPROVE THE R&D PROCESS	
Enhancing Returns on Research Investment	179
RAYMOND S. ISENSON	
Reporting upon the many factors affecting what we might call the productivity of research and development within the DOD framework, the author provides a unique insight into "technology" transfer mechanisms. In citing actual experiences from "Project Hindsight," the evolution of ideas is traced in each individual instance to identifiable sources. The study methodology is described and adequately covers typical items of considerable interest.	
Discussion	187
New Approaches to Maximize the Benefits of Government Research to the Civilian Economy	195
ERNEST B. TREMMEL	
The federal government currently spends \$15 billion a year on a wide variety of research and development primarily intended for its own uses, both military and civil. It seems logical that out of this huge effort we could readily derive great benefits for the industrial segment of our economy. Such is hardly the case and it has taken some of our best brains to make a dent on improving technology utilization derived from sources outside industry's control. In establishing the U.S. Atomic Energy Commission, Congress has recognized that a problem exists and has charged the Commission with maximizing the flow of useful and meaningful data. The author points out that the most difficult aspect has been to insure, in each individual case, the presence of sufficient "built-in" incentives to cause industry to be willing to allocate its own funds for the additional work required to produce commercial products.	
The State Technical Services Act of 1965	209
PHILIP K. REILY	
All sectors of our country do not share equally in the technological advancement resulting from government R&D programs. For the most part, this comes about for the simple reason that this is a competi-	

tive enterprise, and the programs seek out those best qualified to do the work at the lowest possible cost. To attempt to spread the advantages of "centers of research excellence," which result from concentrating competent scientists at a particular institution, a program of *matching funds* has now been enacted into a law called THE STATE TECHNICAL SERVICES ACT. These matching funds are for the purpose of generating new *research* activities within each *state*, based primarily upon unique resources that may be utilized. It will indeed be interesting to watch for the results of this law.

Part VI. MANAGING CREATIVE PEOPLE AND THE FURTHERING OF EDUCATION

What the Creative Man Demands of Management 217

GEORGE A. WHITTINGTON

There can be little doubt that the creative scientists and engineers in our nation's R&D establishments hold the key to maximum technological progress. It is indeed logical therefore that we leave no stone unturned to stimulate this creative force. Certainly, by obtaining a knowledge of the entire "creative spectrum," we will be in a decidedly improved posture. In this regard one of the most disturbing elements in any study is the lack of agreement on definitions (what, for instance, is a Creative Person?) as well as the lack of "follow-on" tactics. The author particularly emphasizes the area of "teamwork in creativity" and shows the need for a "sense of urgency."

Discussion 224

Evaluation and Recognition of R&D Personnel 229

MYRON A. COLER

Much confusion has been caused by the fact that while science and engineering are reasonably objective, the work is always carried out by people. The role that temperament plays has seldom been given proper consideration. This can even be carried a step further, and it can be noted that a great many opportunities are missed and much "miscasting" results from attempts to equate and evaluate all R&D talent as if it possessed invariant individual characteristics. Starting with the premise that there is a real need for a high level of competence in any individual, a sense of "group" responsibility is also required, coupled with a certain amount of "drive." Getting the most out of each engineer or scientist on the Team is of course the end purpose and the author points out the many pitfalls in judging a subordinate's performance. He also forcibly calls to mind that managers have the tendency to overlook changes in their staff members with time. It is not foreseen that a single simple scale can be applied; all men grow older, some get smarter, some remain the same, while the remainder deteriorate.

Discussion 239

Obsolescence of Engineers and Scientists 245

RAWSON A. BENNETT

The obsolescence of an engineer's technical knowledge is quite apparent today with the onrush of technology. In various instances there are measures being taken to bridge the knowledge gap, but in general these are by no means sufficiently comprehensive. What is not so well recognized is that this is not a "spot" problem existent for only one project, but rather is represents a need for a continuous re-education in both technology and management methods across the broad spectrum.

The author cites typical cases from his wide background, which illustrate the points raised.	
Discussion	251
Continuing Education	253
HAROLD K. WORK	
There is an ever increasing interest in this subject since it is impinging upon the livelihoods of our great body of practicing engineers and scientists. Today these persons are faced with a noticeable decline in the effectiveness of their original career preparation. It is therefore vital that a program dealing with all facets of "continuing education" be in force. There is but one alternative, and this is <i>obsolescence</i> , and neither the individual nor the nation can stand by and witness any such deterioration. This paper summarizes certain activities by industries, universities and professional societies relating to maximizing our efforts in continuing education.	
Discussion	259