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ABSTRACT

In this paper certain problems and issues which can be identified from the existing literature concerning the management of interdisciplinary research in the university environment are discussed. In a review of literature concerning multidisciplinary research, recurrent problems and issues were grouped into the following categories: (1) environmental issues, (2) managerial issues, (3) behavioral issues, and (4) other miscellaneous issues. Specially, environmental topics relate to the university as the environment of research, including its administration and organizational structure. Managerial issues deal with those aspects of management which involve selection of personnel, supervision and control, and project evaluation. Behavioral considerations include problems concerning individuality, education, and status, and the miscellaneous category is devoted to issues dealing with the research process itself. A cross-reference with these issues and 25 studies concerning research management is provided. (Author/CP)

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MANAGEMENT OF INTERDISCIPLINARY RESEARCH IN UNIVERSITIES FACES PROBLEMS

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Introduction

Management of interdisciplinary research in the university environment faces problems which are unique, and differs from research management in industry which has been extensively covered in the literature. The long-term commitment involved in industrial research ultimately always becomes subject to criteria of usefulness and return on investment. In contrast, the academic environment is held responsible for the achievement of multiple objectives: teaching, research, and service. Faculty members who assume managerial roles have been educated and trained for the demands of their disciplines. Therefore, the very notion of a collaborative team effort must overcome the compartmentalization of departments and schools of a university and the image of the lone, independent investigator or researcher.

In addition, funding problems associated with research in the university setting are severe and frequently depend on outside sources. Successful completion of a research project involving an interdisciplinary research effort must be viewed, a priori, as a significant accomplishment.

In the present study we will explore these problems through an assessment of large scale interdisciplinary research in universities. It follows on the research conducted by Mar and Newell (1973) under a National Science Foundation grant which involved an assessment of environmental modeling efforts. In that context, they uncovered a number of problems and issues which related directly to the management and organization of interdisciplinary research in the university environment.

This is the first in a series of papers to explore management of large-scale interdisciplinary research in the university setting. The project will eventually include the research design for carrying through a number of site visits to ongoing interdisciplinary research activities at selected universities.

In this paper we identify some of the critical and substantive issues concerning management of interdisciplinary research in universities, drawing on investigations reported in the literature. We will not treat these issues in depth nor do we propose solutions to the problems identifed at this time. We are focusing on the issues and problems in management of interdisciplinary research in order to create a framework or guide which we can use in subsequent field work at specific research sites.

A secondary purpose of this paper is to define some of the important concepts in management, such as administration, organization, planning, direction, and control. There is also the need to clarify the meaning of interdisciplinary research and related concepts.

Management and Administration

Because people with diverse backgrounds who use the terms "management" and "administration" often ascribe different meanings to them, it is necessary to clarify some terminology. Management is a process that involves integrating and coordinating organizational resources toward accomplishment of objectives. From a systems view, management may be thought of as coordinating the activities of such systems and relating them to the environment.

Various definitions of management have appeared in the literature. Kast and Rosenzweig (1974), p. 6) describe management as follows:

> "Management involves the coordination of human and material resources toward an objective accomplishment. We often speak of individuals managing their affairs, but the usual connotation suggests group effort. Four basic elements can be identified: (1) toward objectives, (2) through people, (3) via techniques, and (4) in an organization."

Newman, Summer, and Warren (1972, p. 11) describe management in this fashion:

> "Managing is a social process. It is a process because it comprises a series of actions that lead to the accomplishment of objectives. It is a social process because these actions are principally concerned with relations between people."

Typical definitions of the tasks or functions of management identify management as consisting of the processes of planning, organizing, staffing, directing or leading and controlling. Some authors suggest that these activities can be subsumed under planning and implementation (LeBreton, 1965) or planning and control (Anthony, 1965).

