

STRATEGIC CONTROL FOR A U.K. REGIONAL HEALTH AUTHORITY
- A CONCEPTUAL FRAMEWORK

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Preface

This paper forms the starting point for a research project by IIASA, in cooperation with one of the U.K. regional health authorities, into the development of procedures for monitoring and controlling the implementation of strategic plans. The main body of IIASA research into Health Care Systems is conducted within the Human Settlements and Services Area; but the strategic planning processes are an example of the "Program Management" activities which form one of the research tasks in the Management and Technology Area.

Abstract

After a brief review of the nature of strategic planning, and the problems of defining health service objectives, the paper concentrates on the question of "strategic control", in the context of a regional health authority. The purpose of monitoring is defined in detail. A critical review of concepts of control in various disciplines considers their suitability to the health authority context. An integration of feedforward and feedback control loops is developed, in order to meet the specific characteristics of a system in which "environment" can be viewed as the "input", and to provide the adaptive, learning capability which is required by the situation of insufficient data, ignorance of underlying mechanisms, and continuing change.

Acknowledgements

As with most IIASA research, the ideas offered here arise from team-work and discussions. Thanks are especially due to Loretta Hervey, whose experience of health care and diligence in the library widened my horizons. To David Hughes, whose comments greatly improved an earlier draft. To Richard Gibbs, for introducing me to the administrative history of the U.K. health scene, and to his colleagues. To the multi-national flow of visitors through my office, many of whom infected me with the germ of an idea. And to my permanent personal advisor on nursing care.

Finally, to those constructive critics who will point out the weaknesses and omissions, and thereby contribute valuably to the cybernetic process of feedback control.

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1. INTRODUCTION

1.1 "Program Management" and Health Care

One of the topics identified in the 1978-79 Research Plan [1] of IIASA's Management and Technology Area (MMT) is described as Program Management: "The general problem of translating ideal, multi-dimensional goals into achievable goals, and devising the necessary mechanisms for achieving this in a complex organizational situation." An important contemporary problem, which precisely fits this description, is that of health care planning.

Health care systems are already the subject of work at IIASA, for the topic falls squarely within the definition of "universal problems" as defined in IIASA's Research Plan [1]. Evidence of this universality is provided by the widespread debates on the need for reorganization and improved planning of existing health systems, which are currently taking place in many countries of the world. The examples quoted below both demonstrate this, and introduce some of the central issues.

From Canada, Evans [2]: "The scene is now changing with new efforts to organize regional and local health services on a comprehensive basis. The desirability of regional or district control of the planning and operation of health services has been accepted in principle in all provinces of Canada, but intermediate structures for administering health services at the regional level have only been developed in Quebec."

From Australia, Hetzel [3] reports how a change of government "at the end of 1972 led to the setting up of a new National Hospitals and Health Services Commission which immediately pursued an active policy of initiating community health center development in all states," though local political conditions are said to have led to subsequent modifications of the original proposals. This caveat is equally universal, as the following quotation from Altenstetter [4] suggests:

"In response to skyrocketing increases in the proportion of GNP that goes into the health care sector, most industrial nations are seeking alternative modes of delivering and financing health services. The Federal Republic of Germany is no exception. However, not all innovations and interventions, adopted recently, respond to basic imperatives of a client-oriented health care system that guarantees availability, accessibility, acceptability, continuity and quality of health care services. Instead, such interventions and

innovations tend to respond to the requirements of the political-administrative system."

Perhaps best known of all reorganization debates is the continuing U.S. discussion and negotiation on the subject. Atkisson and Grimes [5] (source of the following two quotations) describe the National Health Planning and Resources Development Act of 1974 (P.L. 93-641) which President Ford signed into law in January 1975. While this leaves open many of the financing questions (still being debated by Congress during President Carter's administration - especially the Cost Control Proposal), P.L. 93-641 bears some striking similarities to the U.K. reorganization described below. "The act fashions several new programs; provides for the establishment of national health planning guidelines; creates a new system of health services planning and regulatory agencies; provides some of the 'front end' preparation for the anticipated adoption of a national health insurance proposal; and terminates [various previously existing] programs." Again like the U.K., the new Health Systems Agencies (HSAs) (responsible for populations of 500,000 to 3 million) are "required to develop long range health plans for their communities as well as annual implementation plans to carry out incremental portions of the long range plans." Thus the U.S. government, like so many others, is groping towards, and has in principle accepted, a regulatory strategy in health. The process is delayed by the political needs for compromise, as pointed out in the Altenstetter quotation above. In the U.S., Altman [6] has described the evolution of the system set up by P.L. 93-641, and the struggle of the states to retain control of the HSAs. He concludes: "In short, the controlling factors in health planning are political, not technical, and these are occurring more at the state and local levels than many had predicted."

The U.K., which forms the context for the research described below, differs from the four countries named above in not having a federal system. The formal implementation of the 1974 reorganization was therefore more straightforward, although as will be seen below, some of the benefits of federalism are sought in the delegation to Regional Health Authorities of considerable freedom to define their own objectives.

The U.K.'s relatively weak economic performance in recent years has at least the advantage of sharpening its interest in cost control, thus further rendering its health system of interest to a wider audience. But at the same time, the emphasis on budgetary stringency linked with the implementation of more systematically designed planning structures focuses attention on the need to pursue ever more scientifically the maximum effectiveness in the use of resources.

An impassioned plea, both emphasizing the need and offering some of the means to meet it, was made at a conference in Maryland, U.S.A., organized by the International Epidemiological

Association in 1975 (sponsored by the Health Resources Administration of the U.S. Department of Health, Education and Welfare). Their "Conference Statement" [7] starts as follows:

"1. Until very recently in the United States there have been few constraints on health care resources, no effective planning processes that relate the flow of funds for manpower and capital to community needs, and no clear foci of responsibility and accountability. Therefore, there has been no obvious need and little incentive for the practical application of epidemiological skills and for the development of adequate health services management personnel and health information systems.

2. The recent federal PSRO [Professional Standards Review Organization] legislation, the Health Services Research, Health Statistics and Medical Libraries Act, and the Health Planning and Resources Development Act have dramatically changed this situation. Each new PSRO, Health Systems Agency, and State Health Development Authority now being established will require personnel with epidemiological and management skills as well as clinical experience, and a mutual understanding of the interrelationships between these skills.

3. The discipline of epidemiology, together with the applied fields of economics, management sciences, and the social sciences, provide the essential quantitative and analytical methods, principles of logical inquiry, and rules for evidence for:

investigating the natural history of disease;
diagnosing, measuring and projecting the health needs of communities and populations;
determining health goals, objectives and priorities;
allocating and managing health care resources;
assessing intervention strategies and evaluating the impact of health services."

The statement continues, emphasizing the requirement for epidemiological personnel. But the reference to "the applied fields of economics, management sciences and the social sciences" indicates why there exists an important role for organizations and individuals in applied systems analysis to recognize the need and the potential for their talents in health care system planning. Altenstetter [4] makes a similar point, referring to

"... two areas in health services research in which the theoretical and empirical state of knowledge, particularly in Germany, is rather limited. At present, there is little capability that could rigorously assess the effects of past national innovations, control, and

steering instruments, on health services organizations in different regions and communities in the Federal Republic of Germany. Similarly, the capability of forecasting potential effects of new interventions is quite limited. Evaluations tend to be made in hindsight. Causal explanations are based on intuitive observation, questionable perceptions and, often, limited analyses and ad hoc experiments, rather than on the basis of vigorous evaluations. Preferred solutions tend to influence such assessments, irrespective of actual developments."

Seeking a definition of "health services research," or of "organizational research in health services," she quotes Lewis [8]:

"Health services research can be viewed as the epidemiology of the health care system, when this system is conceived in its broadest terms. Put another way, HSR is evaluative research which may examine all or any part of the health care system,"

and Georgopoulos [9]:

"Better understanding and adequate knowledge of organization at all levels of the system may hold the key to effective approaches and successful solutions. Knowledge from the social, behavioral, and management sciences, in particular, could well prove crucial in this respect and infinitely more important than knowledge from the health sciences themselves."

The strong statement by Georgopoulos is a suitable note on which to end this introduction. The widespread need and interest have been illustrated, and the invitation to the management sciences is clear. The opportunity offered to IIASA by the cooperation of a Regional Health Authority in the United Kingdom is therefore timely. The help and farsightedness shown by the staff of the U.K. Department of Health and Social Security's Operational Research Section, who encouraged our interest in the monitoring and control problems, is hereby acknowledged.

1.2 Purpose of Paper: A Conceptual Starting-Point

In the U.K. National Health Service (NHS), as in many organizations, there has been an increasing recognition of the need to expand both the time-scale and the scope of their formal planning activities. The service itself underwent a major reorganization in 1974, centering on a shift from an "institutional" emphasis (as in the old Regional Hospital Boards), to a "total community health" emphasis, with its correspondingly broader implications. In 1976, the issue of a new "planning manual" [10] by the U.K. government's Department of Health and

Social Security (DHSS) included a requirement for the preparation of 10-year "Strategic Plans" by the still-recently-formed health authorities. Work on these is already well advanced, with the first cycle of plans appearing early in 1977, and revised versions now in preparation.

The NHS manual defines strategic planning as "the means by which NHS authorities determine their long-range objectives and priorities for the development of the full range of health services," and describes both strategic and operational planning as comprising five steps:

" a. Taking stock. Examining where the organization is now, and forecasting where it is likely to find itself at the end of the planning period if nothing is done to change course. This will require discussion of current services, resources and their use, and existing constraints on operation.

b. Objective-setting. Reviewing what the organization will seek to achieve in the time span being considered - i.e., its aims or objectives. This will require consideration of needs, demands, and resources. It should take into account the values of all concerned as well as the general social, economic and political climate.

c. Defining strategy. Deciding how to move the organization from where it is now to its agreed objectives. This requires considering alternative routes to the goals, the costs and other implications (quantitative and qualitative) of each, and the organization's ability to manage each routing. A selection between the options is then made, leading to the definition of an overall strategy or programme.

d. Developing a detailed plan. Deciding how this general strategy or programme is to be implemented. This means working out financial, staffing and other implications and preparing a formal plan for the period involved.

e. Monitoring implementation. Assessing during and after implementation, whether the plan is still relevant to the objectives, and whether performance is in line with the plan. This requires *some means of monitoring processes and evaluating results.*" (Our italics.)

The final phrase of the quotation is italicized, because after discussions in IIASA and with DHSS staff, it was felt that the area in greatest need of development lay not in the preparation and publication of strategic plans, so much as in the processes of monitoring, evaluation and control which should follow them, accompany their implementation, and lead to their improvement. This paper describes the conceptual framework

which has been developed at IIASA as a starting point for the work in the field. The concept of monitoring and control has had relatively little prominence in the literature of strategic planning. Some effort has therefore been expended in assessing the relevance of published strategic planning literature and control theory concepts to the job in hand, and in creating from these a clearer concept of "Strategic Control" suitable for a public health authority.

1.3 The "Regional" Context of the Research

The 1974 reorganization created 15 Regional Health Authorities in England and Wales, each typically covering some 3 million people. Co-extensive with the local government "counties" within each region are its constituent "Area" Health Authorities - typically three or four; and for management purposes these are usually sub-divided into "Districts" of some 200,000 people. This is reckoned an appropriate catchment population for a "District General Hospital" providing all the basic specialities (if one started with a "green field" situation).

The relationship of the RHA to the DHSS is important, but is not the subject of the research. The DHSS allocates central government funds between the regions, and this is their sole financial support. The regions do not have borrowing powers, nor hold significant financial reserves. The DHSS has also issued a series of "guidelines" which might be seen as setting "strategic objectives" for the regions - as in the "Consultative Document" [11] (March 1976), "The Way Forward" [12] (September 1977), and the "Planning Guide-Lines" [13] (March 1978). The RHA might therefore appear to be merely a "post-box," transmitting and translating the centrally formulated financial constraints and policy objectives to its constituent areas and districts, and returning their comments on feasibility and their local views to the DHSS. Such a view is clearly and explicitly rebutted, however, in the DHSS documents referred to. For instance, in the latest, Planning Guide-Lines [13]:

"Projections are given in Part 4 illustrating a possible national distribution of expenditure and level of service provision in 1981/82 consistent with these financial assumptions and compatible with Ministers' priorities. These illustrative projections are not targets, but signposts indicating the direction of change to be pursued through the strategic planning decade. They are not specific targets for national developments, still less local targets to be aimed at by particular authorities regardless of local circumstances or of the baselines from which they start. The projections illustrate national averages which may reflect wide local variations in patterns of expenditure and provision of services."

This quotation - and many other published and private statements by DHSS officials and ministers - make it clear that the RHA has a significant role to play in the formulation of its own region's objectives and strategy, and in monitoring implementation (i.e., the list of activities quoted in 1.2 above). It is on this process of strategy formulation within the Region, and more particularly, on the monitoring at regional level of the implementation of this strategy, that the research is concentrating. The diagram in Figure 1 illustrates the formal relationships, and is taken from the NHS Planning Manual [10].

