



# Managing Interdisciplinary Research

Edited by  
**S.R. EPTON**  
**R.L. PAYNE**  
**A.W. PEARSON**

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# MANAGING INTERDISCIPLINARY RESEARCH

Edited by

S. R. Epton

*R & D Research Unit,  
Manchester Business School,  
University of Manchester*

R. L. Payne

*M. R. C./S. S. R. C., Social and Applied Psychology Unit,  
University of Sheffield*

A. W. Pearson

*R & D Research Unit,  
Manchester Business School,  
University of Manchester*



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**MANAGING  
INTERDISCIPLINARY  
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## Foreword

The event that prompted the writing of this volume was the Second International Conference on the Management of Interdisciplinary Research held at the Manchester Business School, Manchester, England, in July 1981. The First Conference had taken place in Schloss Reisenburg in the Federal Republic of Germany in April 1979. The growing importance of the interdisciplinary approach to problem-solving had then been recognized by a small group of practitioners and management scientists, which inspired them to call the conference. Their aim was to identify and discuss the key issues affecting the management of this kind of research.

Papers from the First Conference have been collected together in a book entitled *Interdisciplinary Research Groups: Their Management and Organization*, edited by Richard Barth and Rudy Steck. As might have been expected, the Conference revealed the existence of a large number of problems, which caused it to take two concrete decisions. One was to set up an international association to foster the study of interdisciplinary problem-solving groups to be known as Interstudy. This has provided an effective channel for disseminating information and maintaining contact between the interested parties. It is responsible for the publication of *Interstudy Bulletin*, a newsletter edited by Don Baldwin of the University of Washington, Seattle, USA.

The other decision was to plan a series of working conferences to be held at about two-year intervals, designed to permit the regular exchange of views and experience relevant to any of the issues of concern to those involved in interdisciplinary activities. The first fruit of this decision was the convening of the Second International Conference in Manchester.

This was attended by forty-two people from academic, government, and industrial environments from eight countries. Some had attended the first conference; they provided a useful degree of continuity, confirming incidentally that this area has staying power and can be treated seriously as a stable field for investigation.

The Conference strongly encouraged us, the editors, to compile this book. It is not to be read as a formal record of the proceedings. Its aim is rather to use the papers presented at the Conference and the informal discussions which took place around them to capture the main themes and to illustrate the variety of activity in the field.

The choice of material for inclusion was left to us. This has been a difficult task—as has been the putting together of the short introductory chapters which are designed to highlight the points we believe to be the key to the successful management of interdisciplinary research. Inevitably reasons of space have forced us to omit much of the Conference material. We have tried to compensate for this omission in three ways: we make frequent reference to the valuable information contained in the published proceedings of the First Conference; especially in Chapter 4, we make use of the literature on group dynamics; and we provide a generous amount of bibliographical material.

Perhaps our hardest task was to decide which of the twenty-nine papers to reprint in full, given the amount of space available to us. We found this not to be a matter of winnowing the wheat from the chaff but rather one of crude butchery. We applied as uniformly as possible the same criteria as those used for selecting the topics for discussion in the prefatory chapters. We also include a complete list of all papers submitted and a short summary prepared by ourselves of the content of those we have been unable to reprint in full.

Much needed help has come from many people. Our special thanks go to Don Baldwin, who is the leader of this enterprise, as far as an interdisciplinary group such as ours will permit him; to Shirley and Harvey Gold who made many helpful comments and helped to sustain our efforts; to the several authors who abridged their papers or repaired the damage inflicted by our surgery; to all those who participated in the Conference and who recognize their ideas as being included in the book but without explicit acknowledgement; and above all, to Kathleen Eatough who besides acting during the Conference as major-domo uncomplainingly typed and re-typed and re-re-typed the indecipherable drafts of the book with which we liberally provided her.

Manchester 1982

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## CHAPTER 1

# Introduction

Examples of research projects where all parts are undertaken and completed by a single person alone and unaided are hard to come by. Some kind of interaction with other people is always necessary during all phases of a project—at the start, during its execution, and for the implementation of its results. It comes as no surprise, therefore, to find that a good deal of effort has been put into searching for ways of making such interactions as effective as possible. The main conclusion that can be drawn from the search so far is that probably much more remains to be learnt about the process, the task, the situation, and the interactions among the individuals concerned than the search has so far revealed.

Nowhere is there more need for learning than when the scientific content of the task needs inputs from different disciplines and the execution of the task demands that the individuals providing the inputs work together closely and continuously, i.e. in what has come to be known as interdisciplinary research.