Whatever the particular definition selected, it is clear that management is a process which involves a wide range of activities. Planning includes the important functions of assessment of the environment, setting and clarifying objectives, and developing strategies and programs which will facilitate moving toward the objective. Organizing includes division of work and assignment of tasks to individuals and groups. Directing involves leadership, communication and motivation activities by the manager in dealing with individuals in the organization. The process of control includes measuring system activities, comparing them with plans, and taking corrective action where necessary.

A question which frequently arises is the distinction between the terms "management" and "administration". While some have attempted to differentiate between these terms, we wish to emphasize that we will use

them synonymously and interchangeably.[1]

In the context of management and research, a manager strives to establish an environment which will facilitate the creative work of the research group. Management does not imply that control necessarily is centralized. Rather, control is only one aspect of the total management function which aims at completing a task effectively and efficiently. Thus, our framework of management is concerned with creating an awareness of the availability of management tools and techniques which may help an interdisciplinary research team progress toward realizing its objectives and goals without undue delay. It can draw on knowledge about consequences of alternative management approaches and leadership styles. It can clarify the dimensions of the organizational climate and, perhaps most importantly, it can contribute to the understanding of interpersonal relationships among team members and the role of values in individual perception and interpretation of data. Finally, our framework of management focuses upon the impact of structural relationships on the team members' behavior, and their relationship to the team as a whole and to the various home disciplines represented on the team.

We would also like to emphasize that management systems must be designed to accommodate the particular task to be accomplished. Inter-

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[1] Thomas M. Stauffer, writing in 1974 in an unpublished report entitled, "Recommendation of Ways the National Science Foundation Can Assist Major Universities Improve Their Research Administration," construed management in research to mean the active control of research; that is, directing that something will happen. Administration was defined as meaning to dispense services to those who control and conduct research, the principal investigators and their colleagues (page 11). We consider this to be an artificial distinction and at variance with the generally accepted use of these terms in the literature.

disciplinary research in a university is, and should be, managed in a manner quite different from that of an industrial firm. While fundamental principles and approaches characterize management of any kind of activity, they need to be adapted to the particular organization and its mission. Documentation of management and organization design in interdisciplinary research in universities is a primary focus of the present research project.

Multi- and Interdisciplinary Research

There appears to be little uniformity in use of terms to describe scientific research efforts which involve input from more than one discipline. As a way through this terminology jungle, we suggest that it is possible to adopt the use of the term polydisciplinary research to cover the various variants such as cross-disciplinary, multidisciplinary, interdisciplinary, and transdisciplinary. Cross-disciplinary research would refer specifically to research which takes place in the overlapping territory of two or more adjacent disciplines, for example, biology and chemistry, or sociology and psychology. These cross-disciplinary efforts may eventually yield new disciplines, such as social psychology.

Multidisciplinary research refers to research which may have brought together a number of researchers representing different disciplines or departments and thus share common research facilities, common research approaches, common environments, or search for funding of a joint grant request from a funding agency. However, the problems tackled by the individual scholars do not require the integration of the research on the specific problem in question. The individual scholar works on problems relevant to only his own discipline.

We will use the term interdisciplinary research for those situations in which the problems or issues posed require that a group with various disciplines represented integrate their approaches. An interactive joint effort is required to reach a solution.[2]

By transdisciplinary research we are referring mainly to efforts which involve the extention of activities in one department across boundaries into another department and its specialists (Crawford, 1969, p. 85; Secrest, 1969, p. 87).

Hagstrom (1964) suggests that the increasing prevalence of some form of group or team research can be traced to increasingly expensive scientific facilities. A single researcher is lost today in terms of the varied requirements placed upon him by modern scientific techniques and instruments, and research activities increasingly require skills and knowledge from more than one discipline. He suggests, "modern forms of scientific teamwork involve a greater dependence upon external authorities, greater centralization of authority in research organizations, and a complex division of labor involving professional technicians and professionals from different scientific disciplines (p. 256)." Caudill and Roberts (1951) cite approving that Kluckhohn at one time pointed out that, "interdisciplinary research is, above all, an interpersonal situation and the smoothness or strain with which work gets done must be analyzed in terms of structure or the situation as well as in terms of individual

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[2] These definitions follow closely those suggested by Daniel Alpert, "The Role and Structure of Interdisciplinary and Multidisciplinary Research Centers." Proceedings of the Ninth Annual Meeting of the Council of Graduate Schools in the U.S. Theme: Planning for an Uncertain Future. Washington, D. C., December 4-6, 1969, p. 76.

personalities (p. 13)." This has also been stressed by Luszki (1957).