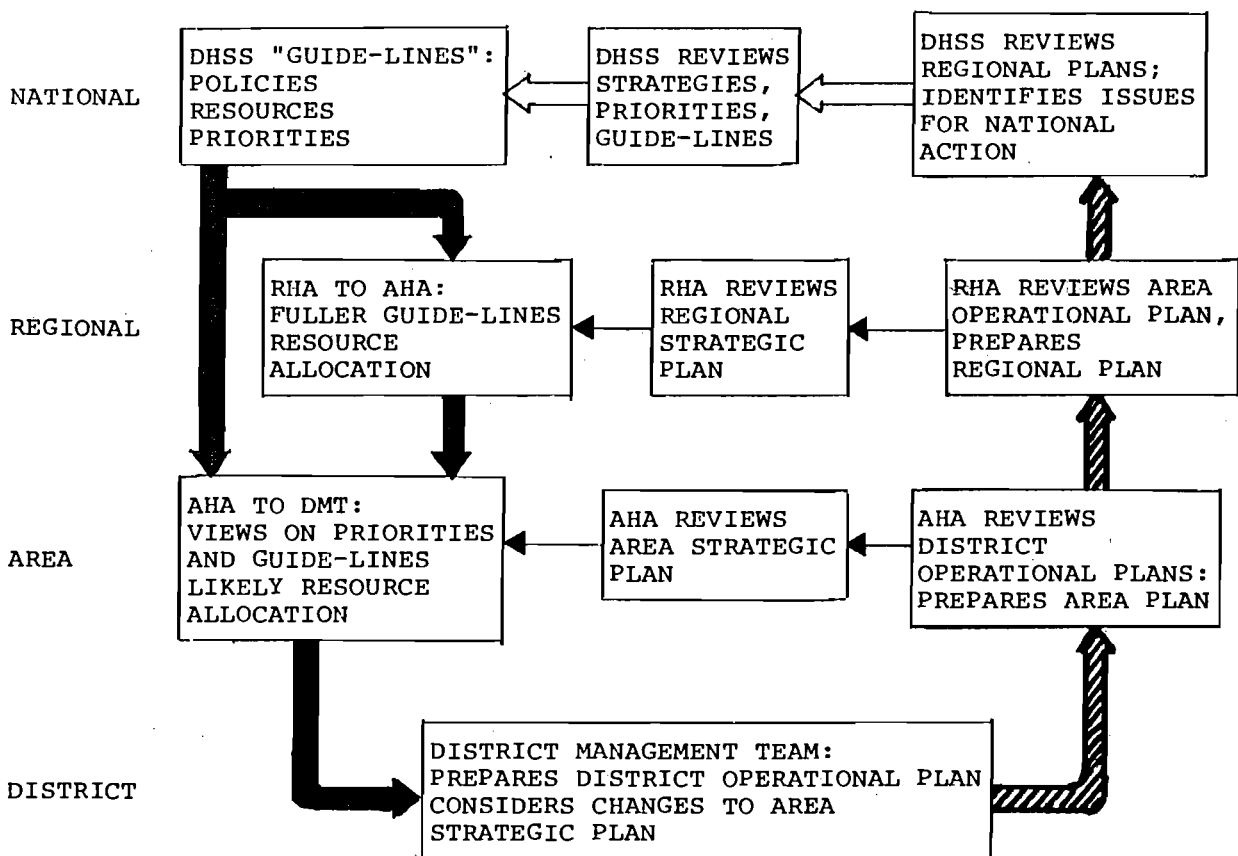


Figure 1 THE FLOW OF GUIDELINES AND PLANS IN THE N.H.S.

2. STRATEGIC PLANNING

2.1 On Strategic Planning in General

An extensive literature has developed over the last 20 years or so in the field or fields variously described as "strategic," "long-range," or "corporate" planning. Although there are some differences of terminology between the various authors, there is a fairly high degree of consensus on the main features. Drucker [14], in a paper on long-range planning published nearly 20 years ago, defined it as follows:

"...the continuous process of making *present entrepreneurial (risk taking) decisions* systematically and with the best possible knowledge of their futurity, organizing systematically *the efforts* needed to carry out these decisions, and measuring the results of these decisions against the expectations through *organized, systematic feed-back*."

Steiner [15] and others published many case studies of how organizations conducted their strategic planning, and how their planning methods had been changing in recent years - generally in the direction of longer time-spans and greater formality of procedure. The journal "Long Range Planning" [16] was started in 1968 by the U.K. Long Range Planning Society, and circulation and membership have grown rapidly. A major attempt to distil a formal, "analytic" approach to corporate strategic planning was published by Ansoff [17] in 1965, and his "Corporate Strategy" has achieved widespread influence: it is further described below.

Authors such as Beer [18] and Ozbekhan [19] placed greater emphasis on the theoretical aspects of planning and control systems, as did Ackoff [20]; but in all cases with an emphasis less on theory than on practical application in designing effective "systems."

The authors above are a few of the major names associated with the theory and practice of strategic planning, in English-language publications. Many of the papers are written in terms of profit-seeking organizations operating in market economies; but it was recognized that many of the needs giving rise to longer-term and more strategic planning, and many of the techniques to meet these needs, were no less applicable to public service activities. Formal 5-year plans for all sectors of the national economy have long been familiar in socialist countries. In the market economies, the proper scope of central government regulation, and the functions for which it should accept responsibility, have long been the subject of debate. There has clearly been a gradual and geographically widespread acceptance of the need for its role to increase. In the field of economic management, the role has expanded from aggregate financial management towards more selective intervention, and "indicative," sectoral, longer-term planning. This was paralleled by corresponding

planning for the publicly financed services such as defence, education and health. The thinking in 1970 is epitomized by the following quotation from an OECD paper on economic growth [21]:

"1. Such objectives as the alleviation of poverty, meeting the demands and aspirations for educational opportunities and adequate health and social security provisions, the prevention of the pollution of the environment, urban congestion and decay, and loss of amenity, and the implications for land use create obvious and important problems of resource allocation.

2. If governments are to devise effective programmes of action in these fields, they will need to frame such policies and plan their implementation on a long-term basis: the relevant time horizon will often be much longer than that implicit in conventional five-year plans and projections."

The reorganization of the U.K. National Health Service in 1974, the redefinition of its objectives, and the subsequent emphasis on 10-year plans all follow naturally from the above historical evolution of views on strategic planning. In the following section, we consider more specifically the application of some of the published planning concepts to a regional health authority; and in section 4 the question of strategic monitoring and control.

2.2 Strategic Planning Concepts in the Health Service

Figure 2 is a very summary picture of a strategic planning process. It corresponds to Ansoff's "analytic approach," but at this level of abstraction would be common to many authors. It should be stressed that this diagram represents only the plan formulation process: it does not explicitly include the control of implementation, and could thus readily lead to the generation of an infeasible plan. The only safeguard against this lies in the realism and accuracy of the forecast of environmental factors, and of the assumptions used in forecasting what performance will result from the interaction between the plan and this environment. The objectives may comprise a few or many, quantitative and qualitative; but in whatever form they are expressed, the forecast has to be prepared in the same terms, so that comparison can be made. From the comparison, or "gap analysis," follows either revision of the objectives, or of the current plan, or both; until apparent consistency is achieved.

This approach can readily be translated in principle into the context of a health care system for a particular community. Such a translation is represented by Figure 3, which is a slightly fuller conceptual picture of the process of plan formulation. A distinction is drawn between the general, long-term "norms" or "values," and the specific, scheduled goals by which they are

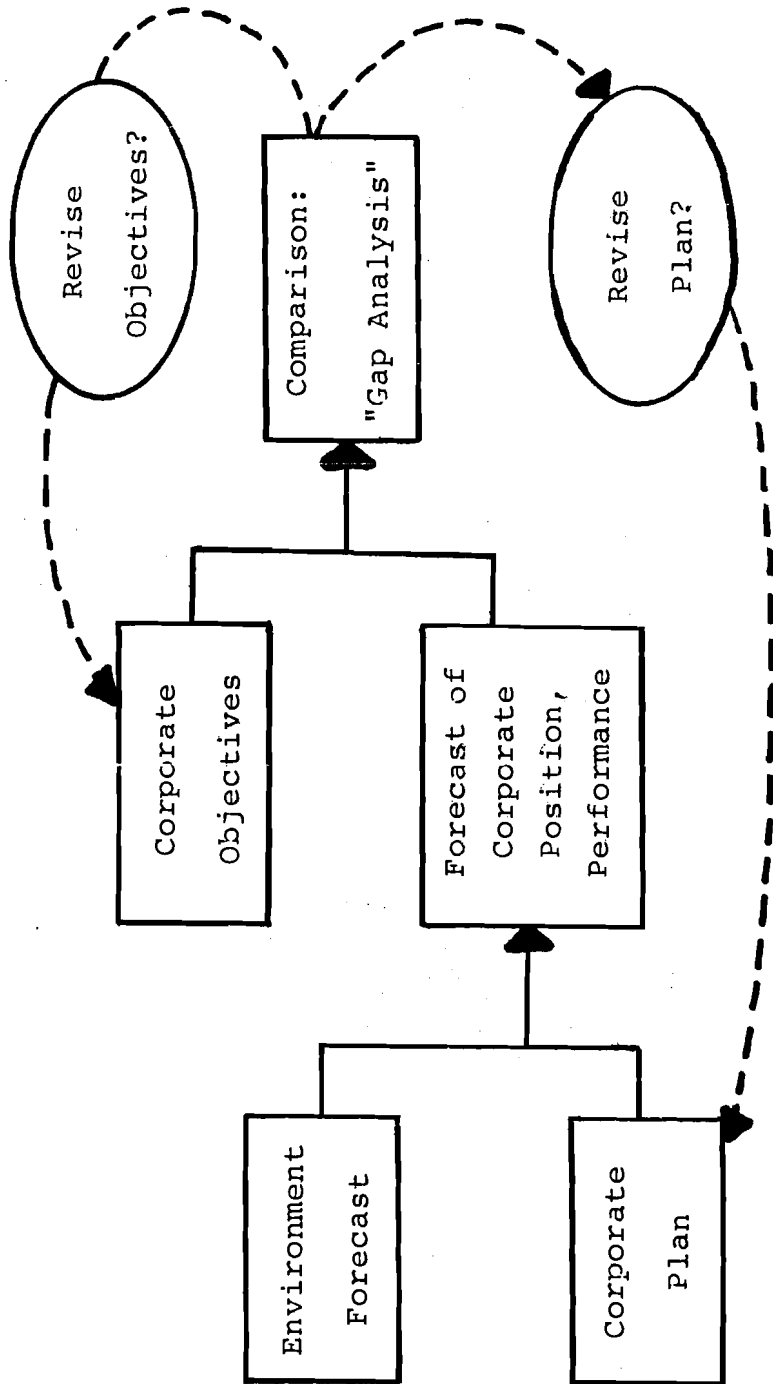


Figure 2 "GAP ANALYSIS" APPROACH TO STRATEGY FORMULATION

to be pursued during the next planning period. The "Environment," by definition outside the control of the authority, is summarized in terms of economic, demographic, morbidity and technological prospects and probable changes. A distinction is drawn between "resources and capabilities" (i.e., mainly the existing staff, buildings and equipment) and the "operating policies" - how the resources are used. The resources will be influenced in the long term primarily through the capital expenditure programme, through closure and redeployment of facilities, and through the decisions on staff recruitment and training. The operating policies will be constrained by the staff, buildings and equipment, and by the revenue budget. Clearly the whole system is closely connected; between buildings, staff, client needs and operating policies; between capital program and revenue implications; and between successive time periods.

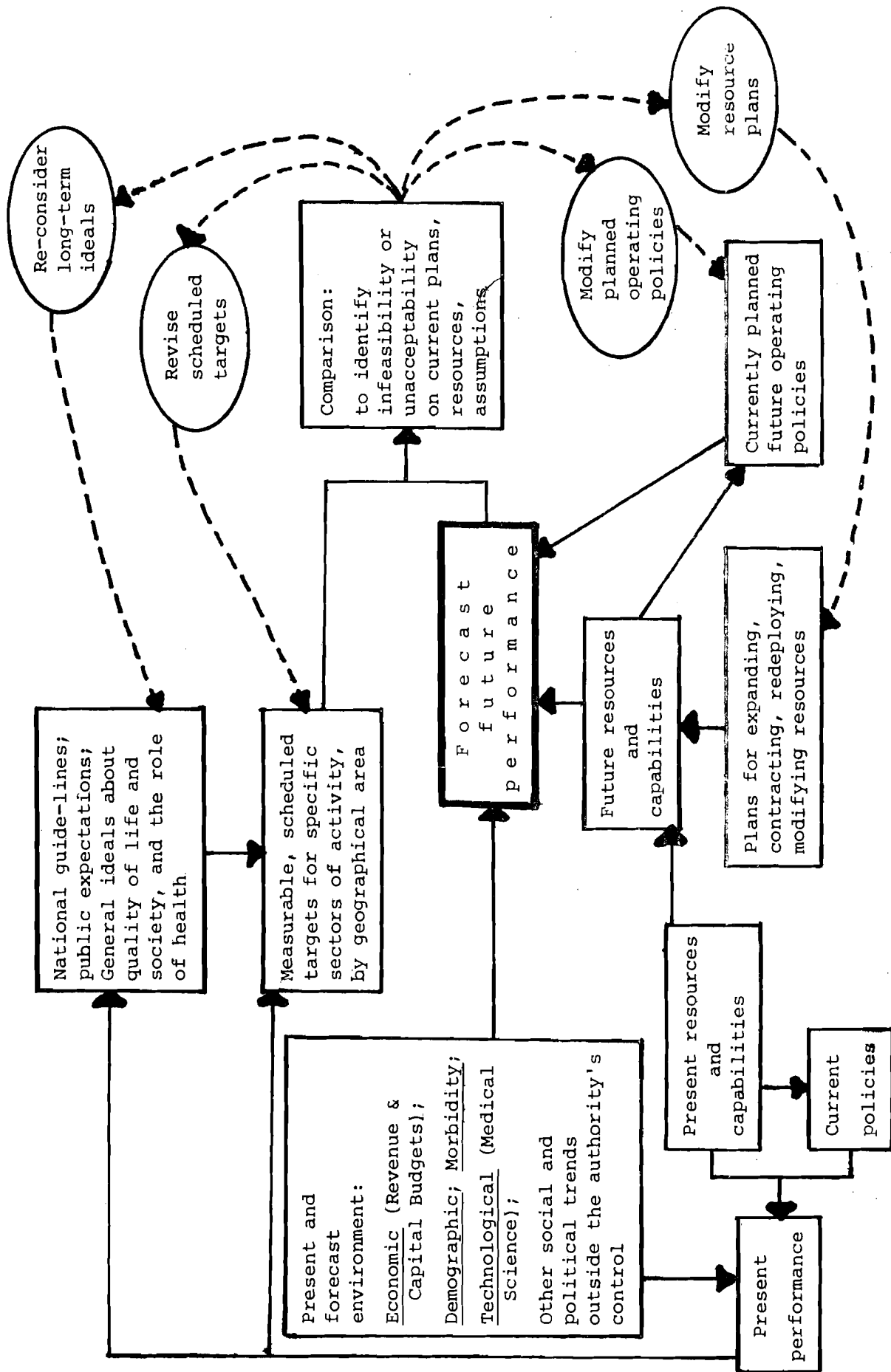


Figure 3 "GAP ANALYSIS" APPLIED TO STRATEGY FORMULATION IN HEALTH CARE

3. OBJECTIVES AND TARGETS

Nothing has yet been said about the objectives and targets, which figure prominently in the strategic plan formulation process outlined above. A huge literature exists on the subject of the measurement of a society's health, via health indicators or indexes; and on the measurement of the output and efficiency of hospitals, doctors, and other resources for health care. For example, a classic paper by Fanshel and Bush [22] in 1969 reviewed the field and defined how a "Health Status Index" could be used to provide "an operational definition of health." A wide-ranging review of the literature on social health indices is that by Elinson [23], and the abstract of his paper summarizes the position:

"The various forms of mortality data and biomedical measures of morbidity have become inadequate measures of the level of health in economically developed countries. Measures of functional physical capacity have some advantages but do not reflect physical impairment. Current attempts to develop sociomedical health indicators include: measures of social disability; typologies of presenting symptoms, which have been used to estimate probable needs for care; measures which focus on behavioral expressions of sickness; research based on operational definitions of 'positive mental health', 'happiness' and perceived quality of life- assessments of met and unmet needs for health care, which are measures of social capacity to care for the sick.