The First Interdisciplinary Research Management Conference in 1979 showed that such research was of growing importance but that many barriers to its introduction and efficient use were being encountered. Most of them were a matter of getting people coming from diverse disciplinary backgrounds to overcome institutional obstacles and personal inhibitions which prevented them from working together in a mutually supportive manner. The difficulties were in fact intensifying because more and more projects required not only collaboration between practitioners of different scientific and technical disciplines but also collaboration over the cognitively greater distances such as separate these as a group from, say, economists, behavioural scientists, and politicians.

A reading of the selection of papers which were presented at the Second Conference on Interdisciplinary Research, held in Manchester, England, in 1981, and which are appended to this volume will show that they tell the same story and add much circumstantial detail needed to confirm its truth. They also provide a number of examples where interdisciplinary approaches have been

successfully used and others where one was greatly needed. The purpose of the prefatory chapters of this book is to present, as we see it, a brief and coherent overview of the scene as depicted by the Conference, where necessary supplemented by material from the proceedings of the First Conference and by information derived from the literature of the subject.

We have organized our overview as follows:

*Chapter 2* is a discussion of the question of nomenclature. This turns out not to be a matter of mere semantics but to reveal a methodological point of some importance. Current usage imposes an evaluative tone to some of the words frequently met which can get in the way of communication. The key to clarity of thought is to use different terms to describe the content of a task and the form of organization needed to carry it out. Specifically we argue that a task requiring a combination of disciplines should be known as cross-disciplinary while the terms multi- and inter-disciplinary should be reserved to describe how the practitioners are organized to make their several contributions.

*Chapter 3* is intended to illustrate the variety of areas in which interdisciplinary problem-solving has a claim to be the best approach to obtaining research results of lasting value. Examples taken from the conference papers show the contribution that interdisciplinary working can make to the solution of technology assessment problems, to basic research, including the formation of new disciplines, to mission-oriented R & D, and to innovation. There is also a brief discussion of the role of the interdisciplinary individual.

*Chapter 4* lies at the heart of the subject for it consists of a consideration of the barriers, institutional and personal, that prevent the setting up of interdisciplinary teams and inhibit the achievement of the needed integration of thought and action. It provides a taxonomy of the setting of interdisciplinary working in terms of group size and institutional location. It is here that we have had the most frequent recourse to the wider literature of the subject and we make extensive use of the analytical concepts developed by Mintzberg. The main message of this chapter is that the means that have to be adopted to get the high degree of cooperation necessary to produce effective interdisciplinary working differ markedly from one setting to another.

*Chapter 5* extracts the lessons for management that lie buried in all the material presented at the Conference, in the papers and the ideas floated in the preceding chapters. It introduces some new material and draws attention to one paper that supplies evidence that the interdisciplinary groups are not the best for all occasions. It is perhaps this part of the book that will most interest those readers who are at the sharp end of all this activity, i.e. those whose daily task it is to run this most demanding form of research activity.

Finally, there are appendices containing a selection of papers presented at the Conference in alphabetical order of first authors' names, brief summaries of papers that could not be reproduced in full, and a bibliography. For completeness we also append a list of papers which were included in the proceedings of the First Conference.

## CHAPTER 2

# Multidisciplinary, Interdisciplinary— What is the Difference?

(In this and the following chapters references quoting authors' names followed by the symbol (1) will be found in the List of Papers presented at the First International Conference; those followed by a date (e.g. 1980) are in the Bibliography; and those followed by neither are included or summarized in the present volume.)

In the introduction we referred briefly to the distinction between multidisciplinary and interdisciplinarity. We have found that making the distinction more specific, i.e. casting it in a form in which it could be used to decide whether a particular project or project group was or was not interdisciplinary, was not as straightforward as it might seem. In fact, the attempt revealed the possibility of methodological problems if the distinction was not carefully formulated. Therefore, arriving at a clear understanding of the meaning of the two terms is not merely an exercise in semantics.

### **Interdisciplinary: is it multidisciplinary plus integration?**

The following extracts taken from papers presented at both the First and Second Conferences represent different expressions of the consensus view of the differences between multi- and interdisciplinary activities:

#### *Birnbaum*

Interdisciplinary as opposed to multidisciplinary research refers to research teams in which the effort is integrated into a unified whole. Multidisciplinary research refers to research in which scholars from different disciplines work independently and are joined together externally through editorial linkages.

*Michaelis*

Interdisciplinary work results from the joint and continuously integrated effort of two or more specialists having a different disciplinary background.

*Rossini, Chubin, Porter, and Connolly*

Multidisciplinarity is the result of the inter-relation of disciplinary components when they are linked externally only . . . interdisciplinarity involves the internal and substantive interlinking of the various disciplinary analyses so that each considers the results of the others in its own development.

*Lindas<sup>(1)</sup>*

IDR implies joint co-ordinated and continuously integrated research conducted by experts with different disciplinary backgrounds working together and producing joint reports and papers in which the specific contributions of each researcher tend to be obscured by the joint product.