Classification of Major Identified Issues

In the report prepared for the National Science Foundation and its Environmental Systems and Resources Division, authors Mar and Newell (1973) dealt with the problem of evaluation of environmental modeling efforts referred to earlier. In this context they conclude that, "very little research has been done on the organizational and administrative problems associated with interdisciplinary research programs in a university setting (p. 15)." In discussing their data on management and organization of interdisciplinary research in a university setting, they identify a number of problems. Further study of the literature has extended the list of problems which can be identified in research management. The range of problems which are emerging from the literature is so broad that a classification scheme is necessary to facilitate their discussion and create a basis on which to consider improvement of research management.

Perspectives

Even a casual perusal reveals that the types of issues or problems in management of interdisciplinary research in universities differ significantly depending on from whose prespective the problems are being surveyed. Five major perspectives may be identified: (1) the project director, (2) the institute or center director, (3) the university administrator, (4) the granting agency, and (5) the society or surrounding environment.

First is the viewpoint of the project director or principal investigator. He is concerned with a whole range of problems from initiating the original idea, obtaining funding, assembling and managing the research team, monitoring and control of research efforts to publication of results.

Second is the perspective of the director of an interdisciplinary research center or institute. These centers have been emerging on university campuses, at least partially in response to the need to provide an institutional framework to facilitate interdisciplinary research. Such centers have a longevity beyond the individual project. The director of the center may be primarily concerned with a flow of projects and people. Many of his management problems focus upon maintaining this flow and providing necessary resources from outside agencies to support ongoing research while maintaining control of compliance with agency rules.

Third is the perspective of the university administration. The university administrator's problems and concerns with interdisciplinary research are quite different from those of either project directors or center directors. University administrators are concerned primarily with questions of research administration facing the university as a whole and not with management of individual research projects. Their management problems focus around such issues as identifying new research areas and cultivating funding sources and activities which will facilitate research. At times they may face questions about the active direction and control of university research processes generally.

A fourth perspective is that of the granting agency. As an illustration of this perspective we cite the National Science Foundation's

Research Management Improvement Program (RMIP) which was conceived in 1972 with the thought that it would focus on enhancing the effectiveness of federally sponsored research in universities. To this end it would make grants available for improving research management capabilities. This formed the basis of the request for proposals on development of innovative interdisciplinary research management techniques which could be transferred to institutions with major research programs under way (NSF Solicitation Number 74-13). The present project is funded under this program.

A fifth perspective is that of the university community as a whole and society. Important questions here have to do with broad national science policy, the role of sponsored research in universities, and the impact of sponsored research on universities.

An advisory panel convened under NSF sponsorship with the assistance of the American Council on Education identified four broad categories of major questions facing universities in their administration of research. The first category deals with internal transactional matters and includes such things as accounting practices, and space and resource allocation. The second category deals with external transactional matters and includes financial relations with granting agencies, patent and copyright matters, and quality audits of sponsored research. The third category refers basically to nontransactional matters unique to each institution or class of institutions. These include, among others, consideration of political forces within an institution which influence the conduct of research sponsored by external funding agencies, internal organizational matters,

personnel matters, the motivation of research scientists, institutional flexibility in research, and other matters which relate closely to the process of successfully managing research to completion. The fourth category involves broad national science policy questions and includes such matters as the role of research in the university, the impact of cost of research on universities, the assessment of national research needs, and impediments to the transfer of research findings into practice (Stauffer, 1974, p. 3-4).

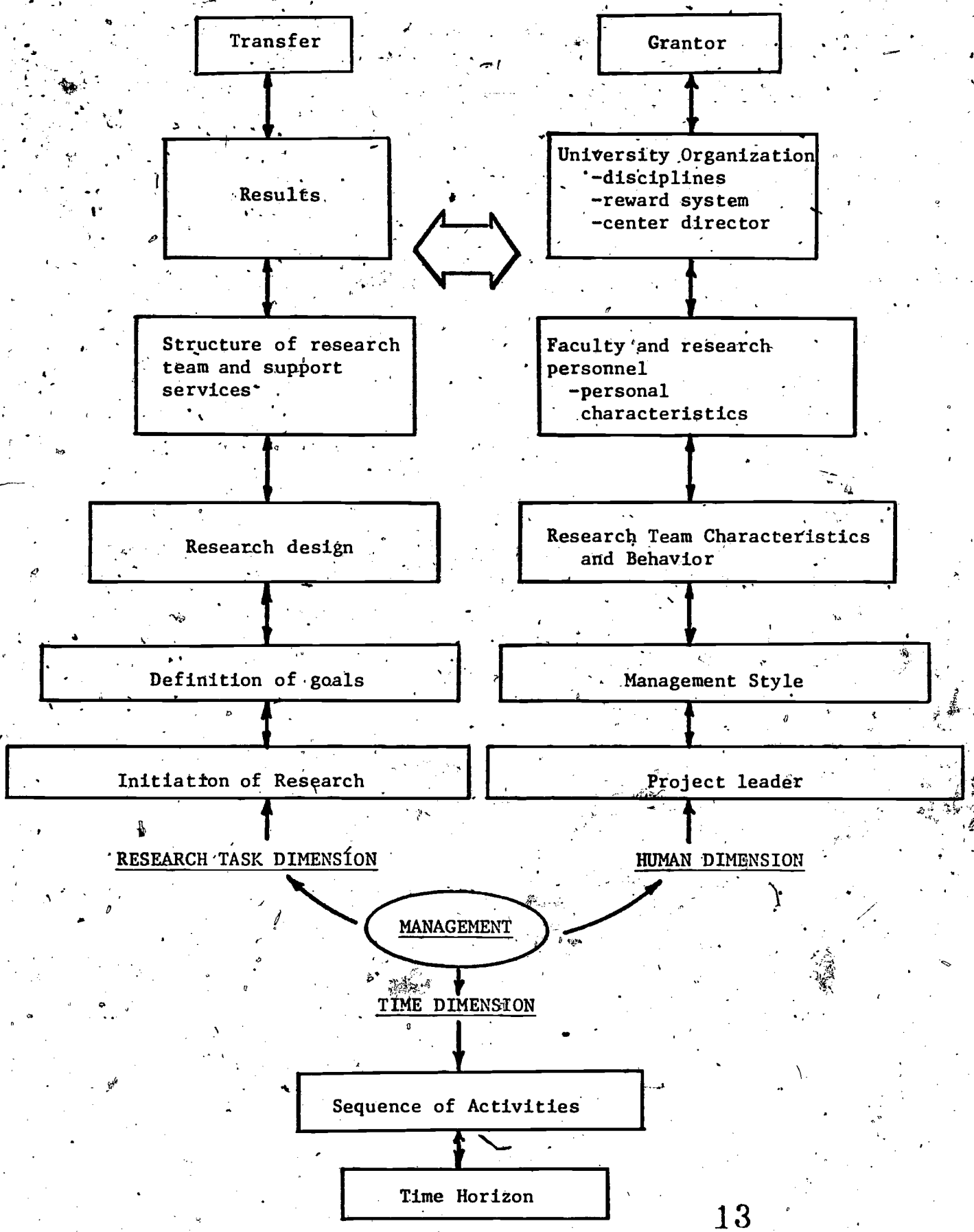
The present research project will focus upon the range of management and administrative problems which face the project director, center director, university administrators, and the interrelationships among them.

Research Management Dimensions

We identify three major dimensions of interdisciplinary research management. They focus respectively upon the research tasks, the human dimension, and the time dimension. Within these dimensions we may further identify a hierarchy of problem area categories. These are illustrated in Figure 1. We will not attempt at this point to fully develop the categories, as this will be the subject of subsequent research reports. Our discussion will be limited to an overview.

Looking first at the range of issues relating to the research task dimension, we see at its base the initiation of research projects. Closely related to this is definition of the goals of the project. This leads to consideration of structure of the research team and the support services required for accomplishment of the task. This is closely coupled

Figure 1.. Research Management Dimensions



to the components of the research design. Task accomplishment leads to results and to transfer of results into published form.

With the human dimension we see at its base base questions concerning the project leader, including his management style. He will be very influential in modeling the behavior of the research team, including the interactions between its members and optimization of team results. Closely related are the personal characteristics of faculty and research personnel. At the level of university organization and management are questions related to characteristics of the university organization, the discipline-oriented departmental structure of a university, the reward system, and academic faculty structure inherent in the university as a whole. Creation of organizational units, such as centers and institutes to facilitate interdisciplinary research may form an important part of this aspect. Beyond the university we see questions related to grantors which include their expectations and the type of control mechanisms used to monitor research expenditures.

On the time dimension we see two aspects, the time horizon represented by the research program and the time sequence of pertinent activities. The time sequence would follow initiation of research ideas, planning research efforts, implementation, controls, and integration to final results and their publication.

Summary Ranking of Specific Issues

The literature on what has become known as "research on research" has grown over the past twenty years along with the growth in outside

funding of research generally. It has become so extensive that a number of systematic attempts have been made to provide prospective explorers with trail markers and maps of the territory. Among the most useful guides to this literature are those by Glueck and Thorp, and Suljak.[3] In addition the College on Research and Development of the Institute of Management Sciences has published several summaries of the literature on the topic of research on research. After reviewing a major portion of this literature in its published form, several general comments concerning its nature are appropriate.

Little of this literature is empirical. Most of it is of a historical nature with many case studies, descriptive surveys, and conference proceedings. The few empirical studies tend to be descriptive rather than tests of hypotheses generated by theory. They tend to describe present structures, conditions, complaints, and relationships. Rarely do they predict change or define norms. A few normative studies tend to advocate policies and procedures in the 1970's which were discarded by the management and administrative science literature in the 1950's. Much of the data used are rarely original, generally being compiled by governmental agencies or national associations. There are, however, some exceptions to this general trend worth noting.

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[3] William F. Glueck and Cary D. Thorp, The Management of Scientific Research: An Annotated Bibliography and Synopsis. Columbia, Missouri: Research Center, School of Business and Public Administration, University of Missouri, 1971.

Nedjelko D. Suljak, Administration of Research: A Selected and Annotated Bibliography. Davis, California: Institute of Governmental Affairs, University of California at Davis, 1972.

Management scientists and operation researchers have applied mathematical programming, simulation, and other quantitative techniques to the managerial problems of allocating resources among competing projects, of selecting and ranking of competing projects, and to research strategy formation. Sociologists and social psychologists have extended their small group studies into the research team's domain and have looked at leadership, size, heterogeneity, personality, values, communication, and innovation. There is still much to do, however.

We have attempted to provide in Table 1 a summary ranking of specific issues as they have been discussed in the literature. They are grouped according to four subcategories: environmental, managerial, behavioral, and miscellaneous. We have included in the table a notation of when each issue was most recently mentioned with a cross reference to relevant articles and books. We have also attempted a ranking by date of most recent mention and by frequency of mention (Table 2). Finally, Table 3 is a list of the issues by joint ranking according to date and frequency.