Sociomedical indicators reflect both objective conditions and social values. They are policy-oriented, serving as mobilizing agents for sociopolitical pressures concerned with raising the overall level of health of the population."

The OECD has since 1970 instituted a program of work on the development of social indicators, and in 1973 published [24] a list of these in which health features prominently: reproduced as Figure 4. This list was used as the basis for work on the second phase of the program, whose objective was "the development of a set of social indicators to measure the level of well-being for each social concern and to monitor changes in these levels over time." Figure 5 shows the contents of the OECD's comprehensive review [25], published in 1976, which gives details of the problems of definition, and positive proposals for a coherent series of measures. The World Health Organization has also discussed the problems of planning and objectives in a recent booklet [26].

FUNDAMENTAL SOCIAL CONCERNS	SUB-CONCERNS
<u>HEALTH</u>	
A-1 THE PROBABILITY OF A HEALTHY LIFE THROUGH ALL STAGES OF THE LIFE CYCLE	
A-2 THE IMPACT OF HEALTH IMPAIRMENT ON INDIVIDUALS	<p>A-2-a The quality of health care in terms of reducing pain and restoring functional capabilities</p> <p>A-2-b The extent of universal distribution in the delivery of health care</p> <p>A-2-c The ability of the chronically impaired and permanently handicapped to participate more effectively in society</p>

Figure 4 SOCIAL INDICATORS - LIST OF SOCIAL CONCERNS COMMON TO MOST MEMBER COUNTRIES (from OECD, 1973)

- I GENERAL BACKGROUND INFORMATION
- II REVIEW OF PAST EFFORTS
- III MONITORING THE LENGTH OF LIFE
- IV MONITORING THE HEALTHFULNESS OF LIFE
- V MONITORING THE QUALITY OF HEALTH CARE
- VI MONITORING THE DELIVERY OF HEALTH CARE
- VII MONITORING THE INTEGRATION OF THE DISABLED IN SOCIETY

Figure 5 CONTENTS OF JAZAIRI'S (OECD) PAPER ON "APPROACHES TO THE DEVELOPMENT OF HEALTH INDICATORS"

What these measures (Fanshel and Bush, those reviewed by Elinson, the OECD items in Figures 3 and 4) all have in common is an emphasis on output or outcomes. If the price mechanism is rejected as a criterion, then performance has to be measured in cost-effectiveness terms. Himatsingani, with his DHSS experience, is closely aware of the practical difficulties, and is worth quoting at length [27]:

"Cost-effectiveness analysis demands explicit considerations of attributes which are not measured in money terms. The essential prerequisites of the approach are briefly as follows:

- determination of criterion (not economic) against which the care can be measured;
- the need for operationally useful measures of effectiveness which are responsive to the changes in the provision of services;
- assessment of health and social needs, and the factors affecting the conversion of needs into demands."

This specification leads to his emphasizing the need for research into outcome-based measures, and into the functional relationships between changes in effectiveness and the provision of services. Until this knowledge has been developed, "it will be worthwhile developing a planning framework based on inputs rather than outputs and this framework should be improved and refined as and when more information is acquired". In his conclusions, Himatsingani refers again to the need for better measurement, for research into the concept of need and into health indices, and continues (he was writing just prior to the 1974 reorganization):

"There should be an increased emphasis on planning at central, regional and area levels. One of the areas of research that should be investigated is the development of a hierarchy of inter-related models, in which progress should be made in making the best use of available information. Models should be made flexible so that these can be developed further as and when more information is acquired."

This quotation emphasizes the close relationship between what can be operationally usefully established as targets, and the nature of the planning models used; and the consequent need for their flexibility. One might go further, and seek to build adaptive capability not only into the models themselves, but into the structure of the planning systems of which the models form a part. The concept of models integrated in participatively-structured planning activities, incorporating either provisional guesses or established data where available, is well illustrated

in the case recently reported by Burton et al. [28]. The mathematical programming allocation models to which Himatsingani refers in his paper have since been extensively developed within the DHSS (e.g. as described by McDonald et al. [29]), but the measures and objectives they incorporate remain primarily input-oriented, or at most intermediate outputs (cases per bed, etc.). Work at IIASA (Gibbs [30]) has used an output-related concept of "inferred utility". but his is a measure derived (via Feldstein's elasticity coefficient calculations [31]) from past clinical behaviour - the descriptive being employed as prescriptive (or merely predictive).

The questions of measurement are central. They are further discussed in the section on monitoring below, and, in the final section, in the context of a specific sub-system. Whatever the future achievements of research, the current requirement to produce plans demands some quantitative targets; and these have to be amplified to become progressively more specific as one moves from central government towards the operating units.

The United Kingdom's Department of Health and Social Security has issued the various "guide-lines" already referred to [13,14, 15]. "The Way Forward" includes measures of per capita expenditure on each of 26 "services". Historic and "illustrative projection" figures are given for these expenditure categories, along with staff and in-patient bed provision, and for the latter, measures of throughput or occupancy. The status of these numbers is not truly that of "targets," since RHAs have discretion to set these for themselves; but they indicate some of the quantities to which RHAs are expected to give consideration. In addition, each year's budgetary allocation gives the revenue and capital allocations; and guidance is given on the different growth rates suggested for expenditure on the different sectors of the service.

Many more detailed measures of activity are available from the routinely collected statistics of the operating units in the health authority. But care must be exercised in selecting which measures are given operational or strategic significance as "targets". A risk, to which many authors have drawn attention, is that the quantitative target selected to measure performance on some objective can become seen as more important than the objective itself; leading to distortions, and misallocation of resources.

Notwithstanding the above indications of interest, the need for the development of indicators is not universally or wholeheartedly accepted. Again quoting Elinson [23]:

"Despite what seem obvious policy implications of health indicators a recent inquiry among hospital administrators, public health planners and legislators revealed a marked unconcern in such measures. Hospital administrators appear to be quite uninterested in health status indicators: the organizational goals of hospitals are to provide hospital services efficiently without

regard to their effect on the health status of the community. At best, hospital administrators might be concerned with 'case treated' indicators rather than with the health status of populations, geographically defined. Some health planners are looking for a single overall national health index, analogous to the Consumer Price Index. Legislators, and other policy makers, on the other hand, show more interest in the evaluation of specific health programs than in indices of the health of the general population. Who, then, cares about health indicators? Global thinkers; top policy makers, occasionally; monopolistic trade unions such as the American Medical Association, who when a national health indicator goes up or down feel a reflection on their self-image; and social reformers who would like to influence health policy."

4. MONITORING AND CONTROL: THE NEED, THE METHODS, THE SHORTCOMINGS

4.1 Introduction and Discussion of Terms

This section considers the nature and methods of strategic monitoring and control in public service organizations, particularly health care systems. It is not a critique of existing organizations; the extent of the need in the specific case of the U.K. Regional Health Authorities is a matter for continuing discussion and research, and the objectives of the research may themselves be modified during the course of discussion. The case presented here is in general terms, and has three parts:

- (a) what is the need for, or purpose of, monitoring and control?
- (b) what published methods exist, or are viewed as standard?
- (c) what shortcomings have been identified in these methods?

The emphasis throughout this paper is on "strategic control"; the word "control" carrying such connotations as "routine" and even "automatic"; but without the usual limitation to "short-term". Consider, for example, the following quotation from Anthony and Herzlinger's authoritative work [32], "Management Control in Non-profit Organizations":

"Programming: In the programming phase, decisions are made with respect to the major programs in which the organization is to engage during the coming period. These decisions either are made within the context of the objectives and strategies that have previously been decided upon, or they represent changes in strategy. If the latter, they are part of the strategic planning process, rather than the management control process; the two processes merge into one another in the programming phase."

Here there is a distinction drawn between the "strategic planning" process and the "management control" process; but it is at least admitted that the implementation of major program decisions within established strategic objectives is seen as part of management control.

In the American literature, much of the appraisal of strategic programs is described as "evaluation". This is close to what we envisage as strategic control, but lacks the connotation of routine, continuing activity: strategic control should not be seen as a once-off evaluation, such as Hofstede refers to in the quotation in 4.5 below (p. 27). However, much of the methodology of evaluation - e.g., as reviewed and summarized by authors such as C. Weiss [33,34] and Suchman [35] - may be relevant to the design and operation of a strategic control system.

4.2 The Need for Monitoring: A Definition

If planning is to be more than a paper-producing exercise, it has to be followed by action. The plans are necessarily made on assumptions and forecasts, which are uncertain. Plans are made only at intervals - in the case of strategic planning, perhaps longer than a year. The adequacy of the original plan as a guide for continuing action is therefore bound to decline with time. Monitoring is the process of information-gathering by which the organization checks both its performance relative to targets, and the behaviour of the environment, assumptions about which formed part of the basis for the plan and the targets. Control actions result from the monitoring, and are typically:

- (a) to change current actions to ensure closer alignment with plan;
- (b) to re-interpret plan targets in light of latest environmental information, and then as (a) above. (Plan targets are often set in relative terms, e.g., "units per thousand population," so that absolute terms, e.g., "units" require an environmental input to fix them).

At a higher level, other results of monitoring may be:

- (c) to discover whether an assumption made as a basis for planning (e.g., a postulated relationship) has in fact proved correct; if in fact it is wrong, or a more accurate assumption is now available, an adjustment to plan may be made;
- (d) to discover that even the perfect achievement of a planned target is not found to be satisfactory, e.g., because it has not contributed towards the policy objective to which it was supposedly related. The target may then be abandoned, modified or replaced, and action as in (a) initiated.

The successive, cumulative operation of the above activities might appear tantamount to a continuous planning system. It differs from planning, however, in its frequency, continuity, and in the fact that there is a steadily growing risk that successive incremental decisions will become increasingly uncoordinated and ultimately incompatible. Moreover, the changes referred to in (a) to (d) above may be impossible to achieve or implement within the delegated authority or resource constraints at the point where the need for change is identified. Thus the apparently desirable changes, rather than being immediately implemented, have to be accumulated as a list of proposals; to be presented at the next appropriate "decision point". This is both a future point in time and a level in the system, where a more comprehensive view of implications can be taken; and where there exists the authority to commit the necessary resources.

Every individual is his own decision point, with some delegated authority for some scale of resources (even if it is only his own time), and has some view of the implications of his choices. The system may be viewed as a hierarchy of such decision points, the higher levels characterized by greater authority to alter resource commitments, and lower frequency of operation. The monitoring system is the process of information collection, organization, interpretation and presentation on which this decision-making hierarchy depends.

On all levels, the results and possible control actions (a) to (d) above have their interpretations. At the strategic level, the necessary actions are the least likely to be capable of immediate implementation, since they require the widest view of implications and the greatest authority over both resources and policy objectives (item (d) in strategic terms).

Thus the need for a strategic monitoring system has been defined as twofold: firstly, to stimulate the implementation of control actions; and secondly, where immediate action cannot be implemented, gradually to accumulate the agenda for the next point of strategic review and decision. Since the need for strategic decision may itself be dynamically dependent upon conditions, rather than fixed by schedule, a further function of strategic monitoring can be to determine occasions when a review of the strategic plan has become necessary.

4.3 Theories and Methods of Control: Introduction

The basic concepts of control have been developed in a number of disciplines, usually labelled by the nature of the system whose control has been attempted or studied. Within the subject of health care, "control" has usually been interpreted primarily as "control of expenditure", and this tendency to view control primarily as a financial function is common throughout industry and government. Money is, after all, the common language of resource allocation; and in industry, is similarly adequate for many purposes as a measure of outputs. In the context of health, however, most national systems prefer to limit or avoid

completely the operation of a price system; with the result that "control of health" becomes "control of expenditure". Feldstein [31] (1967) comments, "As a result, the system lacks automatic regulators to assure technical efficiency, the appropriate input combinations, and the optimal mix and allocation of outputs."

Since Feldstein's book, and in some cases based on it, there has been significant development work on resource allocation models (e.g., McDonald et al. [29]; Shigan and Gibbs [30]); but our emphasis here is on the development of the whole control system, within which the resource allocation process is one component, albeit a major one. Another key component of a control system would be an index or standard for health care performance. The debate on this was referred to in the previous section, and indeed the investigation of methods of measuring the performance of a health care system will inevitably be a major activity of the research.

The bulk of the literature on "control" lies in such fields as "mathematical" and "optimal" control theory; the application of this theory to automatic systems; its extension via econometric models to economic control; and in the field of financial control. These fields are discussed in the following paragraphs, with reference to their potential applicability or actual application to health care systems.

4.4 Optimal Control Theory, Economics and Ecology

The literature of optimal control theory examines the theoretical behaviour of servomechanisms* and of systems incorporating these. It is closely related to engineering needs in the design of automatic control systems for machinery, process plant, or large-scale integrated manufacturing operations. Going beyond deterministic models, stochastic control theory includes statistically specifiable disturbances or variation, such as are necessary where naturally variable inputs are involved - e.g., rainfall inputs to a water storage and supply system.

As such mathematical control theory was being developed in response to engineering needs, Wiener [36] produced a broader, more general view in his book: "Cybernetics: or Control and Communication in the Animal and the Machine." Wiener generalized the cybernetic, feedback and information concepts far beyond the fields of technology, into biological and social realms.

With the development of computing capability and econometric modeling, and the constant pursuit of more successful methods of national economic management, it was natural that attempts should be made to generalize the mathematics of control theory to the control of a national economy. Although the time constants relevant to simple mechanisms might be measured in seconds, hours or days, there is no mathematical objection to inserting the months or years used in econometric data. But there are naturally some practical problems.

* servomechanism: an automatic device for controlling large amounts of power by means of very small amounts of power and automatically correcting performance of a mechanism. (Webster)

First of all, there is the problem of the adequacy of the model as a representation of the system to be controlled; our understanding of the relationships governing the behaviour of large complex socio-economic systems is orders of magnitude weaker than our understanding of simple machines. Beyond this, there are problems of obtaining accurate data, problems of computation, problems of agreement on objectives, and problems of defining constraints on the acceptable or feasible behaviour of policy instruments.

Nonetheless, the prospect of applying control theory to economic management is sufficiently appealing to have lead the U.K. government to set up a special committee just to study this subject. Their report [37] maps realistically the limitations of the approach:

"Apart from the existence of a model of the economic system, the application of optimal control requires that there exist agreement as to the preferences that are to govern policy choice. In addition these preferences must be capable of formalization so as to constrain the optimal calculations made from a model. There are difficulties in representing the preferences of the community in a suitable way."

"Difficulties about defining the social welfare, because social welfare is hard to agree about, do not rule out the possibility of indirect benefits being obtained from the use of optimal control methods. Optimal control theory can be employed at more than one level in the policy making process. It can be used to help in the testing of the dynamic properties of economic models, to hit specified targets using fewer simulation runs, and to explore alternative views on the relative importance of policy targets. Optimal control analysis can be used iteratively in a process of model improvement, and to carry out feasibility tests which reveal the constraints that a model imposes on policy choice."

"Some of the evidence suggested that the weakness of economic models was a serious barrier to the application of optimal control. The Committee felt that if the model builder uses the best model he can get then it is difficult to see why he should not apply optimal control methods to it. If the Treasury persuades Ministers that its model of the economy is the best available, then to say that optimal control results obtained from it are of no use, is in effect to reject the model. On the issue as to whether or not to have a model for policy making at all, Ministers and officials must make up their minds. In any case at present the Committee's view is that optimal control might not only enable a more efficient calculation of alternatives to be carried out, but, more significantly, could lead to

a more thorough examination of the model itself. Models in the United Kingdom have not received the same testing and scrutiny as those in the United States, although it must be borne in mind that resources committed to this work in the United Kingdom have been on a much smaller scale. At the working level the Committee suggests that the use of optimal control can contribute to the more efficient generation of policy runs, the testing of the dynamic properties of models, and the exploration of alternative value judgements about economic targets."

"...Our central conclusion however is that optimal control techniques are at present best looked at as part of the total procedure of model building, testing, and use."

The control of a health system is an interesting subject for comparison with, on the one hand, the control of a machine or physical system; and on the other, with the control of a national economy. Clearly the health system is more complex and less precisely understood than a machine or integrated physical system (e.g., a steelworks). It is less complex than the total economy, in the sense that it forms only one sector of it. It has a much simpler and stabler environment in terms of physical resource constraints, demographic change, slowly-changing technology, and a budget which usually changes only marginally from year to year. But in comparing "the health system" and "the economic system", one must appreciate that what is normally referred to as "the national economy" is only one part or one aspect of "the nation and its activities". Economic control focuses in detail on the course of a few macro-economic measures, over the next one or two years, with five years as the longest term over which economic modeling attempts any significant disaggregation. Keynes aptly summed up economists' attitude to the longer term with his much-quoted remark, "In the long run, we are all dead". Such a remark, if made by a Health Service official, would be liable to cause some concern, as suggesting an unacceptable indifference to the ability of the Health Service to defer the date and ameliorate the manner of our departure.

The perspective of the Health Service has thus typically to be much longer than that of the nation's economic managers, whether or not they use control theory. The demographic projections of population, which run several decades ahead, may be as relevant to current strategic planning as the likely budget levels for the next five years. For even if the budget were dramatically altered, the nature of the problem of maintaining community health would be unchanged, although the means for doing it were constrained.

The "control" of a community's health is more closely akin to the management of an ecosystem, in terms of its time constants. Certainly there will exist theoretical problems and practical solutions in such concerns as forest management, the control of

fish stocks, or the conservation of tigers. However, the objectives of management in these systems are remote from those of a national health and welfare service. It might therefore seem unlikely that much expertise could be transferred from the literature of ecological control to the day-to-day management problems of a health service. But the possibility should not be ruled out; and if there are commonalities, e.g., at the level of system description, the first point at which they might find application would probably be in strategic planning and control. The possibility is strongly indicated by considering the categories of control strategy identified by Walters and Hilborn [38] in their review of ecological management:

- (a) non-adaptive (one-shot decision-making)
- (b) passive adaptive (learning by experience)
- (c) active adaptive (deliberate stimulation of learning opportunities).

This categorization has striking similarities to the control systems whose description is developed in 4.6 below. One might also note the natural "learning opportunity" which is provided by the existence in England and Wales of 15 autonomous regional health authorities.

4.5 Financial Control, The "Cybernetic" Model, and its Limitations

Turning to financial control, this has the longest history, and its practice is vested in a profession relatively isolated from the more scientific disciplines of mathematics, engineering or economics. Nonetheless, the basic conceptual model of budgetary or financial control is identical to the simplest feedback loop of cybernetics, as pointed out by Hofstede (1968) [39], from whom the following quotation and figure are taken:

"The essence of this control process is the negative feedback connection leading from measurement and comparison with standard to a compensating intervention. Now this is exactly what organizational control systems try to do. In our case of the budget, a standard is set; periodically, the performance of the process is measured and compared to the standard; variances are reported back to the budgetee, who is supposed to intervene to compensate for these variances, so that the next measurement of performance will meet the standard again."

Hofstede's research, on which his 1968 book [39] was based, led him to criticise the narrow view of control systems implied by Figure 6. Not only had it operational shortcomings, but it simply did not represent an accurate view of what actually happens in a real organization. It was typically uni-disciplinary in

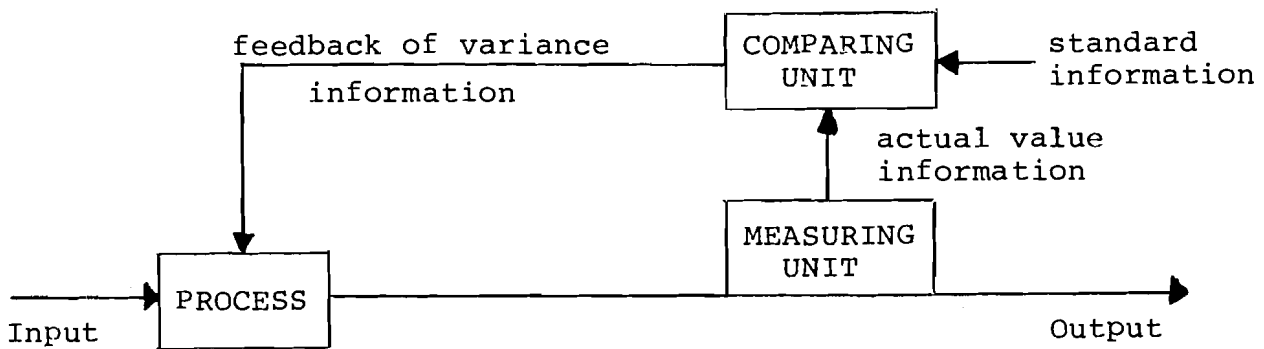


Figure 6 HOFSTEDE'S TECHNICAL CONTROL MODEL OF AN ORGANIZATIONAL CONTROL SYSTEM

outlook, ignoring behavioural or psychological factors; with these, he developed a much fuller view of the process of budgetary control. His recommendations took much fuller account of the potential of the budget system as a motivating tool, and were designed to give full scope to this. Concepts of "games" and the provision of a "tolerance range" (rather than a single target), within which the individual has some scope to "play", were central to his recommendations.

The simple model of Figure 6 came under attack from an independent direction, and with a number of illuminating insights, in Sutherland's 1975 article [40], "System Theoretic Limits on the Cybernetic Paradigm". He summarized the structural components and operational logic of the servocontrol system as in Figure 7, and listed six essential attributes:

1. There is some process we wish to control.
2. Preselected critical parameters of the process are to be constantly monitored.
3. These values are passed to a comparator, which ascertains whether they are tolerable.
4. If the values are outside tolerable limits, a decision is triggered, to initiate action.
5. The departure from tolerance limits is compared with a set of pre-programmed error correction routines, which may provide a suitable automatic response.
6. Failing this, the automaticity breaks down, and reference is required to an external agency with a wider or open-ended range of response possibilities.

Sutherland points out that "under the servo concept, organizational administration becomes equivalent to organizational control". In exploring the limits of applicability of the servo concept, he concludes:

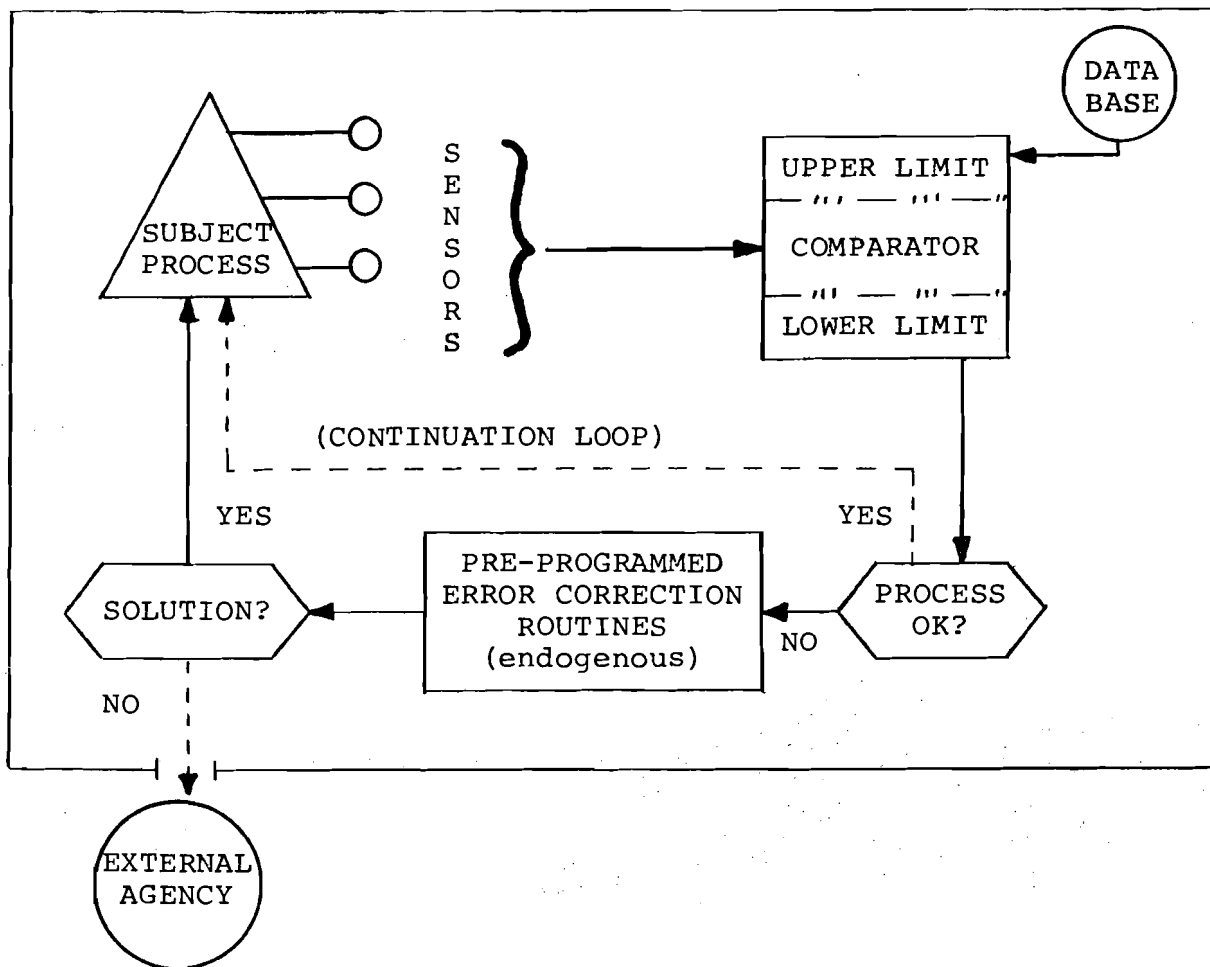


Figure 7 SUTHERLAND'S SERVO PROCESS

"The efficiency of the servocontrol modality in reducing the frequency, magnitude and duration of errors will be directly related to: (1) the frequency or period of sensing operations directed at critical process parameters; (2) the sensitivity or resolution power of the sensors themselves; (3) the speed and precision with which the arithmetic or logical comparator operations are performed; (4) the range of departures from planned or desired performance parameters for which we have pre-programmed solution or rectification routines to be automatically implemented by the servocontrol system; (5) the extent to which pre-programmed error correction routines exhaust the departures from planned or desired performance parameter which might occur; (6) the inherent efficiency of the pre-programmed error correction routines themselves; and (7) the probability of error associated with the performance of the servocontrol system itself, e.g., the extent to which it is effectively deterministic.

Clearly, all of these properties will in turn depend on the characteristics, both structural and dynamic, of the process or system which we are attempting to control via the servomodality."

Characteristics (4) and (5) are critical in classifying the systems to which the servocontrol concept is applicable. At one extreme, there are mechanistic, deterministic systems which barely require control. Moving through mildly stochastic systems towards increasingly complex, ill-defined or unpredictable systems, the efficiency of the servomodality decreases precisely because we must expect a decrease in the ratio of pre-identifiable to unexpected errors. What are the conclusions for monitoring of such systems? Sutherland suggests the nature of the changes, and the required response:

"System or process state changes generally occur in either of two ways: (a) through the introduction of essentially new state variables, e.g., structural determinants, during some interval of interest; (b) by the introduction of significant alterations in the quality of the relationships among system or process components. Thus, when we try to apply the servocybernetic approach to systems or processes approaching the organic ideal type, the demands on the control system increase radically and rapidly. Among these demands we find: (a) the need to monitor several or many different state variables and to collect estimates on them with great frequency; (b) the need to monitor coefficient or relational values among the state variables in addition to parameter values; (c) the tolerable process limits will represent complex functions rather than single parameter values such that the comparator process will be comparing states rather than the numerical values; (d) hence, any routine error corrections we pre-program will represent complex state shifts rather than simple process parameter changes, e.g., a significant tendency toward snow might result in a shift from land to air transportation, a shift with extremely wide ramifications."

As with the other disciplinary approaches (control theory, econometrics, etc.) it is not immediately obvious where one should place a health care system, or a regional health authority, on the spectrum from simple deterministic to complex, rapidly changing and open-ended. It is complex and multivariate, open-ended in the long run but not the short, and relatively slowly changing. But items (b) and (c) in the last quotation from Sutherland would seem relevant.

Hofstede [41] (1975) has drawn on Sutherland as a vindication of his own earlier work, as a demonstration of the "poverty of management control philosophy," and as an explanation of its general inapplicability to a large and important class of systems. He states:

"All cybernetic models of control have to assume that:

1. There is a standard, corresponding to effective and efficient accomplishment of the organization's objectives.
2. Actual accomplishment can be measured.
3. When standard and measurement are compared and variance information is fed back, this information can be used to intervene in the process so as to eliminate unwanted differences between measurement and standard for the next round.

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In many organizational situations, however, one or more of the three above-mentioned basic assumptions are not justified: standards do not exist, accomplishment is not measurable, feedback information cannot be used. This is in particular the case for ... all non-industrial organizations, such as schools, hospitals and public bodies."

Hofstede claims that misconceived attempts have been made to apply the cybernetic model beyond its proper limits, citing PPBS ("Planning-Programming-Budgeting-System") and MBO ("Management by Objectives") as possible examples of consequent failure. His conclusions on "alternatives to management control in non-cybernetic situations" are the shortest part of his paper, and the key section is as follows:

"The essence of the non-cybernetic situations is that they are political; decisions are based on negotiation and judgment. Decisions often deal with policies. The main ingredients in policy are not rational elements but values, which may differ from person to person, and norms, which are shared within groups in society but vary over time and from group to group. (Vickers [42], 1973, ch. 11). It makes little sense to speak of control processes here; it does make sense to speak of a control structure, taking into account the power positions of the various parties in the negotiations. Once resources are allocated, there is no automatic feedback on the effectiveness of their use; the only controls possible are, whether the resources are really spent and if no funds were embezzled. Beyond that, it is a matter of trust in those in charge of carrying out the programs; the real control takes place through the appointing of a person to a task. Activities once decided upon will tend to perpetuate themselves; corrective actions in the case of ineffective or inefficient activities are not automatically produced by the control system but ask for a specific evaluation study; deciding upon

such a study is in itself a political act which may upset an established balance of power."

4.6 From "Feedback" to "Feedforward": Extending the Cybernetic Model

We have described the views of Sutherland and Hofstede at some length partly as a good résumé of the cybernetic model of control and its applicability, and partly as a starting point for a fresh examination of monitoring and control over long time-scales in public service organizations. For Hofstede's analysis and conclusions seem to us to ignore significant possibilities for well-structured and appropriate control procedures, based on the concept of "feedforward" control. He mentions this in passing, but dismisses it because it "assumes that interventions are programmable in advance as a known function of environmental disturbances: a condition which is unlikely to be fulfilled in most management control situations."

We take issue with this view, particularly in the context of a health authority, but our criticism would have some validity also in the context of industrial strategic planning. In a very real sense, the "environment" of a health care system comprises the client population it is designed to serve; who may equally be viewed as potential "inputs" to the health care system. About these inputs, a great deal of information is known, at least at an aggregate, statistical level - demographic forecasts, morbidity statistics - and there is at least some understanding of what types of treatment and resources will be appropriate in broad terms when the predicted case-loads materialize. If the elderly population is going to increase, we prepare to increase geriatric care, nursing homes, etc.; if the birth rate is falling, we reduce the capacity of the maternity wards and teacher-training colleges. Such examples are evidently appropriate cases for the application of feedforward control, as shown in its simplest form in Figure 8; and in practice any forward planning based on forecasts is in fact a form of feedforward control.

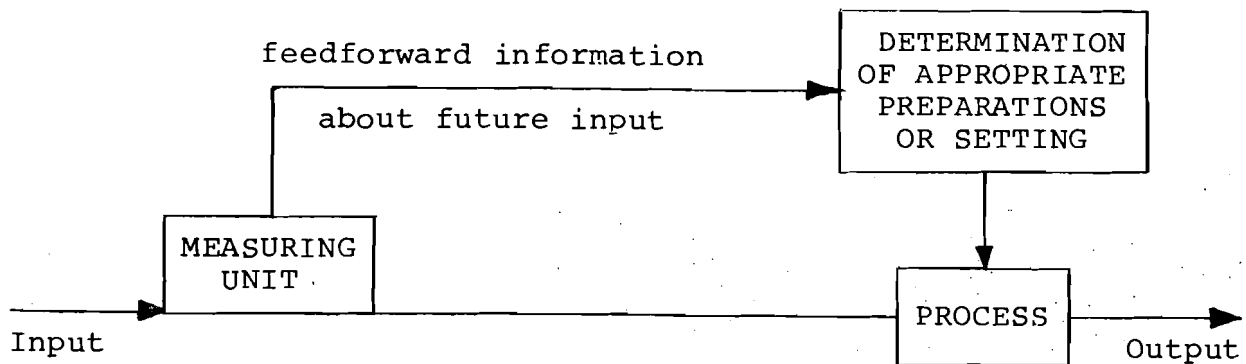


Figure 8 FEEDFORWARD SYSTEM: BASIC LOOP

Thus the theoretical case developed by Sutherland, indicating the growing inefficiency of the cybernetic control model when faced with situations of increasing uncertainty, is quite altered if we have at least partial knowledge of the deviant input values in advance of the process action. Sufficiently in advance, that is, to enable anticipatory action to be initiated.

The emphasis shifts to the ability to use effectively the advance information; and this requires a theoretical model of the relationships linking the process settings, the characteristics of the inputs, and the resulting outputs. The validity of this model becomes the central question. Figure 9 illustrates the role which feedback continues to have in checking and maintaining the accuracy of this model. Relationships observed in comparable situations elsewhere may also be incorporated in the system, providing an independent, external standard for comparison; the 15 regions of the U.K. create considerable potential for mutual learning.

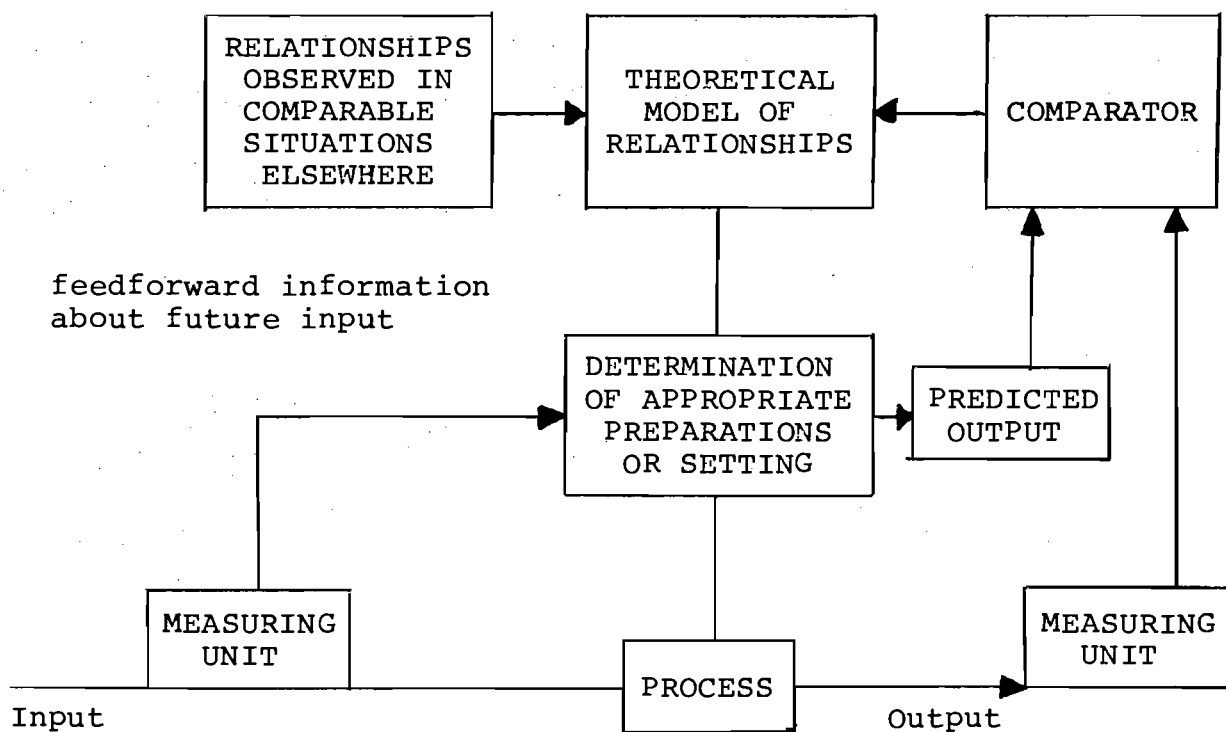


Figure 9 FEEDFORWARD CONTROL SYSTEM WITH FEEDBACK CHECK

It is instructive to compare Figures 2, 3, 8 and 9. If in Figure 2, "Environment Forecast" is viewed as "Measurement of Input", then the "Corporate Plan", and the cycle of its revisions, correspond to the "Setting" of the "Process". The setting is spelt out in greater detail of resource and operating policy modifications in Figure 3. This setting is designed to cause a certain "Predicted Output" (Figure 9), corresponding to the "Corporate Objectives" (Figure 2) or scheduled targets (Figure 3).

As was pointed out in the first paragraph of 2.2, Figures 2 and 3 represent only the plan formulation process. Figure 9 replicates this in the basic feedforward loop, but has in addition a control loop to check the correctness of the model. The single arrow running from "Comparator" to "Theoretical Model" is itself an over-simplification. The adaptive, or learning capability, by which the theoretical model is automatically revised to follow changing circumstances, is more fully elaborated in Figure 10. As shown in Figure 10, there could be several explanations for a discrepancy, each requiring different administrative action; in the absence of the measurement and identification mechanisms, no action may follow at all.

It is the strength of the system illustrated in Figures 9 and 10 that it can in principle be implemented in any setting, no matter how weak the initial data base. In theory, it could be inoperable if the input was unpredictable in even a statistical sense, or if the relationships between "process", "input" and "output" were changing at magnitudes and frequencies greater than the adaptive mechanism could keep pace with; but in the context we are discussing, this seems unlikely. It does in fact replicate - with the addition of anticipatory capability - the homeostatic or "ultrastable" system which Ashby [43] (1952) showed to be basic to all living systems. It is closely similar to the "adaptive management system" of Ackoff [20] (1970); the common "Double feedback loop" is discussed by Cantley [44,45] (1970, 1973).

The strategy formulation process described previously was attributed in its basic conceptual structure to Ansoff [17], and it is of interest to consider his approach (as described in "Corporate Strategy", 1965) as the basic loop of feedforward control. His own summary says:

"Our final result is what may be called a 'theory of strategic decisions'. It is built on a series of concepts: objectives (attributes, priorities and goals), strategy (product-market scope, growth vector, synergy, competitive advantage), present position (measured by forecasts), capabilities (measured by the competence profile), and synergy (measured by superposition of profiles). Strategy is viewed as an 'operator' which is designed to transform the firm from the present position to the position described by the objectives, subject to the constraints of the capabilities and the potential."

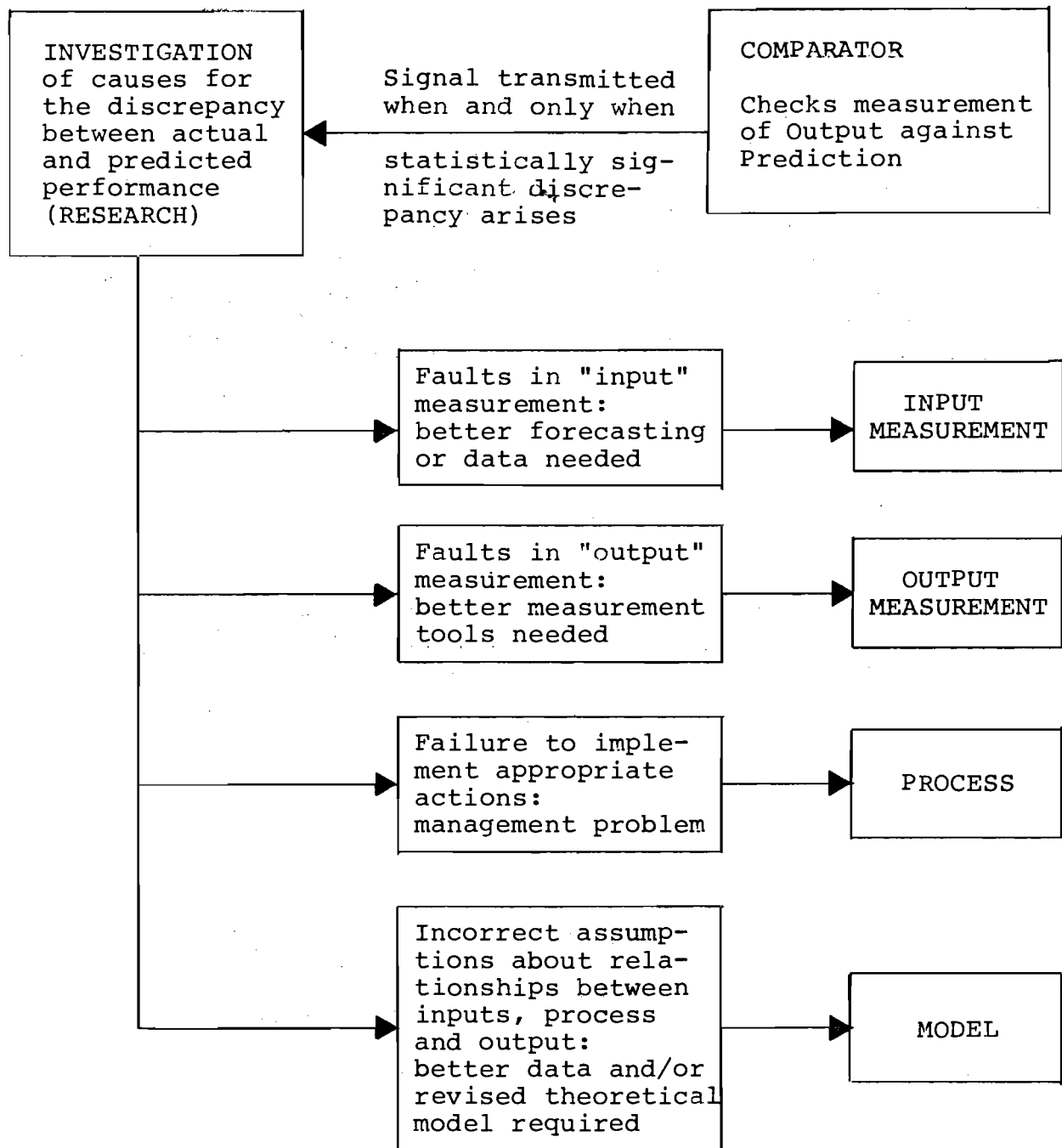


Figure 10 DETAIL OF CONTROL LOOP INSTIGATED BY COMPARATOR

We propose to modify this, with the context of the public service organization in mind, by viewing the "environment" as that which is to be processed: the health of the community is to be improved (relative to what it would be in the absence of health care), by the use of the health care process. The fundamental difference is that Ansoff treats the firm as an entity in principle independent and mobile, seeking to transform itself to a more favourable position (in terms of product-market sectors) in the general, open-ended environment (exploiting its "placid, clustered" and allowing for its "disturbed, reactive" characteristics, to use the environmental taxonomy of Emery and Trist [46]). By contrast, a health authority's position, its geographical boundary and its responsibilities, are statutorily fixed (though it is interesting to note that there may be some attempts to shuffle away from parts of these - "passing the buck"). Its duty is to transform not itself but the health of the population - the changes in its own instruments being incidental - however the health problems may change and evolve. The difference is as fundamental as that between a nomadic and an agricultural pattern of human activity; "j'y suis, j'y reste".

The view of environment as the object rather than the context of planning was formulated by Ozbekhan [19] (1969), but without elaborating the implications for control:

- "● 'Planning' can be defined in its greatest generality as a future-directed decision process.
 - The fundamental characteristic of this process is that it is conscious and rational.
 - It represents acting on some object, defined as environment. Such action is undertaken for the purpose of effecting changes in the environment.
- Planning, therefore can be said to include the following: (1) perception of the environment; (2) definition of the purpose of the changes one wishes to effect in the environment; (3) design of the acts whereby the environment will be altered."

An integrated view of adaptive planning and control, consistent with the above analysis, is that of Ackoff [47] (1974), in which the diagram of the "adaptive-learning control system" has basic similarities to our Figure 9. Particularly interesting is the "symptom and presymptom identification," which is precisely what is implied by the measurement process in "feedforward control".

4.7 Shortcomings and Proposals

In the absence of formal controls, the principal safeguard that a public service organization is properly and effectively pursuing the ends for which it was created lies in the integrity

and professional standards of the staff. There exists in some countries the insulting but widespread belief that the integrity and professionalism of individuals engaged in industry and commerce is much lower than that of public service employees. This belief is fed by the existence of statutory controls on the behaviour of companies, gradually developed over a century or more in response to evident need. These controls require not only the publication of extensive information (as in the annual report and accounts), but the independent checking and certification of these accounts by auditors. The belief is reinforced by the occasional scandals these checks reveal, or more often fail to reveal until too late.

In spite of these checks on behaviour, modern management literature shows increasing preoccupation with failures of strategic perception, or of inadequate or inappropriate strategic response.

In the public service sector, while at the basic level of controlling flows of money there exist the usual procedures for preventing misappropriation, there are ample grounds for doubting whether controls relating to overall purposes are so well-developed as in industry and commerce: partly because the purposes are themselves more difficult to define. While professionalism and individual standards are important, they do not prevent the honest and dedicated pursuit of purposes which can diverge from the proper objectives. Institutional aggrandisement, professional scientific interests, preference for more congenial types of work, are all motivations which can lead to a shift of priorities and resources within an organization's activities, without producing any obvious distortions or improprieties.

To illustrate from another field how widespread can be the tendency for strategic achievement to wander, unmonitored, from its original objectives, one might cite British experience with land-use policy since the 1947 Town and Country Planning Act. Coleman [48] writes:

"Land-use planning was the only type of planning mentioned in the 1947 Act, and planners were expected to monitor the results of their decisions by producing up-to-date land-use maps every five years. This they have signally failed to do, and it was not until the mapping vacuum was filled by the Second Land Utilization Survey that it became possible to make any objective assessment of how far land-use planning has achieved its aims.

...a number of sample resurveys have been initiated in fifteen counties, and the initial results are distinctly discouraging. Whilst some areas are still attempting to implement Classical Planning, others have abandoned all pretence of doing so and are actively abetting a reversion to 'Lemmings Rule'."

Some answers to this "quis custodiet" problem lie in the press; in informed public comment; and, in the U.K., in the newly created "Community Health Councils". The effectiveness of these bodies depends on the availability of reliable and pertinent information, and it is to be hoped and expected that the CHCs will have a strong interest in the creation and maintenance of an effective monitoring system. Their creation reflects a perception, by the architects of the reorganization, of the need discussed above; but the councils do not themselves constitute a method or process. In the following paragraphs, we develop further both some perceptions of the public policy control problem, and of proposals for its solutions.

One of the most basic questions to be asked of any public policy involving large and continuing expenditure is this: what level of expenditure, or proportion of the total, should be devoted to checking on or researching into the effectiveness of implementation of the policy, and the correctness of the assumptions on which the policy and related plans were based? If the question is not asked, there is ample reason to suppose that the amount so spent will be too small, rather than too large; and because it is too small, the likely consequence is of misallocated or ineffectual expenditure of resources an order of magnitude greater than the cost of their identification and prevention.

Anthony and Herzlinger [32] refer to a "tradition of inadequate management controls" as one of the "key characteristics" of nonprofit organizations, and substantiate this strong statement by U.S. experience:

"Barriers to Progress

Since the Federal government lacks the semi-automatic control that is provided by the profit mechanism, it needs a good management control system even more than a business does. Why has the government lagged so far behind? There seem to be three principal explanations. First, for many years, there was a prevalent attitude to the effect that the differences between government and business were such that government could not use the management control techniques developed by business. Articles to this effect written by eminent authorities appeared as recently as the 1950s, and this attitude continues to be implicit in some texts on government accounting. Second, the Congress, and particularly the House Committee on Appropriations, having become thoroughly accustomed to a certain budget format, is reluctant to shift to a new format; because of the importance of the budget, this affects the whole management control system. In part, this reluctance is based on simple inertia; in part it reflects a suspicion - an unwarranted suspicion - that the change is an attempt by the Executive Branch to 'put something over' on the Legislative Branch. Third, many career officials appreciate the fact that a good management

control system is two-edged; it provides new information for management, but it also provides new information for outside agencies - the Office of Management and Budget and the Congress. They are not anxious that outside agencies have access to the new and better information. (It is interesting to note the contrast between the second and third reasons.)

Other Nonprofit Organizations

In general - and there are numerous exceptions to each of the following statements - state and municipal governments have even poorer management control systems than does the Federal government. The two largest classes of other nonprofit organizations - health care and education - until recently had poor management control systems. Hospital systems, under the impetus of Medicare and in response to widespread criticism of skyrocketing prices, have been improving rapidly, although resistance to modern budgeting practices continues in many of them. Colleges and universities, led by certain state universities, also are making rapid improvements, although they have a long way yet to go. Public schools generally use a system developed under the auspices of the U.S. Office of Education; although recently revised, it continues to be an antiquated system. Religious organizations generally have only rudimentary control systems, although there are important exceptions."

Ackoff, in giving the outline specification already referred to [20] for an adaptive control system, refers to the problems associated with building flexibility and adaptive capability into purposeful systems; and to the work of Donald Schon. Schon's work [49] based on extensive experience of U.S. Federal Government programs and some of the American health and welfare organizations, is a valuable illustration of the various potential forms and ways in which such systems can fail; failing not only to achieve their objectives, but even to pursue them or define them correctly. It serves as a useful starting point for our consideration of possible shortcomings of a monitoring and control system; and for seeing how far the U.K.'s health service reorganization is designed or is likely to avoid these shortcomings.

In his description of how institutions react to strategic change, Schon uses the term "dynamic conservatism" for the property of resistance to change. It is not merely inertia, but a tendency to fight to remain the same. He describes how in the U.S.A., institutions for the treatment or rehabilitation of the blind have failed to adapt to the changing characteristics of their client population, and yet have maintained their traditional mode of operation, by such "instruments" as the following:

policy. Localities learn to beat the system. Government tends to bury failure or to learn from it only in the sense of veering away from it. Evaluation, then tends to be limited to the role of establishing and monitoring the extent of peripheral conformity with central policy.

The social systems of the agencies mirror the theory underlying the implementation of policies. Agencies are the social embodiment of policies, and in their efforts to sustain and protect themselves they also sustain and protect established policy. New problems fragment established agencies just as they fragment established policies. With the loss of the stable state, policies must be viewed as transient, their change being the foreground condition, and continuing fragmentation of agencies and policies becoming the rule.

For government to become a learning system, both the social system of agencies and the theory of policy implementation must change. Government cannot play the role of 'experimenter for the nation', seeking first to identify the correct solution, then to train society at large in its adaptation. The opportunity for learning is primarily in discovered systems at the periphery, not in the nexus of official policies at the centre. Central's role is to detect significant shifts at the periphery, to pay explicit attention to the emergence of ideas in good currency, and to derive themes of policy by induction. The movement of learning is as much from periphery to periphery, or from periphery to centre, as from centre to periphery. Central comes to function as facilitator of society's learning, rather than as society's trainer."

In considering Schon's criticisms in the context of the U.K. National Health Service, it is interesting to see that a number of the key criticisms are well met. The "imposition on localities at the periphery" of centrally formulated policy is at least softened by a strong suggestion of local participation in the framing of objectives.

It is interesting to note Schon's emphasis that the opportunity for learning is primarily in the systems at the periphery, not in the nexus of official policy at the centre. This is precisely the same as the point made by Burgess [50] in the context of U.K. education policy. His views are that all public policy should be based on explicit, testable hypotheses, and they form an appropriate complement to a paper on the strategic control of public policy in health care.

"The task for the social and natural scientist is one of trial and error; of inventing hypotheses which

can be practically tested and of submitting them to these tests. In most current practice the trial is unmonitored, the error explained away. Existing social science is more interested in describing and explaining than in testing the explanations. What we need is a way out of the anecdotal and taxonomic prison in which public affairs and their attendant social sciences find themselves.

I believe that such a way out exists. We can begin by accepting Karl Popper's formulation of the continuous process by which intellectual progress is made. The process begins with the formulation of a problem; for this we propose a trial solution; to this solution we apply tests to eliminate error; all of which leads us to a new situation with the possibility of new problems. In this process the most often neglected step is the first - the formulation of problems. In politics and social affairs generally we are all too ready to leap to a solution, and we often persist in the solution, regardless of its irrelevance to our pressing problems.

Hardly less neglected is the third step - that of testing our proposed solutions. Public affairs are littered with policies and 'experiments' which are successful only to the extent that activity equals success. We do not normally test or monitor our solutions, or even wonder what tests might be appropriate. But the task of creating apt tests is as difficult and important as that of formulating problems. One consequence of our neglect is that our attempts at the second step - of proposing solutions - remain at an unacceptably humdrum level. Most of our 'solutions' have in fact been tried before, and have scarcely ever met the case. Only when we know that the first thoughts off the tops of our heads are either unrelated to our deepest problems or unlikely to offer solutions to them shall we be tempted into the bold and imaginative proposals that our present social catastrophe demands.

The heart of the matter is the demarcation which Popper makes between science and non-science, that is, his notion of falsifiability. A scientific statement is one which can be falsified: not verified - because no amount of verification can give us the assurance of truth. One falsification, however, can give us the assurance of error. This is why our testing in stage three of the process sketched above is the elimination of error, not the confirmation of truth. It is also why it is mistaken to contrast the certainty of the natural sciences with the uncertainties of the social sciences: all knowledge is provisional, and we make use of one hypothesis until a better one comes along.

But the bolder our hypotheses the more vulnerable they are to refutation. This is their value: if they survive our best efforts to refute them, they have got us further. Popper has destroyed scientific certainty and replaced it with scientific progress, but progress is possible only if people formulate real problems, propose imaginative solutions and test them to destruction.

This approach is directly relevant to public policy: we can and should study policy scientifically. In politics, our hypotheses are policies. They are proposed solutions to particular problems. We have to decide what would tell us that the hypothesis was wrong; that is, that the policy had failed. It is failure that we have to look for. This would of itself add rigour to our proposed solution and would help us to predict the consequences of policy and test our predictions. We should be alert for unintended consequences and well poised to learn from mistakes.

Above all, we need this rigour to enable us to move quickly. In social affairs we are dealing with people, so to persist in error is especially irresponsible. We need, in short, the quickest means, consistent with reliability, of knowing that things have gone off the rails. It is more important to find apt tests, even crude ones, than to accumulate sophisticated data. It is this process of formulating social problems, creating solutions and testing them which properly constitutes social science.

Of course, policies do not exist in a vacuum: they are implemented through social institutions. Creating these institutions can be thought of as a social technology. We have to ask of institutions, as we do of machines, whether they are fit for the purpose. If they are not, we need to decide whether to tinker with them or scrap them. This is no separation of theory and practice, for the practice is an important aid to theory and rationality. Indeed social theory cannot long remain rational if divorced from social practice.

I hope it is now clear that such an approach is essential in a democracy. It is by the rigorous testing of policies that we can hope to hold a government accountable. If we cannot decide what would tell us that a government had failed in its policies, we have no ground but whim for turning it out, and no ground for protesting that it has been arbitrary and capricious. Criticism is the spur of science and democracy alike. There is no proposal that cannot be improved by the criticism of those less expert than its authors.

Democratic governments seek to remedy abuses, relieve misery or reduce barriers to opportunity and self-fulfilment by changes in policies. They do this all the time, fitting new institutions into the framework. These governments, and their societies, can make mistakes and learn from them without risking a disaster that would dissuade them from further reform. They can make repeated experiments and continuous adjustments. But if this is how governments are to act, we must have a scientific approach to public policy. Otherwise our reforms will be in vain, our mistakes unnoticed and our aspirations frustrated.

There is nothing new in the techniques we have to use: indeed some of them are crude in the extreme. What we must do is use the techniques to some purpose, and that purpose is the testing of public policy. In short, I believe that there can be an objective social science, that public policy and administration can be ordered scientifically."

The problems reviewed above, and the various proposals and responses, seem to us compatible with the analysis in the earlier parts of section 4: in particular the specification of the need (4.2) and the specification of the means to meet it (4.6, culminating in Figures 9 and 10). These provide the initial conceptual basis for our research: by their own logic, they should themselves be subject to critical feedback and review.

5. ILLUSTRATIVE CASE

The discussion of strategic control methodology cannot be usefully pursued without practical investigation and experience. This brings us back to the question of the most effective practical research which can be pursued by IIASA, in cooperation with the regional health authority, within limited time and resources.

Central to the design of a monitoring and control system is a model of the controlled system. A system as large and complex as the community health care system can be viewed as a unitary entity for a few purposes, including aggregate budgeting and planning, and overall design of control structures. But for all the practical questions of resource allocation and management, some more limited perspectives are required. It seems to us desirable that at least one "sub-system" within the total system be selected for more detailed investigation, in order to test and refine the theoretical ideas.

If one considers the "feedforward-feedback" system of Figures 9 and 10 (Hugh Lofting's "Pushmi-Pullyu" provides an apt name), then a sub-system of contemporary interest for study would be one in which the measurement unit of the feedforward side is currently signalling significant forthcoming change. Considering Figure 3's "environment" box (which in Figure 9

becomes "input"), the principal sources or types of change could be

- (a) Economic
- (b) Demographic
- (c) Morbidity
- (d) Technological.

Examples could be provided of all of these in the contemporary health scene, and the monitoring process should include consideration of all four. But to select an example for the purposes of illustration, let us consider a demographic change: the forecast increase in the numbers of elderly in the population.

There can be identified a "system" of care for the elderly, as illustrated in Figure 11, albeit in an oversimplified form. This figure is a conceptual model, from which various points, and indeed a whole method of approach, can be illustrated. Firstly, it represents an integrated view of the total "system" or succession of "states" through which the client population moves. The institutional arrangements are secondary, in the sense that they should be viewed instrumentally as channels through which resources are made available to match client needs, or meet community purposes. The administrative problems, e.g., of coordination between health and local authorities, are not of primary concern to the client.

Figure 11 itself reflects various existing institutional categories, so it is not as "pure" a model of "client states" as the above paragraph implies. One might draw a simpler diagram showing only various categories of "states of health," between which the client moves with various probabilities of transition. But it is not only administrative convenience that makes Figure 11 more useful: it is preferable because it recognizes the impact which the health system's actions have upon the individual's possible states of health. The boxes of the diagram summarize statements about both administrative arrangements and states of health.

Figure 11 can be viewed as an individual's map of alternative routes, and it is probably possible to establish widespread consensus on the relative preferences or values associated with the states or routes. These valuations are important for policy, but given existing preferences, the administrator will be more concerned with the aggregate flows represented by the arrows of Figure 11, with the aggregate numbers of clients in the various categories, and with the consequent resource implications.

Returning to Figure 9, the response to the signal, "increasing numbers of elderly approaching" must be some appropriate change of "process settings". The determination of the nature, amount and timing of the "appropriate changes" must, explicitly or

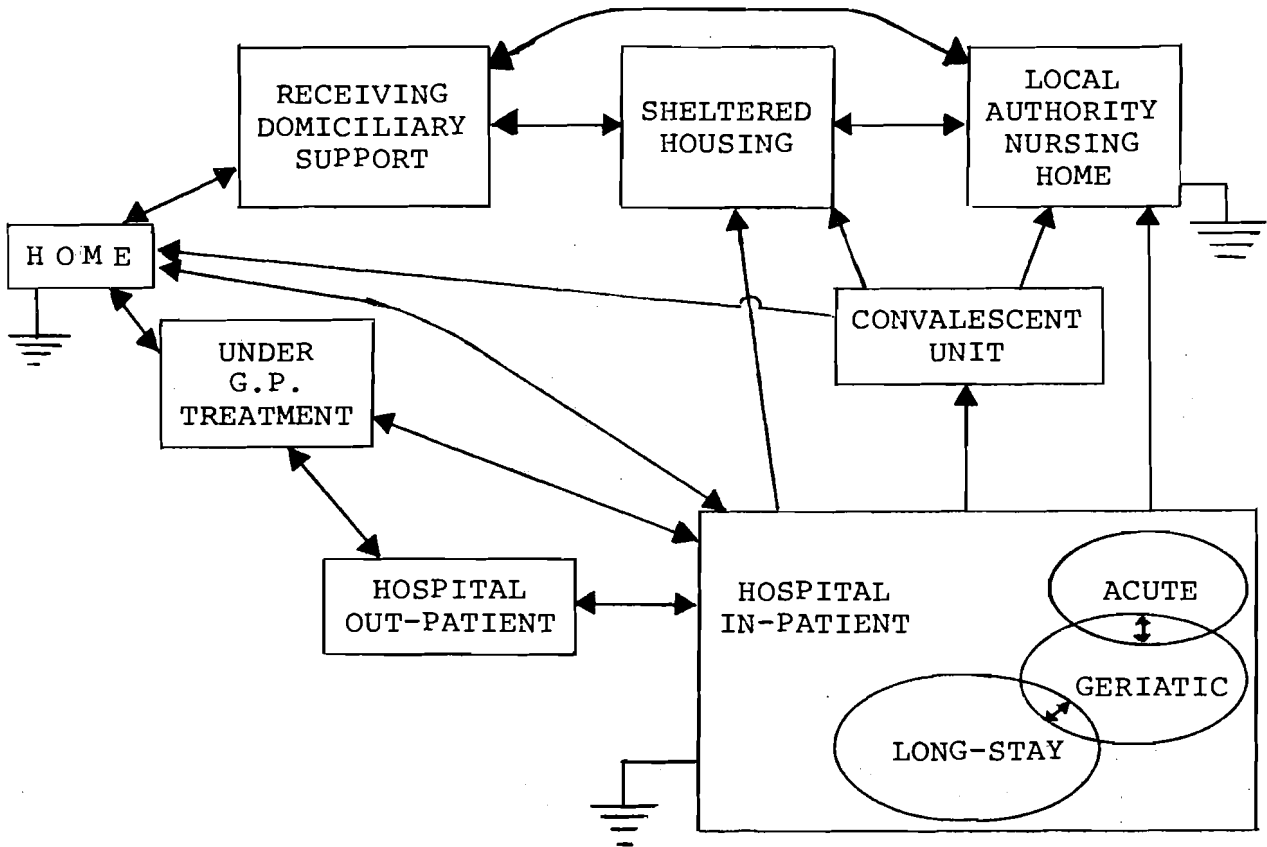


Figure 11 EXAMPLE OF "SUB-SYSTEM" FOR ELDERLY

implicitly, be based on a model, containing assumptions about quantitative relationships. These would be of the form,

"One thousand 70 year old females implies 50 requirements for opthalmic out-patient treatment at four consultations per year."

The measures required are both of the incidence of specified disability, and of the type and quantity of treatment judged appropriate. The treatments appropriate will often - particularly in the care of the elderly - include alternatives. The choice between these, and the choice of the feasible amount of care, are the core of the resource allocation models mentioned earlier. These are important, in the context of sub-systems such as that of Figure 11, in giving some answers to questions such as "what difference would an increase in home nursing or sheltered housing make to the demand for hospital in-patient geriatric care?"

There is a diffuse boundary between the "exogenous" measures of "actual" need, "he is very ill", and the measures which reflect policy choices and constraints in the resource requirements or allocations which were assumed to be necessary to meet the actual needs: "he is in need of 10 days' hospital in-patient general medical care."

The monitoring process has to check continually the accuracy of all the measures and assumptions referred to above, accumulating and organizing the evidence as described in 4.2 above.

Continuing with the examples of the elderly as a focus for specific research, the research agenda would include:

- (a) the sources of demographic data - its organization and format, and past accuracy;
- (b) methods of description and categorization of the incapacitation of the elderly, and data on the incidence by age and category;
- (c) specification, for each of the preceding categories of disability, of the treatment alternatives, their resource implications, and effectiveness;
- (d) statistics describing, for each of the types of resource referred to in (b), the present, and the future planned or potential, availability;
- (d) assumptions about relationships between (a), (b), (c) and (d) - e.g., about the substitutability of one pattern of treatment for another;
- (f) the present statistical data sources, reporting formats and procedures, and other arrangements relevant to the function of monitoring the system shown in Figure 11, and the health authority actions bearing on it;
- (g) the arrangements by which policy preferences on care for the elderly are formulated and translated into plans - e.g., the roles of the DHSS, the authority's officers, medical staff, and the Community Health Councils.

The two greatest potential areas of difficulty concern points already referred to. Firstly, the problem of finding an acceptable working position and relationship in and with the ongoing political and administrative systems of the authority. This is a central problem of applied research methodology, to be resolved by discussion and negotiation with the affected parties. The aim is to build up the sort of working, participative team of researchers, administrators, medical and nursing staff that has characterized some of the successful operational research work in the health service. Barber [51] and Burton et al. [28] describe two successful examples, and various others are reported in White and Henderson [7].

The second problem is that of measurement, as already referred to in Section 3 and in the quotations from Himatsingani. This is less of a problem; for even a weak starting point is usable. In the context of the care of the elderly, putting numbers on Figure 11 in the context of a U.K. Health Authority

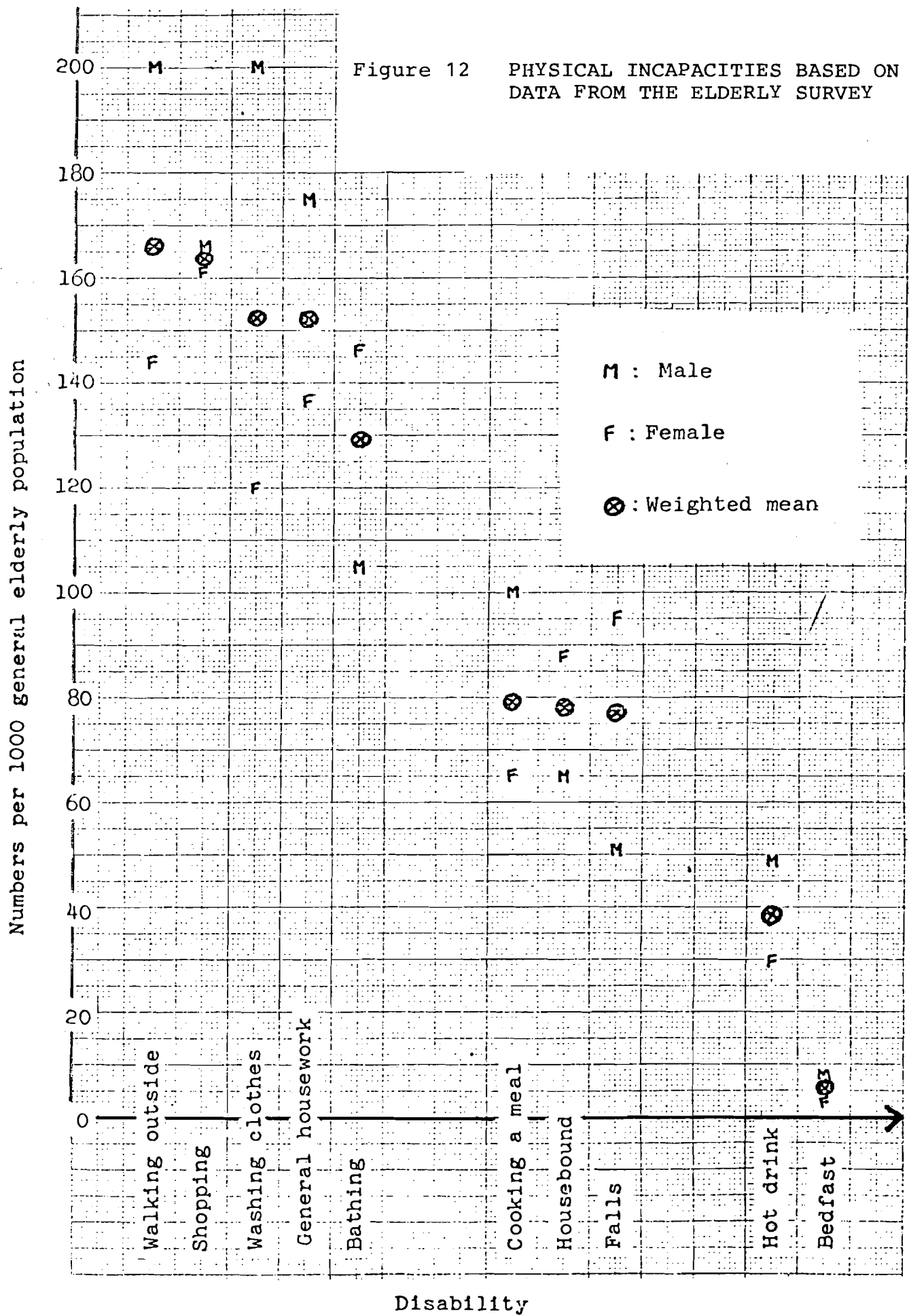
faces the problem of four administratively distinct contexts. Elderly citizens in potential need of health care may be living at home, making no demands on the system (though they should in general be on the list of some general practitioner (G.P.)). They may be in regular touch with their G.P., who is an independent contractor to the N.H.S. They may be undergoing hospital care, either as out-patients or in-patients. They may be in local authority sheltered housing or in a local authority residential home. It is understandable that health information system specialists stress the difficulties of "record linkage", while epidemiologists stress the need.

But considering the question of measuring need, the situation is not a complete blank. The General Household Survey, a regular, comprehensive national survey of long standing, includes a small number of questions relating to use of medical services. There have been surveys carried out by local authority Social Service departments, to establish records of disabled persons in their areas - indeed, this is a statutory responsibility laid upon them by the Chronically Sick and Disabled Persons Act. For example, Figure 12 and 13 are taken from a London Borough report [52] which seeks to assess the need for sheltered housing and residential care. Figure 12 gives the "incidence" or "morbidity" of various degrees of physical disability in the elderly population. (The figures were also recorded by age, and mental state also noted.) It is then a policy decision (doubtless influenced by resources) to define categories of need. Figure 13 shows the age-specific pattern for one such definition.

Several authors have discussed the question of nationally standardized definitions, and clearly a RHA will wish to have comparability between its districts. The information base relating to the elderly's need for care is of importance in planning future facilities and operating policies; for there is forecast a major demographic increase in the elderly and very elderly (over 75) age groups. Moreover, increased mobility and the decline of family size to historically low levels in the 1920s and 1930s will tend to increase the proportion of the elderly who will be living alone without the support of their children.

Further details of the research have to be discussed in consultation with the staff of the RHA, and possibly with local (e.g., university-based) research-oriented groups with an interest in co-operating with IIASA. Their role in maintaining continuing close contact with the health authority may be essential, in view of the constraints which geography imposes upon IIASA patterns of activity.

The immediate objective of the research is the improvement of monitoring procedures, and hence ultimately the improved effectiveness and efficiency of the authority in the discharge of its responsibilities. The scope for improvement cannot be appraised before existing procedures have been reviewed. The broader aim of the research for IIASA is the general development of the methodology of strategic monitoring and control.



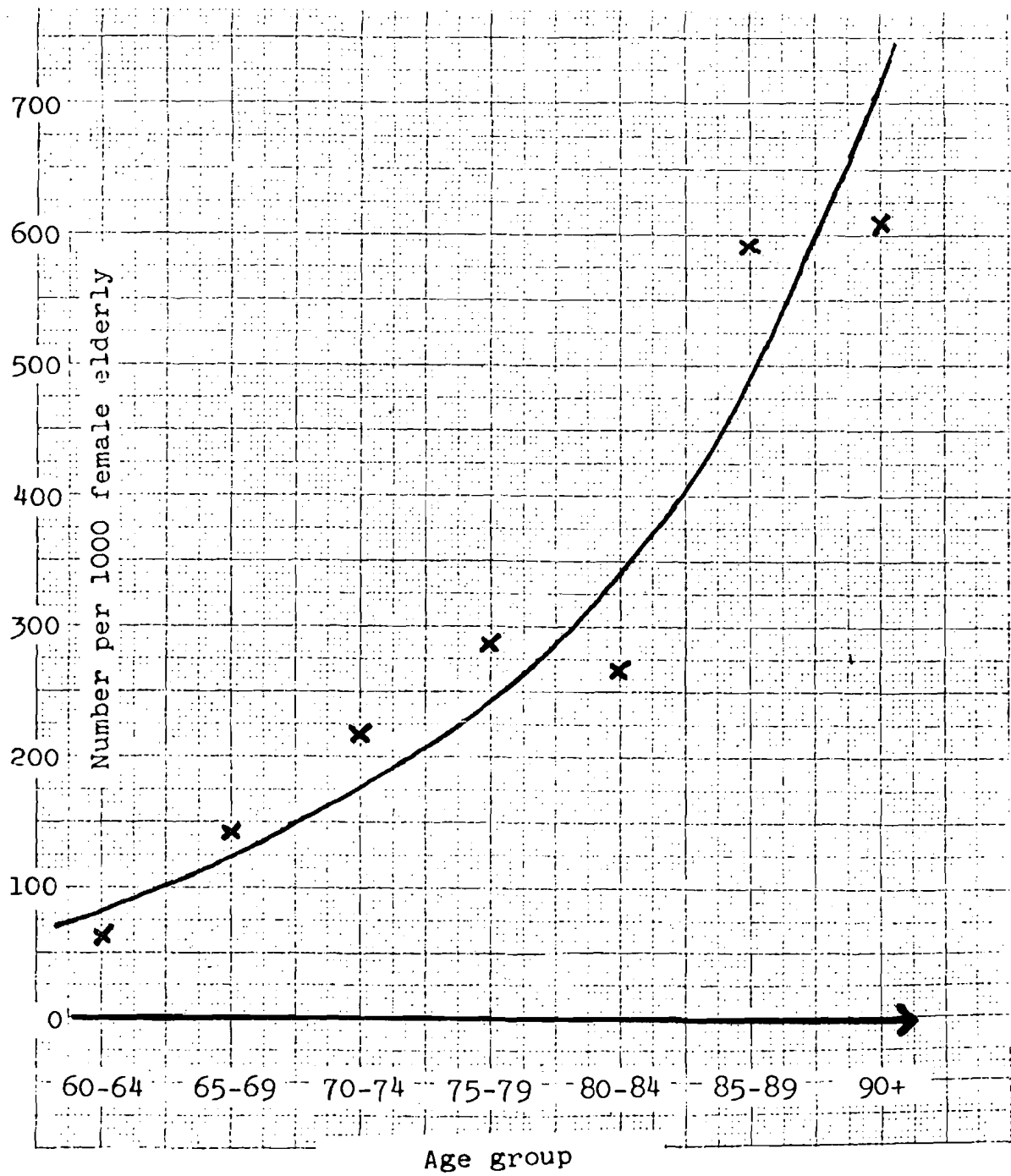


Figure 13 NEED FOR RESIDENTIAL CARE (FEMALES, BY AGE GROUP)

References

- [1] Research Plan 1978-79 (1978), International Institute for Applied Systems Analysis, Laxenburg.
- [2] Evans, J.R. (1975), Planning and Evolution in Canadian Health Policy and Programs, in ref. [7].
- [3] Hetzel, B.S. (1975), A Model for Public Learning in Health Care: Administrative Applications of Epidemiology and Health Statistics in Australia, in ref. [7].
- [4] Altenstetter, Christa (1978), The Health Service Paradox: Spending More and Feeling Worse: Intergovernmental and Interorganizational Relations in Health, Paper for International Conference on Innovations and the Service Sector, Berlin, June 13-16, 1978, available from Wissenschaftszentrum, Berlin.
- [5] Atkisson, A.A. and Grimes, R.M. (1976), Health Planning in the United States: An Old Idea with a New Significance, Journal of Health Politics, Policy and Law, 1, No. 3, Fall 1976.
- [6] Altman, D. (1978), The Politics of Health Care Regulation: The Case of the National Health Planning and Resources Development Act, Journal of Health Politics, Policy and Law, 2, No. 4, Winter 1978.
- [7] White, K.L. and Henderson, M.M. (ed.) (1976), Epidemiology as a Fundamental Science: Its Uses in Health Services Planning, Administration and Evaluation, Report of conference organized by the International Epidemiological Association, in Maryland, 2-4 March, 1975.
- [8] Lewis, C.L. (1974), Health Services Research: Asking the Painful Questions, In: The Challenge of Community Medicine, ed. R.L. Kane, Springer Publishing Co., New York, 69-86.
- [9] Georgopoulos, B.S. (ed.) (1972), Organization Research on Health Institutions, Ann Arbor, Michigan, Introduction, p. 2.
- [10] Department of Health and Social Security (1976), The NHS Planning System, HMSO, London.
- [11] Department of Health and Social Security (March 1976), Priorities for Health and Personal Social Services in England: A Consultative Document. HMSO, London.
- [12] Department of Health and Social Security (September 1977), The Way Forward, HMSO, London.

- [13] Department of Health and Social Security (March 1978), Health and Personal Social Services in England: DHSS Planning Guidelines for 1978/79, DHSS, London.
- [14] Drucker, P.F. (1959), Long-Range Planning: Challenge to Management Science, Management Science, 5.
- [15] Steiner, G.A. (1963), Managerial Long Range Planning, McGraw Hill, New York.
- [16] Long Range Planning, Journal started 1968. Pergamon Press, Oxford.
- [17] Ansoff, H.I. (1965), Corporate Strategy: An Analytic Approach to Business Policy for Growth and Expansion, McGraw Hill, New York.
- [18] Beer, S. (1966), Decision and Control, Wiley, New York; also, The Aborting Corporate Plan - a Cybernetic Account of the Interface between Planning and Action, in Perspectives of Planning (ed. E. Jantsch), OECD, Paris, 1969; and The Brain of the Firm, Allen Lane, Penguin, London, 1972.
- [19] Ozbekhan, H. (1969), Toward a General Theory of Planning, in Perspectives of Planning (ed. E. Jantsch), OECD, Paris.
- [20] Ackoff, R.L. (1970), A Concept of Corporate Planning. Wiley, New York.
- [21] OECD (1970), The Outlook for Economic Growth.
- [22] Fanshel, S. and Bush, J.W. (1970), A Health-Status Index and its Application to Health-Services Outcomes, Operations Research, 18, No. 6.
- [23] Elinson, J. (1974), Toward Sociomedical Health Indicators, Social Indicators Research 1(1), 59-71.
- [24] OECD (1973), List of Social Concerns Common to Most OECD Countries, OECD, Paris.
- [25] Jazairi, N.T. (1976), Approaches to the Development of Health Indicators, OECD, Paris.
- [26] World Health Organization (1976), Application of Systems Analysis to Health Management, W.H.O., Geneva.
- [27] Himatsingani, C. (1973), Approaches to Health and Personal Social Services Planning in the National Health Service and the Place of Health Indices, International Journal of Epidemiology, 2, No. 1.

- [28] Burton, R.M., Dellinger, D.C., Damon, W.W., and Pfeiffer, E.A. (1978), A Role for Operational Research in Health Care Planning and Management Teams, Journal of the Op. Res. Soc., 29, No. 7, July 1978.
- [29] McDonald, A.G., Cuddeford, G.C., and Beale, E.M.L. (1974), Balance of Care: Some Mathematical Models of the National Health Service, British Medical Bulletin, 30, No. 3.
- [30] Shigan, E.N. and Gibbs, R. (ed.) (1977), Modelling Health Care Systems, Proceedings of a IIASA workshop, March 28-29, 1977, IIASA CPl7718.
- [31] Feldstein, M.S. (1967), Economic Analysis for Health Service Efficiency, North-Holland, Amsterdam.
- [32] Anthony, R.H. and Herzlinger, R. (1970), Management Control in Nonprofit Organizations, Richard D. Irvin, Inc., Illinois.
- [33] Weiss, C.H. (1972), Evaluation Research, Prentice-Hall.
- [34] Weiss, C.H. (1972), Evaluation Action Programs, Readings in Social Action and Education, Annyn & Bacon, Boston.
- [35] Suchman, E.A. (1970), Action for What? A Critique of Evaluation Research, in "The Organization, Management, and Tactics of Social Research", (ed. Richard O'Toole), Scherkman Publishing Co., Cambridge, Mass.
- [36] Wiener, N. (1948), Cybernetics, John Wiley & Sons, New York.
- [37] Committee on Policy Optimisation Report (1978), Cmnd. 7148, HMSO, London.
- [38] Walters, and Hilborn, R. (1978), Ecological Optimisation and Adaptive Management, Annual Review of Ecology and Systematics, 9, (in press).
- [39] Hofstede, G. (1968), The Game of Budget Control, Tavistock, London.
- [40] Sutherland, J.W. (1975), System Theoretic Limits on the Cybernetic Paradigm, Behavioral Science, 20, 191-200.
- [41] Hofstede, G. (1975), The Poverty of Management Control Philosophy, Working Paper 75-44 of the European Institute for Advanced Studies in Management, Brussels.
- [42] Vickers, G. (1973), Making Institutions Work, London, Associated Business Programs.
- [43] Ashby, W.R. (1952), Design for a Brain, Chapman & Hall, London. Repub. 1965 as Science paperback.

- [44] Cantley, M.F. (1970), Long-range Planning in British Enterprises: Current Developments, Methods and Problems, International Conference on Industrial Economics, Budapest, April 1970.
- [45] Cantley, M.F. (1973), Corporate Planning, A Review of Questions and Answers, Omega, 1, No. 1.
- [46] Emery, F.E. and Trist, E.L. (1965), The Causal Texture of Organizational Environments, Human Relations, 18; reprinted in "Systems Thinking", (ed. F.E. Emery), Penguin Modern Management Readings, 1969.
- [47] Ackoff, R.L. (1974), Redesigning the Future: A Systems Approach to Societal Problems, Wiley, New York.
- [48] Coleman, A. (1978), Land-Use Planning in a World of Shrinking Resources, Long Range Planning, 11, February 1978.
- [49] Schon, D.A. (1971), Beyond the Stable State: Public and Private Learning in a Changing Society, repub. by Penguin Books, London, 1973.
- [50] Burgess, T. (1977), Education After School, Pelican Books, Penguin, London.
- [51] Barber, B. (1977), Operational Research and Implementation at the London Hospital, European Journal of Operational Research, 1, 79-84.
- [52] Greenwich London Borough (Program Planning Section, Chief Executive and Town Clerk's Dept.) (1972), Old People's Homes and Sheltered Housing in Greenwich, Key Issue Report, November 1972.