The thinking behind these and other formulations to be found in the papers implies the following propositions:

*Proposition 1*

There are tasks that require for their effective completion contributions from more than one discipline. In the literature such tasks are sometimes referred to as multidisciplinary, sometimes as interdisciplinary.

*Proposition 2*

Such tasks can be carried out using either of two different organizational forms:

- 2.1 The 'pure' *multidisciplinary* form in which the portions of the task are carried out by organizationally separate units each of which includes practitioners of only one discipline. The products of their activities are combined into a coherent whole by a task coordinator who bears ultimate responsibility for so doing.

The task coordinator may be a member of one of the units or he may stand apart from all of them; he may or may not have a supervisory relationship to any or all of them. It is also possible for the project coordinating responsibility to be carried out not by an individual but by a group bearing a similar relationship to the operating units.

- 2.2 The 'pure' *interdisciplinary* form in which the elements of the task are carried out within a single organizational unit consisting of the

practitioners of the disciplines necessary for the completion of the task. The members of the unit share the responsibility for combining their individual products into a coherent whole.

These two propositions are objective and non-evaluative. If the only difference between the multi- and interdisciplinary collaborative forms were that between 2.1 and 2.2, it would be possible to decide on this basis alone whether a given task was being implemented in a multi- or interdisciplinary manner.

Unfortunately this is not the end of the story for the quoted definitions imply another distinction between the terms multi- and interdisciplinary. According to them it is possible for a unit to purport to be working in an interdisciplinary manner yet not fulfil its responsibility for self-integration. In such a case there is an implication that the group should be referred to as multidisciplinary. As a result, the terms lose their objective status and become evaluative—interdisciplinary, good; multidisciplinary, bad.

Quite apart from the possibility that empirical data may not always support this proposition (cf. Birnbaum's paper in this volume) it is methodologically unsound to employ terms which have two different meanings, one of them objectively value-free and the other subjectively value-laden, especially when the context does not provide a clue as to which meaning is being employed in that moment.

In fact, the value-laden meaning of these terms imposes a real methodological problem. The characteristic, i.e. actual self-integration, which is said to distinguish the multi- from the interdisciplinary style can be observed only on the unit in action or when its task is completed. A unit must therefore be deemed to be multidisciplinary until observation of its actions and results proves it to be interdisciplinary. To make matters worse, any measures of integration are certain to be continuous; therefore an arbitrary degree of integration would have to be set (by whom?) before a unit could be allowed to call itself interdisciplinary.

More precision is clearly necessary to avoid ambiguity and confusion. Some suggestions about how to achieve it are made in the next section.

### **Distinguishing task, organization, and performance: the key to precision**

The key that opens the door to precision is to keep three matters separate: the task, the organizational framework within which the task is carried out, and the evaluation process which measures how well it has been done.

To preserve this distinction we need to modify the terminology. This is done reluctantly, for the subjective already has an overabundance of terms. Nevertheless, the changes suggested in the following seem to be a necessary minimum if the objective of clarification is to be achieved. They have the merit of neither introducing new polysyllabics nor altering the meaning of commonly used words.

We rephrase Proposition 1 as follows:

*Proposition 3*

There are *tasks* that require for their objective completion contributions from more than one discipline. Such tasks are defined as *cross-disciplinary*.

A valuable precedent for using the word cross-disciplinary in this sense is that it is so used by Rossini *et al.* in their paper in this volume. To clarify matters further, we note that it would be correct to employ the word as a qualifier of terms such as ‘study’, ‘mission’, or ‘project’, but not of terms such as ‘unit’, ‘team’, or ‘group’. In other words, ‘cross-disciplinary’ should refer exclusively to the *content* of a task.

We now turn to the question of describing the organizational form. The proposal is to use the words multidisciplinary and interdisciplinary only as qualifiers to terms that refer to the *manner* or style in which a task is being carried out. The problem is to define them descriptively and not normatively and in a way that does not require postponement of a judgement about which one to apply until the unit in question has been observed at work or has completed its business.

The necessary distinction can be made relatively easily provided that users are ready to accept an *intention* to work in an interdisciplinary manner (later to be defined) as the distinguishing characteristic rather than how far the intention is translated into practice. In making this proposal more concrete we draw on the paper in this volume by Gold and Gold. This proposes a model of collaborative working that focuses on the nature of transactions between members of the group in question.

Gold and Gold’s analysis starts from a consideration of the nature of transactions between the members A and B of a minimal collaborative group. A has the capability to produce a desired output from inputs elicited from B. The mode of the collaboration between A and B then depends on how the responsibility for specifying, producing, and using the output is shared between them.