However, this listing, derived from the literature, does <u>not</u> imply that the higher the ranking, the more important is the problem. One part of the present project will be to ask experienced managers for their priority ranking of issues. The present investigation will thus be able to contribute to the theoretical development in the field of research management and be useful in solving pressing issues which the research manager faces.

Table 1

Cross Reference of Issues in the Research Management Literature

	DATE LAST MENTIONED	C & R 1951	Bush & Hattery 1958	Blackwell 1955	Bennis 1956	Luszki '57, '58	Cottrell 1962	Hagstrom 1964	Work 1965	Nissan 1966	Robinson 1967	Rubenstein 1968	Williamson 1968*	Kash 1968	C. on Grad. Schools 1969	K.R. & S. 1970	Ritchie 1970,	Petch 1970	Garbarino 1970	McEvoy 1972	Burrough 1972	Will 1973	Mar & Howell 1973	
Environmental Issues																								
1. University Structure	1973										x							x					x	
2. Constraints due to external conditions	1972		x											x		x				x	x			
3. Liaison with non-research activities	1968											x												
Managerial Issues																								
1. Supervision of Team	1973		x			x						x	10			x			x					
2. Control	1973											x	7						x					
3. Research Team Characteristics	1973		x									x										x	x	
4. Organization Structure of Team	1973											x								x				
5. Evaluation of Results	1973											x	1		x		x							
6. Project Selection	1973											x												
7. Costs of Interdisciplinary Research and Development	1968					x						x												
8. Budgeting	1968											x												
Behavioral Issues																								
1. Communication	1973	x		x	x	x		x				x	4			x	x	x						
2. Status	1973	x		x																				
3. Innovation	1972			x	x	x	x			x		x				x	x							
4. Behavior patterns	1973	x			x										x									
5. Motivation	1973	x		x																				
6. Lost Individuality	1968			x	x	x		x				x								x				
7. Psychological differences	1973		x																					
8. Conflict related to size	1970					x										x			x					
9. Conflict and power struggles	1970							x								x			x					
10. Training	1968											x	5											
11. Pressures	1956	x				x																		
12. Conflict and increased conservatism	1955	x		x																				
13. Values	1953		x																					
Miscellaneous Issues																								
1. Not focusing on common problems	1973	x																						
2. Applied versus Pure Research	1970			x						x														
3. Faddism	1955			x																				

*Williamson prioritized issues

Table 2

Ranking of Issues by Date and Frequency of Mention Separately

BY DATE ( )

1. Communication (1973)
2. Supervision of team (1973)
3. Research team characteristics (1973)
4. University structure (1973)
5. Control (1973)
6. Status (1973)
7. Organization structure of team (1973)
8. Evaluation of results (1973)
9. Behavior patterns (1973)
10. Motivation (1973)
11. Project selection (1973)
12. Psychological differences (1973)
13. Not focusing on common problems (1973)
14. Innovation (1972)
15. Constraints due to external conditions (1972)
16. Conflict related to size (1970)
17. Applied versus pure research (1970)
18. Conflict and power struggle (1970)
19. Lost individuality (1968)
20. Cost of interdisciplinary R & D (1968)
21. Training (1968)
22. Budgeting (1968)
23. Liason with non R & D activities (1968)
24. Pressures (1958)
25. Conflict and increased conservatism (1955)
26. Faddism (1955)
27. Values (1953)

BY FREQUENCY ( )

1. Communication (9)
2. Innovation (8)
3. Supervision of team (7)
4. University structure (7)
5. Constraints due to external conditions (6)
6. Control (5)
7. Status (5)
8. Lost individuality (5)
9. Research team characteristics (4)
10. Organization structure of team (4)
11. Evaluation of results (4)
12. Behavior patterns (4)
13. Motivation (4)
14. Conflict related to size (3)
15. Applied versus pure research (3)
16. Project selection (2)
17. Psychological differences (2)
18. Not focusing on common problems (2)
19. Cost of interdisciplinary R & D (2)
20. Training (2)
21. Pressures (2)
22. Conflict and increased conservatism (2)
23. Conflict and power struggle (1)
24. Budgeting (1)
25. Liason with non R & D activities (1)
26. Faddism (1)
27. Values (1)

Table 3

Joint Ranking (Date and Frequency) of Issues in the Literature

1.	Communication	1 + 1 = 2/2 = 1
2.	Supervision of team	2 + 3 = 5/2 = 2.5
3.	University structure	4 + 4 = 8/2 = 4
4.	Control	5 + 6 = 11/2 = 5.5
5.	Research team characteristics	3 + 9 = 12/2 = 6
6.	Status	6 + 7 = 13/2 = 6.5
7.	Innovation	14 + 2 = 16/2 = 8
8.	Organization structure of team	7 + 10 = 17/2 = 8.5
9.	Evaluation of results	8 + 11 = 19/2 = 9.5
10.	Constraints due to external conditions	15 + 5 = 20/2 = 10
11.	Behavior patterns	9 + 12 = 21/2 = 10.5
12.	Motivation	10 + 13 = 23/2 = 11.5
13.	Lost individuality	19 + 8 = 27/2 = 13.5
14.	Project selection	11 + 16 = 27/2 = 13.5
15.	Psychological differences	12 + 17 = 29/2 = 14.5
16.	Conflict related to size	16 + 14 = 30/2 = 15
17.	Not focusing on common problems	13 + 18 = 31/2 = 15.5
18.	Applied versus pure research	17 + 15 = 32/2 = 16
19.	Cost of interdisciplinary R & D	20 + 19 = 39/2 = 19.5
20.	Training	21 + 20 = 41/2 = 20.5
21.	Conflict - power struggle	18 + 23 = 41/2 = 20.5
22.	Pressures	24 + 21 = 45/2 = 22.5
23.	Budgeting	22 + 24 = 46/2 = 23
24.	Conflict - conservatism	25 + 22 = 47/2 = 23.5
25.	Liason with non R & D activities	23 + 25 = 48/2 = 24
26.	Faddism	26 + 26 = 52/2 = 26
27.	Values	27 + 27 = 54/2 = 27

SUMMARY OF RESEARCH MANAGEMENT IMPROVEMENT PROGRAM

As part of the continuing research management improvement effort of the University of Washington, a group of University faculty, administrators, and graduate students is conducting a two year $300,000 investigation on "Assessment and Experiment With the Management of Large Scale Interdisciplinary Research Projects." Since 1972 the National Science Foundation (NSF) has funded a variety of studies at a number of public and private institutions aimed at improving the management of research. The University's program (grant NM 44380) is one of nine supported by NSF designed specifically to investigate various aspects of interdisciplinary research management, particularly in academic settings.

Dr. Donald E. Bevan, Professor of Fisheries and Marine Studies and Assistant Vice President for Research at the University is program director. Mr. Donald R. Baldwin, Director, Grant and Contract Services, is associate program director. Bevan and Baldwin are assisted by a local advisory board of ten senior research administrators from throughout the university. The board is chaired by Dean Joe S. Creager, Professor of Oceanography and Associate Dean for Research and Facilities, College of Arts and Sciences. Dr. Borje O. Saxberg, Professor and Chairman, Department of Management and Organization is also serving as an advisor to the program directors while actively participating in the research on both the assessment and experiment phases of the program.

A significant and growing percentage of research at major universities is goal-oriented and is being done by research teams made up of individuals

drawn from two or more academic departments or disciplines. Often these research efforts are conducted under the aegis of a center or institute set up to deal with teaching, research and public service aspects of a problem or an interrelated set of problems or intellectual concerns that cut across the boundaries of traditional academic departments.

As both the organization of research teams and the centers or institutes established to bring together the support and resources necessary to conceptualize and carry out interdisciplinary research have become more complex, problems of managing these activities require increasing attention. The University's program will explore some of these management problems in an attempt to better understand the dynamics of administering interdisciplinary research and to suggest how management might be improved.

Dr. William T. Newell, Professor of Management in the Graduate School of Business Administration is project director of Phase 1 of the program. Newell and his group will assess management of large scale interdisciplinary research in the academic setting. After identifying the major problems and issues related to interdisciplinary research management through literature review and preliminary research at the University of Washington, the research team will carry out site visits at selected private and public universities which conduct interdisciplinary research. The results of the research will be incorporated into a series of case studies which will report the problems of organization and management, examine the reasons for these problems and suggest how management might be improved.

Phase 2 of the program will be an experiment conducted by Dr. Brian Mar, Professor of Civil Engineering and Research Coordinator of the Institute for Environmental Studies. This experiment will focus on the

preproposal stage of interdisciplinary research and will test the notion that interdisciplinary research teams that are able to spend more time and other resources on preproposal activities than is normally available will have a higher probability of being successful in both finding funding and then carrying through on their research. Within the experiment, several interdisciplinary research teams at the University of Washington will be given money during their preproposal phase for faculty release time, graduate student assistance, consultants, travel to confer with peers and/or representatives of prospective funding agencies, and perhaps other uses appearing worthy of testing. Crucial to this experiment is the requirement that participating teams are not continuation projects from prior research. The success or failure of the teams receiving funds will be followed and the results recorded and reported by Professor Mar.

It is anticipated that this program will result in information useful toward improving research management at the University of Washington and that these results will be largely transferrable to other universities and helpful to Federal funding agencies. In addition, the research should help advance understanding of research and research management as an increasingly important part of the contemporary American university and suggest new areas of concentration for future research management improvement efforts.

Summary and Conclusions

We set out in this working paper to provide a framework of problems and issues which we can identify from the existing literature in the management of interdisciplinary research in the university environment. Management is defined as the achieving of objectives with physical, financial, and other resources, relying heavily on the organization's members. It involves a process of integration and coordination through the functions of planning, staffing and acquisition of resources, organizing, directing, and controlling.

An interdisciplinary research effort includes a group or team representing various departmental disciplines. The research focuses on a problem which requires that the disciplines integrate their approaches.

The review of the literature reveals that the problems and issues can be grouped under the following categories: (1) environmental issues, (2) managerial issues, (3) behavioral issues, and (4) miscellaneous issues. The environmental issues relate to the university as the environment of research, including its administration, organizational structure, and other aspects. The managerial issues include those aspects of management of interdisciplinary research which involve selection of team members and their staff personnel, the structuring of the organization, supervision and control, administration of funds, and the evaluation of the completed project. The behavioral issues include consideration of the members of the team and their relationships with each other. This is reflected in interpersonal conflicts and communication, the motivation of the researchers, problems associated with their individuality, psychological differences,

training, education, and status. Finally, miscellaneous problems or issues deal with the research process itself, the base for selection of topic of research, and the continuing discussion of applied versus pure research in the university setting.

We were also successful in tentatively generating a ranking of issues from the literature based on the frequency of mention and the recency of the research. This ranking suggested that communication is the most recent and frequently mentioned problem facing management of interdisciplinary research in the university setting. This was followed by supervision of the team, the university structure, control, research team characteristics, status, innovation, organizational structure of the team, evaluation of results, and constraints due to external conditions to mention only the first ten.

This survey of the literature suggests that there is much to do to improve management of interdisciplinary research. The research which exists on management of research in the university setting relies heavily on secondary sources and information compiled by governmental agencies. Field research is sparse and generally not well defined. Considering the currency of interdisciplinary research as a parameter in granting funds, the potential return from research on improving management of interdisciplinary research appears to be very significant. In addition, research into interdisciplinary research management should constitute an important contribution to the search for effective performance and to management theory generally.

This paper, in effect, sets the stage. It discusses concepts, defines terms, and raises issues. The attempt has been to provide a view of the forest. Subsequent papers will begin to examine the trees.

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