Two extreme modes are defined: the contractual and the partnership modes. In the contractual mode, A plays the role of a customer and is entirely responsible for the specification of the input, which B, playing the role of a contractor, uncritically accepts; B is then entirely responsible for producing the input which A will accept and use, provided only that it fulfils the specification. At the other extreme, in the partnership mode, A and B share equally the responsibility for all three operations. They jointly define the specification, jointly produce the input, and jointly use it to produce the output.

Between these extremes Gold and Gold describe a third form, referred to as the consulting mode. Here A plays the role of a client and B that of a consultant. A takes the lead in specifying the input but B can view the specification critically and suggest a redefinition. B will have the lead responsibility for producing the

redefined input, but A may intervene in B's production process to suggest a modification into some more appropriate direction, and so on. Unlike the contracting mode A and B do not operate at arm's length and unlike the partnership mode A and B retain their disciplinary identities.

The *contractual* mode describes very satisfactorily in formal terms the relationship we would expect between the IDR coordinator referred to in Proposition 2.1 above and the members of the satellite units that supply him with inputs. On the other hand, the *consulting* mode is apt for describing the relationship expected (and aimed for) between members of a group functioning in an interdisciplinary manner as defined in 2.2.

Let us now put these proposals more formally as an amendment to Proposition 2:

#### *Proposition 4*

Cross-disciplinary tasks can be carried out using either of two different organizational forms:

- 4.1 The 'pure' *multidisciplinary* form—in which portions of the task are carried out by organizationally separate units each of which includes practitioners of only one discipline. The responsibility for ensuring that their outputs are compounded into a coherent whole lies with a task coordinator whose relationship with members of the contributing units may be described as 'contractual', in the sense used by Gold and Gold.
- 4.2 The 'pure' *interdisciplinary* form—in which the elements of the task are carried out within a single unit that:
  - (a) Includes practitioners of all the disciplines necessary for the completion of the task.
  - (b) Has an internal structure such that transactions between the members can take the form described by Gold and Gold as 'consulting'.

The essential difference between 2.2 and 4.2 is the responsibility it puts on the designers of the interdisciplinary unit to set it up in such a way that interdisciplinary working is possible. In this case, to establish whether a cross-disciplinary task was being tackled in a multi- or interdisciplinary manner one would look for data on the size of group, geographical separation between its members, existence of formal procedural instruments devised to make the consulting mode of collaboration a practical possibility, evidence of team-building activities, absence of any circumstances that could confer higher status on a particular discipline (though this does not rule out status differentiation on other grounds), etc. The essential point is that the distinction is made on the intended situation rather than the actual process.

A new problem of nomenclature is created by the adoption of these definitions. In many cases reported in the literature, and perhaps some cited



in this volume, the papers do not make it clear or do not provide sufficient evidence whether the terms inter- and multidisciplinary are being used in the senses defined in the chapter. To allow us to discuss such cases we need a neutral description of the organizational form. To avoid bringing in yet another word we shall use ‘cross-disciplinary’ for this purpose, in addition to the one given to it by Proposition 3, but we do not think that this will cause any confusion.

### **Complexities of the R & D process**

The preceding discussion gives the impression that any cross-disciplinary task can be carried out either in a pure interdisciplinary or pure multidisciplinary form. But a task as complex as the average cross-disciplinary project is always divisible into sub-tasks, each of which in principle could be managed in a multi- or interdisciplinary manner. Furthermore, an interdisciplinary group may obtain some of its information by sub-contracting part of its work to external specialist units.

The situation is made more complex still when consideration is given to the whole R & D process rather than only that part in which the actual research task is executed. The total process consists of at least three separate stages which we can call project initiation, project execution, and results implementation.

The initiation stage is that in which the task objectives and resourcing are decided, usually across an interface and in collaboration with sponsors and other potential beneficiaries from the results. The execution stage consists of the professional research operations properly within the internal world of R & D. The implementation stage is the one during which the R & D results are transferred across another interface and into the keeping of the sponsor/user.

Each stage is a separate task with its own objectives and problems to be solved. Not all are necessarily cross-disciplinary, and not all of those that are need to be always carried out in a multi-disciplinary manner. For example, Sharp’s paper describes a project whose object was to forecast the environmental effects of offshore drilling for oil in the Texas Gulf. This was recognized as a cross-disciplinary problem. An interdisciplinary group was set up to manage project execution and integrate the data, the acquisition of which was sub-contracted to separate specialist groups. Another example is provided by Moser and Levy-Leboyer in their paper. They describe the operations of an interdisciplinary research-funding committee (i.e. project initiation stage) which sponsored many projects that were carried out by single-disciplinary groups.

The existence of such complexities provides a further reason for avoiding the use of the terms in question in an evaluative manner. The message is that task comes before organization and evaluation should relate to the appropriateness of the form chosen to the task undertaken.

### **Conclusion**

This discussion has led to the following conclusions: