The Management of Innovation : The Implementation
of Contemporary Science Programs within the
Tasmanian Secondary School System.

BRIAN ALFORD

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TABLE OF CONTENTS

Abstract.

ABSTRACT

The term innovation embraces a broad spectrum of ideas from superficial and marginal changes to actions directed at radical restructuring of contemporary society. That innovation is of itself "good" and likely to lead to improvements in existing situations is often assumed.

The school, as a social institution, has not been immune from these processes of change and renewal and it has been our task to consider the implementation of innovative science programs within the Tasmanian Secondary School System.

Emphasis has been placed, disproportionately we believe, on the nature and content of innovations rather than on the processes by which innovative ideas interact with the target systems. If the integrity of new ideas is not to be compromised then it is vital that the variables affecting successful implementation of such initiatives be clearly identified.

Surveys of current literature suggest very strongly that factors antagonistic to the successful implementation of innovations are largely due to insufficient funding and lack of materials, inadequate preparation of teachers, and what is often stated as, "the resistance of teachers to change".

While recognising the above constraints, it is our thesis that one of the most potent barriers to worthwhile innovation develops through the creation of threat overtones for the encumbent in his dealings with both system and innovation. Such interactions may give rise to feelings of insecurity and anxiety as he attempts to reconcile the expectations of the system with the uncertainties inherent in the more "open", non-prescriptive nature of contemporary programs. The intellectual and professional demands placed on him through his association with innovative ideas may add to his feelings of unease.

This existence of a climate of threat is likely to initiate behaviours which are destructive of the task at hand. These dysfunctions may well lead to modification, institutionalisation or total rejection of the innovation.

We believe that contemporary science programs represent a major change from the view of traditional science and its instructional methods; a change from science as a search for universals and the building of an "ordered body of knowledge" most efficiently transmitted by the "authority of the master", to a view of science as the creation of explanatory models, held to be tentative and subject to refutation. The role of the modern science teacher is that of a guide, leading his clients to an understanding of the methods of science and an appreciation of both its potential and limitations as a key to explanation of natural phenomena.

This much more diffuse and uncertain task is likely to place him at variance with the expectations of a slowly changing educational system, an organisation still largely characterised by a rational authority structure. By this we mean a structure in which emphasis is placed on the selection and maintenance of behaviour patterns which are in keeping with the organisation's purposes.

If, then, we are to succeed in our attempts to innovate we must propose strategies which will provide alternative security bases for the teacher so that he may retain the support of the system but at the same time be free to invest in change and diversity. Our final section suggests the nature of management strategies, placing emphasis on self development, external validation including community support, teacher education and career reform and the active involvement of teachers in the innovative process.

Chapter 1.

Introducing the Task

The school, like other social institutions, is being subjected
to ever-increasing pressures to question the assumptions on which
it rests and the expression of these assumptions as reflected in
the experiences it provides for its clients.   This desire to bring
about change, to invest in programs of renewal and regeneration
within education systems, has been for some time reflected in the
rapidly expanding area of educational innovation.

Our interest will lie, not so much in innovation per se, nor
innovative programs in particular, but rather in a search for an
understanding of the potential interactions between innovative
ideas and their target systems, especially in relation to those
interactions which may lead to ineffectual use and even destruction
of the innovations themselves.

This will involve a search for the dynamics of innovative processes,
a quest for the real tensions in the interactions between the
constraints of the system and the "new" programs.   Miles makes a
relevant comment when he says:

> "The dominant focus in most contemporary change efforts ...
> tends to be on the content of the desired change, rather
> than on the features of change processes.   It is [our]
> thesis ... that attention to change processes is critical.
> We need to know, for example, why a particular innovation
> spreads rapidly or slowly, what the causes of resistance
> to change are in educational systems, and why particular
> strategies of change chosen by innovators succeed or fail."[1]

The Karmel Report expresses similar sentiments in speaking of
"This widespread lack of concern with the dynamics of change in
the complex systems which schools are," and again when it states
that "Emphasis has been placed on the substance of the change and on
the conditioning of participants to accept its consequences, ..."[2]

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1. Miles, M.B.   Innovation in Education,   Teachers College Press,
         New York, 1964, p.2.

2. Schools in Australia,   Report of the Interim Committee for the
         Australian Schools Commission, May 1973, p.126.

Of particular importance in this study will be the search for, and
identification of, "causes of resistance to change" in organisational
situations.

Evidence for this resistance is perhaps nowhere better illustrated
than by the <u>lag in diffusion time</u> for the adoption of innovations
by the target systems. Mort (1953) had this to say on educational
innovation:

> "A period of about 50 years may elapse between insight into
> a need and the invention of a solution which will be accepted.
> Fifteen years typically elapses before it is found in three
> per cent of the school systems ..."1.

The same author, in gathering information on this point from well
over one hundred studies, found a decade later:

> "Typically, an extravagantly long time elapses before an
> insight into a need ... is responded to by innovations
> destined for general acceptance in the schools. This
> period is measured in decades."2.

Although there is evidence to suggest that the rate of innovation
during the 1960's and 1970's has shown a pronounced increase, it
seems that this is true for innovations of a technological nature
rather than for those changes which affect organisational structure.[3]

We may fairly ask the question: What is the nature of the process
which tends to maintain the status quo despite a contemporary
environment which is characterised largely by rapid change?

It will be asserted that, in relation to the organisation to be
studied, one of the most potent areas of conflict will arise
through the generation of a <u>threat dimension</u> as the dynamics of
innovative programs challenge the inertia of the target system.
By a threat dimension we will mean those states of anxiety, insecurity
and conflict which may arise when a person's traditional security bases
are put at risk.[4]

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1. Mort, P.R. <u>Educational Adaptability</u>, N.York, Metropolitan School
        Study Council, 1953.

2. Mort, P.R. writing in Miles, M.B. (ed) <u>Innovation in Education</u>, p.325.

3. For example, see M.B.Miles, <u>op.cit.</u>, pp. 5-7

4. We admit that these states may, in some situations, be advantageous
        to the individual, particularly if he views them as a <u>challenge</u>.
        We believe such situations to be infrequent.

1.1 Point of Focus

Our specific tasks in this analysis will be to

(a) identify the nature of the dysfunctions [1] which are likely to develop during the period of implementation of innovations, particularly in relation to the behaviour of encumbents in the target system and

(b) to suggest strategies of management which are likely to increase the chances of successful implementation of innovative programs by these systems.

In order to make the task meaningful we have decided to be selective in both the area of innovation and the system involved.

In the first place it can be stated that educational innovation may fit broadly into such categories as educational principles, modes of organisation, teaching aids and curriculum content and materials.[2]

For the purposes of this study we will concern ourselves with those aspects of the educational enterprise which may be broadly categorised as curriculum-oriented. Curriculum, then, will be considered as the vehicle of innovation. Although the term, "curriculum" is often used to "describe all the learning which is devised and guided by the school, wherever and however it may occur",[3] we will use the term in a very restricted sense. In looking at curriculum as the change-agent, we will be concerned with those programs which are subject and level specific, in our case science at the secondary level. Although this is a more narrow conception of the curriculum, much of the innovation occurring in education is through the agency of subject-specific programs.

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1. In speaking of dysfunctions we are referring to patterns of behaviour which may be destructive to the purpose at hand. Such behaviours may be direct or indirect consequences of what is being done.

2. Hoyle, E. & Bell, R.   Problems of Curriculum Innovation I, The Open University Press, Walton Hall, Bletchley, Bucks. 1972, p18.

3. Hughes, P. (ed).   The Teacher's Role in Curriculum Design, Angus & Robertson, 1973, p3.

Within the last two decades a significant number of secondary
science programs have been developed overseas, both in the
specialist and generalist science fields.   Several of these
projects have been used in Australian schools although often in
modified form.   Our interest will lie in the introduction and
use of materials designed for the early years of secondary education,
in particular the first four years of secondary schooling.

It will be necessary to identify the premises on which these
programs are based and the nature of the interactions engendered
through the intersection of the spheres of influence of innovation
and system.   An examination of the strategies of implementation of
the Australian Science Education Project[1] should shed light on how
this first national curriculum project intends to manage the acceptance
of its model.   (See chapter 5).

Our second point of focus relates to the target system to be studied
in our analysis.   This is the Tasmanian Education Department Secondary
School System, hereinafter referred to simply as the System.   This
System can best be described in terms of what Pusey refers to as the
first and second dimensions of organisational structure.[2]   Our concern
here will be the introduction and use of innovative science programs into
what we will assert is a highly formalistic[3] and goal-directed structure
where change has been directed largely to "surface" modifications

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1. The Australian Science Education Project was set up in 1969 as a
    national secondary science curriculum project funded by both the
    Commonwealth and the states.   The first of its materials are now
    available.

2. The first dimension refers to the formal structure, particularly
    the distribution of formal authority, while the second dimension
    is representative of the technology - the physical and cognitive
    aspects of the system's operations.   See -
    Pusey, M.R.   The Tasmanian Education Department Secondary School
              System : A Study of Organisational Processes,
              Dr. of Education thesis, Harvard University, 1972.

3. We refer here to an authority structure in which authority devolves
    from higher echelons of the organisation and which operates within
    a set of closely defined regulations.

rather than to basic changes in the authority structure.[1.]   Of
particular importance here will be the generation of behaviours
at the innovation - System interface and the consequences for both
innovation and System.

1.2 Framework of the Study

The purpose of chapter one to this point has been to define the
aim of the study and to pose questions relating to both the
implementation and management of innovation in an organisational
context.

Chapter two attempts to clarify and define "innovation" as a process
for it has become fashionable in education to use this term to
describe a very wide spectrum of ideas from minor changes to radical
alterations of existing situations.   Since our study relates ultimately
to the management of innovation, it is vital that we have an under-
standing of the relevant aspects of innovation and associated processes.

Chapter three examines the nature of science education, both traditional
and contemporary, and the organisational structure of the System.   The
prospects for successful implementation of contemporary innovative
science programs within the System are discussed.

In Chapter four we have identified what we see as being dysfunctions
in relation to the implementation of "new ideas" within the System
and we have argued that the development of a threat dimension is a
likely outcome.   This section is the core of the study.

We conclude in Chapter five with some thoughts on how innovation
might be fruitfully managed within structures having organisational
frameworks similar to those of the System.

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1.   To illustrate this point we may cite the Tasmanian Education
     Department's decision to "decentralise" its administrative
     structure.   This involved the setting up of regions within
     the state and the appointment of Regional Directors and
     associated staff.   In essence, the centralised structure that
     operates by clearly delineated (and thereby formalised) lines
     of authority has become more extensive in a geographical sense.
     Such a "change" has not, for example, substantially increased
     the decisional power of teachers in the classroom.

Chapter 2.

Innovation and Change

In speaking of innovation we will be concerned with a set of change processes which develop from a deliberate plan to alter an existing structure. Miles sees it this way:

> "Generally speaking it seems useful to define an innovation as a deliberate, novel, specific change, which is thought to be more efficacious in accomplishing the goals of a system. ... innovations in education ... ordinarily have a defined, particular, specified character, rather than being diffuse and vague."[1].

Miles further feels that "the worthwhileness of an innovation is ordinarily justified on the basis of its anticipated consequences for the accomplishment of system goals". This assertion will need to be kept in mind because of its implication for change in the innovation rather than in the system. Such a change could lead to the innovation being absorbed into the system and institutionalised.

We will not concern ourselves with the largely unproductive assertion that an idea is innovative only in the sense that it makes its appearance for the first time. This situation of creating something new, that is, invention, is probably fairly rare in practice. Armstrong's heurism, originating in the late nineteenth century (and at that time, certainly innovative!), has made spasmodic appearances in various guises over the last seventy years and has in fact had a continuing influence on science teaching. Contemporary science programs appear, on the surface at least, to have much in common with a discovery rationale. But, whereas the heuristic method was a tightly structured approach leading students to the final "act of discovery", contemporary programs view discovery as an invitation to inquiry in open-ended situations. In this respect then, science programs of the last ten to fifteen years are innovative because of a differing perception of the nature of discovery. In this sense, the innovation relates to some object, concept or operation which is perceived by the individual as being new and thus appearing to be fundamentally different from current practice.

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1. Miles, M.B., op.cit., p14.

Often associated with this perception is the belief that innovation is _good_ for the organisation, likely to _improve_ an existing situation and be more efficacious in achieving the organisation's goals. It seems to us that innovation is often justified on such preconceptions so that the very act of introducing innovative ideas implies their success prior to an evaluation being made. Thus, the innovator may well find himself unprepared for the problems that are likely to develop through the interaction between innovation and target system.

There are two distinct yet complementary aspects of "innovation". In one sense we use the term to describe the inherent _nature_ of the new idea, particularly in relation to the field of knowledge it describes and the rationale on which it rests, as for example, the Australian Science Education Project which is based on an individualised, self-paced, enquiry-oriented approach. In another sense, we are concerned with innovation as a _process._ In the Karmel Report, innovation "... means the creation of change by the introduction of something new."[1] We will be particularly interested in the processes involved in the _introduction of something new_ and how new ideas come to be adopted, modified or rejected by a group or organisation. Although we will be largely concerned with this latter _process_ connotation, it is obvious that inherent characteristics of the innovation itself can be expected to create responses from those in the target system.

In a deeper sense, innovation suggests the existence of alternative realties. Traditionally, science, for example, has concerned itself with what could be called, euphemistically, the "real thing" but the New Science is much less certain about the nature of reality, preferring to construct explanatory models in order to describe natural phenomena. Such a shift in emphasis has implications for not only a changed view of science but also for the nature of knowing. The nature of the interaction between these new realities and the inbuilt conservatism of educational systems will need to be analysed in this study.

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1. _Schools in Australia,_ _op.cit.,_ p126

2.1 Stages in Educational Innovation

An innovation, from its conception to its final acceptance into a target system, that is, its pattern of diffusion, normally passes through more or less defined stages. Gross et. al. suggest three stages, viz. initiation, attempted implementation and incorporation. They see these stages as follows:

> "Initiation covers the period of time in which a particular innovation is selected and introduced into an organization. More specifically, it is the stage in which an organization defines a problem, decides on an innovation to resolve it, and presents the innovation to organizational members. The period of attempted implementation begins after the announcement that an innovation will be adopted and focuses on efforts to make the changes in the behaviour of organizational members specified by the innovation. If during this period organizational members do not make the required changes in their organizational behaviour, the process breaks down. Incorporation is the period when a change that is implemented becomes an enduring part of the operation of the organization."[1].

Lewin (1958) uses similar notions but in relation to behaviours associated with innovative processes when he speaks of unfreezing, changing and refreezing.[2]

The initiation stage suggests the existence of a need. We might ask: Are the needs for a change felt by the system, its members or society? Does research support the need for change and the direction it should take? Is the change simply for the sake of change and is this necessarily unacceptable? Certainly the move from initiation to attempted implementation has serious implications for the development of strategies for the management of innovation. In our final chapter we will look closely at the creation of climates conducive to innovative thrusts.

The attempted implementation stage looks to the actual in-school dynamics of the innovation in action and the processes leading to acceptance and/or rejection.[3]

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1. Gross, N., Giacquinta, J. & Bernstein, M. Implementing Organisational Innovations, Basic Books Inc., New York, 1971.

2. Gross et.al. op.cit., p.17

3. These processes constitute the substantive issues of this study and the basis for chapter four.

It is relevant at this point to comment on what we see as fairly widespread misunderstandings about the nature of the implementation process. In the first place it is easy to confuse successful implementation of an innovation with its institutionalisation. In the former case we mean that a new idea (at least an idea _perceived_ as being new and fundamentally different from current practice) becomes an accepted and integral part of the educational structure so that its basic premises and integrity are not compromised. This is in contrast to the situation where, because of the entrenched positions of management and staff, the innovation is tailored to fit the organisation. Goodlad and Klein in looking at innovation in the classroom comment on this point: "Projects usually appeared to be 'tacked on' rather than integrated into the fabric of the school". They go on to say:

> " ... some of the highly recommended and publicized
> innovations of the past decade or so were dimly
> conceived and, at best, partially implemented in
> the schools claiming them. The novel features
> seemed to be blunted in the effort to twist the
> innovation into familiar conceptual frames or
> established patterns of schooling".1.

J.S.S.P.[2] material is a good case in point. Although this program certainly appeared to be quite different in approach to that of traditional programs it has been forced to fit into time slots already in existence[3], accept an evaluative system of long standing (thereby compromising its own in-built system) and suffer a denial of its individualised, self-paced learning strategy since class sizes and necessary economies have meant that students work not as individuals but in pairs. Such a program has become largely institutionalised within the System.[4]

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1. Goodlad, J. & Klein, M. Behind the Classroom Door, Wadsworth, California, 1970, p.72.

2. The Junior Science Secondary Project (J.S.S.P.) developed materials initially for teachers and students in grades 7 and 8 in Victorian schools. Tasmania and South Australia became involved in the Project in 1966-67 and today units are available for schools throughout Australia. The materials are prepared in kit form with student booklets and teacher guides. The materials are based on a self-paced, individualised rationale.

3. True, "timetabling" in some few secondary schools has allowed less restrictions in "periods" available for science teaching.

4. See Carlson, R.O. Adoption of Educational Innovations, University of Oregon Press, 1965, p77, for an account of "sabotage" in relation to programmed instruction where teachers restricted self-pacing in favour of a lock-step approach.

There is a second important source of confusion in considering
implementation of innovations.   This arises since the teacher
often mistakenly believes that he in innovating in a meaningful
way when in fact change would be a better description of the
activity.

> "The two words "change" and "innovation" have
> interesting meanings, and they mean interestingly
> different things.   The word change is related to
> the word "exchange".   It connotes the idea of
> making something different in one or maybe two
> particulars, but not really the activity of converting
> to something wholly new.   Innovation, on the other
> hand, does mean the introduction of something new.
> It takes its meaning from the word for "new".   To
> innovate is to create something new, something that
> deviates from the standard practice."1.

The boundary between these two processes is not sharp but the
distinction is important when one considers renewal in educational
systems, for change as above defined can be expected to lead to
superficial re-organisation of activities within a system rather
than major restructuring.   Quite obviously fundamental innovation
may languish if encumbents believe that piece-meal, peripheral
initiatives inevitably lead to worthwhile change.

A third area of confusion relates to the belief that "innovation" by
individuals is likely to bring about change in the organisation;
that change in the individual's perception of his role will
substantially alter organisational behaviour.

> "The major error in dealing with problems of
> organisational change, ... is to disregard the
> systemic properties of the organisation and to
> confuse individual change with modifications in
> organisational variables".2.

The innovator, in his expectation of support from the very system he
is trying to change, may find a developing conflict between what he
sees as essential requirements for implementation and what the
organisation decides are acceptable roles for its members.   The need
for support during the process of innovation is seen as a sine qua non
of successful implementation and is discussed below in more detail.

A fourth and final note of caution is in order.   This relates to the
learning and use of the language of innovation;   as Bassett comments,

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1. Hillson, M. & Hyman, R.T.   Change and Innovation in Elementary and
                                Secondary Organisation, Holt, Rinehart
                                and Winston, N.York, 1971, p.1.

2. Katz, D. & Kahn, R.L.   op.cit., p.390

" ... the language of innovation being accepted in lieu of innovation itself." He continues,

> "It enables a person to gain power over things by
> learning their names, and protects him from the
> need to discard firmly held beliefs and values,
> and to modify well practised skills. It enables
> him to tolerate the idea of change while being
> uncommitted to it, thus reducing its threatening
> aspects. It enables him to appear to maintain
> his place in a moving sense by adaptive movement
> on the one spot. It has emotional value for him
> in sustaining professional self-esteem and morale.
> But it does not lead to change".1.

This de facto commitment to "change" can actively work against worthwhile initiatives since it substitutes pretence for practice.

The recognition of the above areas of misunderstanding and confusion in the implementation stage is vital, for misconceptions about the nature of innovation and its implementation within the System may well divert our attention from the fundamental issues involved. For those associated with the management of innovation an awareness of the above pseudo-innovative situations is of fundamental importance.

Finally, the incorporation stage refers to the adoption and institutionalisation of the change. At this point, unless the innovation is subject to a continuing process of re-appraisal and modification, then it may well be absorbed into the system and subverted, losing its identity and potential for initiating further change.

Both communicative and evaluative procedures are concomitants of each stage, the former playing a vital role in the initiation and spread of ideas, the latter providing continuing feedback so that the diffusion process may be more effectively managed.

2.2 Resistance to Innovation

Although there is a considerable volume of literature on specific innovative programs there is little information on the processes involved in their implementation. This is particularly so in relation to studies on problems associated with implementation and the nature of "resistance-to-change" processes. We believe it is

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1. Bassett, G.W. "Change in Australian Schools". The Australian Journal of Education, No. 1 March 1971, pp 48, 49.

relevant at this stage to mention some of the findings in this field
and comment briefly on the nature of the "barriers" adduced.

Gross and others in a study relating to the introduction of the
Catalytic (teacher) Role Model for the purpose of motivating
lower-class children, found that resistance to this innovation
could

> "primarily be attributed to five circumstances:
> (1) the teachers' lack of clarity about the innovation;
> (2) their lack of the kinds of skills and knowledge
> needed to conform to the new role model; (3) the
> unavailability of required instructional materials;
> (4) the incompatibility of organization arrangements
> with the innovation; and (5) lack of staff motivation."[1]

Such findings indicate fairly clearly a lack of adequate
communication between those introducing the innovation and
the teachers involved.   At the same time the variables
identified suggest little about "human" factors in the implementation
process, particularly with respect to psycho-social determinants.
Gross and associates saw these findings as a repudiation of the
oft-stated assertion that "initial resistance to change" was a
major factor opposing innovation.   Whether this study successfully
challenged such an assertion can probably be decided only by further
research.   Later in our study we will assert that resistance to
change is very real on the part of those in the target system but
as a developing, on-going process initiated by interactions between
the innovation, teacher and System.

Eichholz and Rogers (1964), in a study of electro-mechanical
innovations developed a theory of rejection related to an adoption-
rejection continuum.   This framework for the identification of
Forms of Rejection is set out below.[2]

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1.   Gross et.al. op.cit.,   p.122.

2.   Miles, M.B. op.cit., p.310.

Form of Rejection	Cause of Rejection	State of Subject	Anticipated Rejection Responses
1. Ignorance	Lack of dissemination	Uninformed	"The information is not easily available."
2. Suspended judgment	Data not logically compelling	Doubtful	"I want to wait and see how good it is, before I try."
3. Situation -al	Data not materially compelling	1. Comparing	"Other things are equally good."
		2. Defensive	"The school regulations will not permit it."
		3. Deprived	"It costs too much to use in time and/or money."
4. Personal	Data not psycho- logically compelling	1. Anxious	"I don't know if I can operate equipment."
		2. Guilty	"I know I should use them, but I don't have time."
		3. Alienated (or estranged)	"These gadgets will never replace a teacher." (If we use these gadgets, they might replace us.")
5. Experiment -al	Present or past trials	Convinced	"I tried them once and they aren't good."

This study, conducted into a technology-based innovation, sought to
identify causes of rejection in what was basically a teaching-aid
field. The findings suggested that in addition to some basic
inadequacies, for example, lack of information, participants tended
to reject the innovation because of personal attitudes, previous
experience and lack of confidence in handling new ideas. Such
doubts on the part of the subjects may well lead to feelings of
guilt, anxiety and insecurity. In other words, the potential for
a threat situation was implicit in the findings.

Eric Hoyle (1972) saw three basic barriers to educational innovation:
resources, attitudes and organisational structures. He identified
resources as materials (basically a matter of funding), time (need
for teachers and others to be "free" from existing commitments) and
facility.

> "This term [facility] is used in the present context
> to include all those resources - power, authority,
> influence ... which those who wish to induce others
> to adopt an innovation can call upon in seeking to
> bring it about ... Some social units and individuals
> in education have the necessary authority to induce

> innovation. Thus, the LEA has the <u>authority</u> to plan
> a system of comprehensive education; a headteacher has
> the <u>authority</u> to destream his school. This authority
> has a legal basis; the LEA and the head have the <u>power</u>
> to initiate these changes and ultimately they have access
> to means of <u>coercion</u>. However, this approach would be
> highly inappropriate in the context of curriculum change,
> since this can only be successfully achieved by willing
> teachers. Thus, the more appropriate initiative lies
> in the capacity to <u>influence</u>." 1.

In particular, this concept of <u>influence</u> is an important one for the
management of innovations, expecially where it is based on an
individual's capacity to persuade because of his background,
leadership style, power of sanction (in a positive sense) or access
to material sources.

In relation to attitudes the authors write:

> "At the deepest level, individuals can, as part of
> their basic personality disposition, have attitudes
> which are favourable towards <u>change in general</u>". 2.

Although in certain cases this is no doubt true, one would want to
know what the processes, the on-going determiners of such attitudes,
are. Certainly, teachers' attitudes will lie along radical-
conservative, revolutionary-evolutionary, open minded-closed minded,
continua but it is vital to understand the origin and sustaining
forces of such orientations if planned strategies of innovation are
to be successful.

Finally, the point relating to organisational structures. This does
not, as might be expected, relate to the organisation of the target
system per se but rather to the structures for <u>linking</u> the sources of
innovation with potential innovators. This is certainly an important
idea implying as it does the development of a functional system of
communication. Interpersonal relationships and group dynamics will
play a vital part in such a social interaction.

Mackenzie, in looking at curricular change, suggests that failure to
achieve adoption of an innovation is due to such factors as inadequate
planning, insufficient attention to preparing teachers for change, lack
of commitment by teachers and deficiencies in resources or power (to
implement the innovation.)[3.]

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1. Hoyle & Bell, <u>op.cit.</u>, p.32.
2. <u>Ibid.</u>, p.29.
3. Miles, M.B., <u>op.cit.</u>, chapter 7.

It appears from the brief survey presented and other critical appraisals (for example see Gross et.al. 1971, Chapter 2) that many of the assertions relating to resistance to innovation come from both the organisation and the environment in the initial stages of implementation. During the planning stage, there may be insufficient funding, lack of materials and inadequate preparation of both innovators and those in the target system. Organisationally, internal constraints of time-tabling existing programs, and the general status quo may pose problems. On a personal level some teachers may be resistant to change and see the very suggestion of innovation as a threat to be avoided.

Although it is likely that some teachers will feel initial resistance to change, what are the processes which may bring about changes in behaviour of those who are neutral or positive towards change and yet develop negative attitudes over a <u>period of time</u>?

In seeking an explanation to this question we will not assume that there exist invariable barriers or constraints. Rather we will search for those characteristics of organisation, its members and environment which through <u>interaction</u> may lead to conflict situations and hence to the rejection of investments in new ideas.

Chapter 3

Science and the System.

Before moving to the core of our study in chapter four, it is
essential that we state in broad terms what we see as the
development and the nature of contemporary science and the basic
structure of the System into which contemporary (innovative)
science programs are being and will be introduced.   The outcomes
of the interactions between science education and the System will
determine the fate of innovative ideas and their chance of
worthwhile implementation.

The division, in a time sense, between "old" and "new" science
programs is difficult to locate with any certainty but for our
purposes we will consider innovative science programs to be a
phenomenon of the sixties and seventies.   In the United States,
for example, this period coincided with an upsurge in educational
change.

> "A particularly strong drive for educational
> reform took place during what might be called the
> education decade, beginning in 1957 and concluding
> about 1967."[1].

By 1958, at least one new science program, that of the Physical
Science Study Committee, was in production in the U.S.A.   Certainly,
the 1960's saw the introduction and somewhat cautious implementation
of the "new science" both in the countries of origin and, later,
within Australia.   In general, the programs have been imports to
this country but during the last decade programs of Australian design
have made an appearance.   These include the NSCM (National Science
Curriculum Materials), JSSP (Junior Secondary Science Project) and
the national, second generation ASEP (Australian Science Education
Project).   This is not to overlook the development of local, usually
state-level, changes in science education.   Neither should we fail
to recognise that at the classroom level there has always been the
individual teacher who has thrown off the yoke of prescription and
attempted to break with tradition.[2].

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1. Goodlad, J. & Klein, M. op.cit., p.3

2. In this study when we speak of innovation we will be concerned
    in the main, with those programs which are conceived and planned
    outside the System.

3.1 Science Education

The rapid and extensive changes that have taken place in science education during the last twenty years have been motivated, we believe, by a recognition of the inadequacy and irrelevancy of traditional courses.

During the first few decades of the twentieth century, science was often expressed as a search for "truth" with emphasis on the compilation of an "ordered body of knowledge". While it was held to be legitimate for the scientist to be involved in the search for universals, the schools often found themselves restricted to the role of passing on the "products" of the scientists' labours. Probably the most efficient way of transmitting this product to students was through a simple master/student relationship in which rote learning was pre-eminent. Thus there developed a "one best way" methodology in which the authority of science was communicated through the authority of the teacher.

In the classroom a fairly rigid division was maintained between theory and practice suggesting a misinterpretation of the dual yet complementary and closely interwoven functions of deductive/ empirical approaches in science.[1] Theory was considered to be essential, while practice was considered useful for illustrating and confirming theoretical aspects of the course. No doubt we still clearly remember the organisation of science in the schools into "theory" and "practical" periods. Little success was achieved in bringing about a fruitful union between these two vital aspects of science.[2]

The belief that science was really a collection of easily defined disciplines, subsumed under the heads of "natural" and "physical" sciences, led to undue emphasis on infrastructures and specialism. Since the inception of secondary education in Tasmania (1913), the science curriculum has shown a marked bias towards specialist sciences. Until the creation of the Schools Board in 1945 and its new courses, secondary science was focused largely around

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1. Cartesian and Baconian approaches, respectively.
2. This "two-track" approach is, of course, completely alien to contemporary views of science. (See later comments in this chapter).

Chemistry and Physics with some demand for such subjects as
Biology, Botany, Hygiene and Physiology.   Following this
period, as Johnston writes,

> "... the Schools Board brought with it the
> substitution of General Science A and General
> Science B for the various specialised branches
> of the subject.   For the first two years of high
> school, a common General Science course was
> followed and a choice between Science A, B or some
> other subject such as typing was made at the start
> of the third year.   General Science A was biassed
> towards Physics and Chemistry while General Science
> B was centred on Biology.
>
> In 1957, a new arrangement of science options was
> introduced, the previous two subjects being divided
> into Science A, B and C.   The following year this
> system was adapted for all candidates.   As before,
> a choice was made at the end of second year.   Those
> pupils intending to matriculate in science were to
> study Science A, which in contrast to the old General
> Science A included equal portions of Biology, Chemistry,
> Geology and Physics, and pupils were to choose any two
> of these". 1.

Science B aimed at a broader treatment of science while Science C
was oriented towards Biology.   The 1960's, while seeing the
introduction of more general courses, saw the continuation of
specialised sciences still largely determined by matriculation
requirements even at a time when a changing mood in the field of
science was evident.

One sees here clearly the continuation of a belief in science as
a study of specialisms and ipso facto the importance of the
specialist science teacher.

This situation was tightly controlled by the existence of a highly
structured and severely prescriptive <u>syllabus</u>, explicitly designed
to lead to pre-ordained goals.   Success was measured by the
<u>examination system and tangibly expressed through certification.</u>

Finally, science was seen as a closed, objective and highly structured
system where the human component was to be minimised lest objectivity
and truth be compromised.

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1.   Johnston, G.L.   <u>State Secondary Education in Tasmania</u>,
                    M.Ed. Thesis, University of Tasmania, 1962, p.481.

The presentation of science, then , in the traditional sense, dealt with the transmission of very specific information involving an "instruction" role for the teacher, rote learning for the students and the use of the formal examination. Goal specification was a fundamental aspect of this process. Quite clearly, such a view would be consonant with that of systems in which emphasis is placed on behaviours associated with a "means-ends" school of thought.

The 1950's witnessed the first stirrings of a revolution within science education, particularly in pre-tertiary fields. The genesis of this change may be attributed to various agents. Hurd sees it this way

> "... in recent years, technological advancement
> and a knowledge explosion in science have fomented
> the doubts about what schools should be doing.
> Attention has been focused more on the content
> of subjects, its up-to-dateness and usefulness for
> modern living, and whether courses are being taught in
> an authentic or 'scientific' manner".1.

There is little doubt that Sputnik acted as a spur to scientific and technological progress in the western world as political decisions ensured generous funding of educational programs, particularly in mathematics and science.

Whatever the real origins of this discontent with traditional science may have been it seems reasonable to assume that new understandings of science and society and deeper insights into how children internalise knowledge about their world initiated involvement in many contemporary science curricula.

This "new" science movement has been a very strong one, rejecting the view of science as an authority-steeped, largely routinisable endeavour. Rather, it views science as a dynamic experience-based, inquiry-directed search, operating within social and psychological frameworks. The emphasis has moved from the product to the process with the methodologies taking precedence over, but contributing to, the "body of knowledge".

The new perceptions of science and science education as reflected in contemporary science programs identify the materials as innovative.

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1. Hurd, P. DeH. New Directions in Teaching Secondary School Science, Rand McNally & Co., 1970, p.2

The "new science" requires as a sine qua non an atmosphere free
of constraints if its integrity is not to be compromised.   It
requires staff and students to have the freedom to pursue interests
and alternatives in open-ended situations.   It sees as essential
the freeing of teachers from prescriptive syllabuses and
institutionalised goals and the universalistic view of children
which develops in such a climate.   The role of the teacher in
this new task will be a much more diffuse one, a much more
threatening one, for innovation implies a displacement of one's
allegiance from the expectations of the organisation through a
commitment to novelty and uncertainty.

3.2 The Target System

It is not our intention, nor is it essential to the main argument of
the dissertation, to present a detailed analysis of the Tasmanian
Secondary School System.   Such has already been most comprehensively
covered by Pusey (1972).   However, it is necessary to indicate a few
salient characteristics of the System so that one might be clear as
to the frictions likely to develop at the innovation - System interface.

We see the System basically as a rational structure, that is, one in
which emphasis is placed on the selection and maintenance of behaviour
patterns which are in keeping with the organisation's purposes.[1]

Authority for the maintenance of these patterns flows from higher
echelons of the structure and is given shape through the exercise of
the organisation's rules and regulations.   Authority is thereby
formalised, ensuring that roles are tightly defined, and the
consequences of individuals' behaviours, predictable.   Such a
structure, with its demands for routinisation and predictability
of role performance, has little room for intellectual inquiry, the
outcomes of which are likely to be indeterminate and not susceptible
to standardisation.   It is to be expected then, that any attempts to
introduce new ideas into such a framework, can be only partially successful.[2]

1.   This type of structure has much in common with what has been called
     a "mechanistic organisation", where emphasis is placed on input-
     output relationahips.   What happens within the "machine", particularly
     in relation to the human components, seems to be less important than
     the eventual products.   See -
     Burns, T. & Stalker, G.M.   The Management of Innovation,   Tavistock, 1961.

2.   It is not our intention to make value judgements of the System.
     Given the present structure, our interest lies in the interactions
     between System and innovative ideas and the subsequent outcomes.

Such a structure is typical of many institutions within Australia.
Pusey has this to say:

> "It seems that Australia relies very heavily on
> formal structures as its principle means of
> establishing and maintaining order, coherence,
> and especially equality. ... this striking
> dependence on the authority of centralized
> governments is a result of several factors.
> A result certainly of the nation's beginnings
> as a penal establishment which remained for a
> long time under the control of a quasimilitary
> gubernatorial government. It is a result also
> of geography since widely scattered and tenuous
> settlement could not, and still cannot survive
> in such an inhospitable land without the support
> of central government. Moreover this dependence
> on the machinery of state is clearly related to
> the lack of a viable and distinctive ideology -
> the state has tended to fill the vacuum. We have
> stressed also that central authority was steadily
> strengthened as it was turned to serve the interests
> of a working and middle class majority".1.

Notwithstanding the modicum of changes that have been and are occurring
in the structure, our schools "... are based on nineteenth-century models
and as institutions have scarcely come to terms with twentieth-century
needs."2.

In the secondary school wider "subject" offerings, a differing view of
the teacher/student relationship and a broader interpretation of
evaluative measures are some of the changes that seem to us to be
worthwhile. However, the basic structure appears unchanged and of
long standing. There exists still, an expectation for staff and
students to reach prescribed ends through involvement in fairly
traditional means. Ritual and sanction still play a part in this
endeavour.

We may well ask what maintains this highly rational structure which
sees the task of organisation as a means to procure prescribed ends.
For changes, certainly in respect to the basic authority structure are,
in fact, conspicuously absent. Decentralisation, which prima facie,
appears to be a change of some magnitude is likely to facilitate
decisions of an administrative nature. However, it is unlikely to
bring about "grass-roots" changes that are necessary if teachers are
to feel free to move outside present organisational barriers.

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1. Pusey, M.R. op.cit., p.35

2. Hannam, C. et.al. Young Teachers and Reluctant Learners, Penguin, 1972,p.14
        Although this is a reference to English schools, we believe
        the situation to be somewhat similar in Australian schools.

Johnston, in referring to a review of State Secondary Education
between 1919-1941, stated:

> "The outlines of the system of State secondary
> education which had been established between 1913
> and 1920 ... remained relatively unaltered to the
> end of 1941."1.

Again, in relation to the 1942-1962 period he wrote:

> "In the twenty years from 1942 onwards, in common
> with the progress of educational change throughout
> almost the whole western world, Tasmanian secondary
> education was subject to far more sweeping reform
> than had been achieved in the previous thirty years
> of its existence".2.

A close analysis of this "sweeping reform" however, indicates that it
was basically related to the introduction of the comprehensive high
school under the banner of "secondary education for all".   The
structure of the administrative system remained largely unaltered.
Even since 1962 change has been very much restricted to the technology-
oriented dimension.

Introduction of new courses, freeing-up of syllabuses, "open" plan
movements and, of late, community-school experimentation all appear
on the surface at least to reflect major restructuring of the system.
However, since the underlying system structure has remained largely
unaltered, innovative practices are generally incongruent with, and
lack the support of, the System.[3.]   Two different frameworks emerge
with no point of intersection.   The end result for innovation is often
non-acceptance during the initiation or collapse during the attempted
implementation.

The structure of long standing, has in fact become legitimised by time.
Its emphasis on goal specification, accountability and measurability
has led to a continuance of its structure, methods and expectations.
The curriculum has been a means of guaranteeing the attainment of
specified ends.

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1.   Johnston, G.L.   op.cit.,   p.295

2.   Ibid., p.463

3.   Even for new and projected secondary schools, where there should
     exist the opportunity to innovate, staff tend to be appointed to
     "established" positions.   By providing traditional staffing
     structures the nature of future programs is likely to be frozen.
     (An exception here is the Tagari Community School in Hobart).

For the teacher, security in this structure means conforming to the
rules and the acceptance of routine with the possible prostitution
of personal initiatives and values.   Such a situation does not augur
well for basic organisational change.

3.3 Science, System and Environment

We believe there has been a high degree of congruence between the
expectations of our "education system" and the nature of traditional
science and its teaching.   But whereas the nature of contemporary
science, compared with earlier views, represents a change of some
magnitude, the System, except for certain peripheral, largely
technological changes, has remained basically a formal, goal-directed
organisation into which new ideas and approaches must fit.

Stated in another way, we are asserting that the System has remained
effectively isolated from its environment.   Certainly, positive efforts
have been made by the "hierarchy" to keep abreast of a quickly changing
society.   This is evidenced, for example, by the preparation of a report
on The School in Society[1] and the implementations of some of its
recommendations.   However, since the report is now somewhat dated,
effective future implementation is of doubtful value.

The rational structure of the System enables tasks with predictable
end-points to be reached since the expected behaviours are clearly
defined.   Contemporary society, of which students are a part, is
characterised by change and unpredictability and it is doubtful whether
the System's existing structure can effectively adapt to this new challenge.

Lawrence and Lorsch have stated very powerfully the need for organisations
to tailor their management process to both task and environment and to
realise that effective systems are those able to interpret and respond
to environmental change.   In their own words, "In order to relate
effectively to its environment, any organisation must have reasonably
accurate and timely information about the environment and especially
about environmental changes."[2]   Thus the nature of the task must to a
large extent be dependent on the needs of the clientele and the larger
society rather than independent of, and isolated from, contemporary
consciousness.

1.   The School in Society, published by the Education Department of Tasmania,
                    Hobart, Tasmania, 1968.
2.   Lawrence, P.R. & Lorsch, J.W.   Developing Organisations: Diagnosis &
                    Action,   Addison-Wesley, 1969, p.25

The growth of many contemporary science programs has been largely outside the control of school systems. A significant number of American science teaching innovations, for example, were initiated by professional scientists, developed by schoolmen and science educators and often financed by national groups. The possibility of close inbreeding was avoided since school systems per se were not involved. (Contrast the role of subject committees of the Schools Board of Tasmania!) In general, this means that the "new science" should be more consonant with the contemporary environment both in terms of current philosophies of science and the nature and needs of society.

It is to be expected, then, that systems which tend to be overly inwards-looking and dedicated to the maintenance of traditional tasks, are likely to become divorced from, and unresponsive to, the demands of a rapidly changing environment. And, it is in such environments that many of our innovations are conceived.

In summary then, we believe that there has existed an isolation between the System and the environment. The encumbent has been largely, an integral and conforming component of this System. Innovative ideas, at least in our context, have been spawned in general in the environment outside the System, a situation generally true for science teaching innovations in the Western world. (Figure 1. suggests this isolation of System from environment).

In figure 2. we are suggesting the pattern that is likely to develop as new ideas move into the System, often through the initiation and mediation of the encumbents. We also suggest that there will be a number of "interfaces" and "areas of ferment" created. It is the nature of these interactions and their management that will form the substantive issues of our final two chapters.
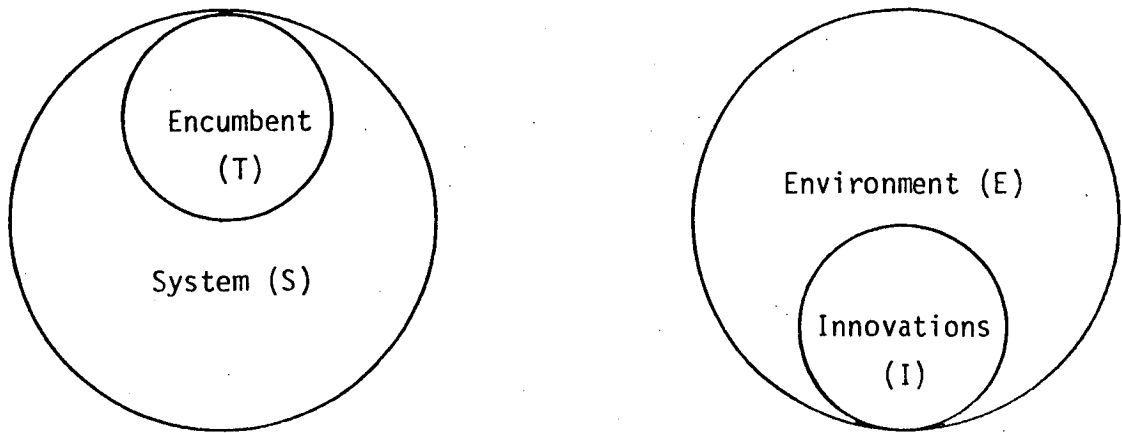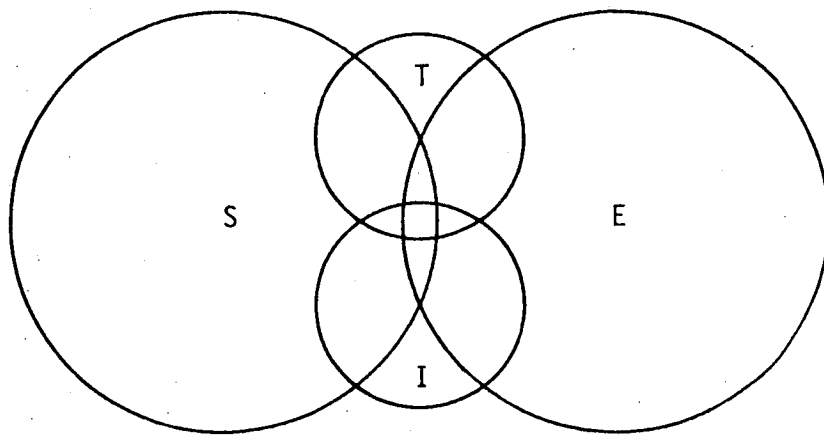
fig. 1.

fig. 2.

Chapter 4

The Threat Dimension

In chapter one we asserted that feelings of threat were likely to develop for the encumbent as innovative ideas challenged the inertia of the System. Such an assertion assumes that a prior state of security, with its attendant expectations, exists in the encumbent's system. It will be necessary to identify those sources from which the incumbent derives security and suggest the kinds of conflict likely to be generated through disturbance of the status quo.

For the teacher[1] of science in the secondary school we would suggest the existence of several sources of security. We believe the more important ones to be:

(a) The teacher is a specialist with particular expertise in one or two sciences. Freedom to work in his chosen field will give rise to feelings of _self_ satisfaction and professional fulfilment. (4.1)

(b) The teacher has depended largely on prescription and direction within the confines of his subject, ensuring for him a defined role. (4.2)

(c) The teacher has subscribed to a world view which sees science as the key to understanding reality rather than providing models which may lead to more meaningful explanations of natural phenomena. (4.3)

(d) The teacher has developed particular teaching methods through the influence of past experiences, present needs and future goals. The "one best way", basically a teaching strategy, has been widely accepted. (4.4)

(e) The teacher has searched for peer support and fruitful inter-personal relationships with those at the workface. (4.5)

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1. For our purposes the terms "encumbent", "teacher", are considered synonymous.

(f) The teacher has believed in, and relied on, certain expectations
     with respect to the System's goal structure, standards of
     behaviour and status issues. (4.6)

(g) The teacher has been part of a closed, protective and supportive
     environment, characterised by routine and isolated from the
     uncertainty of the "real world". (4.7)

In a sense we are asserting that the introduction of a situation
which threatens the continued existence of these sources of
security, which challenges the teacher's state of dependence
and which runs counter to the realisation of his expectations,
may well generate a climate opposed to change.   Innovation, in
today's context, implies essentially a "freeing-up" process, a
change from what is familiar and traditional.   It is to be expected
that individuals who are part of a formal system will experience, in
a psychological sense, a fear of this new freedom in the shift of
responsibility from a state of dependence to individual decision making.
That they will search for means of "escape" in such situations is to be
anticipated.[1.]   We suspect in many cases this will be achieved by a
closer identification with the System and its expectations.

In addition to this fear of freedom and the threat that uncertainty can
generate is the matter of motivation and the influence that change can
have on the attainment of desired ends.   In terms of the teacher in our
System, motivation for him has been <u>future oriented,</u> with emphasis on
specified and prescribed means for the realisation of goals.   These
end-points have been certification for the student, promotion and status
change for the teacher and overall continuance of a steady-state process
for the system.

At the same time it is reasonable to assume that such motivation is
really a veneer or overlay for a much more basic, largely unconscious
drive on the part of the teacher to satisfy, in Maslow's sense, certain

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1. See Fromm, E. <u>The Fear of Freedom-Mechanism of Escape</u>, (RKP), 1942.
    For example, the individual may overcome feelings of insignificance in
    relation to a threatening and overpowering environment either by
    renouncing his individual integrity or "destroying" others so as to
    remove or alleviate the threat.   He may in fact "cease to be himself"
    and submit to new authorities which offer him security and relief
    from doubt.

physiological and psychological needs.[1]   Maslow assumes that human
motives are arranged in an hierarchical way from basic physiological
needs to those of safety, love, esteem and self-actualisation
(realisation).   In a sense, such needs are goals but on-going
rather than determinable end-points.   The means to these goals
are difficult to specify.

4.1 Science Teacher as Specialist

The secondary school science teacher through inclination and training
is a specialist.   His pre-service experiences combined with the
subject structure of the System reinforce a belief in the respectability
of teaching the "pure" sciences.   We have already noted that courses
during the first thirty-odd years of secondary science were structured
around specialist sciences, particularly physics and chemistry.   After
the setting up of the Schools Board in 1945 specialist sciences still
played a large part in the school curriculum in that students had to
select specific sciences after two years of "general science".   The
general science course was introduced, in part at least, in reflection
of a movement to reduce early specialisation by the schools although by
the late 1960's schools were still wedded to specialisation in school
subjects.   In 1968 a report prepared on the role of the school in
society had this to recommend: "... the first four years of secondary
education should be general in nature, ...".[2]

On the surface, the introduction of general science suggested that
this recommendation had been anticipated.   However, it was only
general in the sense that it included snippets of the specialist
sciences.   It was certainly not an integrated, holistic view of
science and its methods.   The science teacher therefore was able to
continue with his specialisms even if for the first two years he was
constrained into dispensing smaller doses.

In the mid-sixties a committee initiated a study into the nature of
science at the secondary level.   This work culminated in the preparation
of the Trial Science Syllabus (for School Certificate).   This document
was noteworthy in that it contained only a statement on the nature of

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1.   See Maslow, A.H.   "A Theory of human motivation", Psychological Review,
     Vol. 50, 1943, pp. 370-96.

2.   The School in Society, op.cit., p.42.

science and an assertion of what were seen to be the important themes or "super-concepts" of science. These were structure, classification, energy, change and equilibrium.[1] The prescriptive course of study approach was rejected. The Trial Syllabus thus had much in common with the rationale of overseas innovative science programs.

It is not surprising that this innovation, despite encouragement on the part of those associated with this effort, did not become accepted to any degree. In retrospect the reason is seemingly obvious.

The introduction of a philosophy which rejected the teaching of specialist sciences could be expected to cause concern on the part of many of the teachers within the System. Science had been long considered as a set of separate disciplines and it had been forgotten that the breakdown of science in this way was largely a matter of convenience. It is only at the higher levels of study that specialisation becomes increasingly necessary.

The perceived role of the specialist was basically to impart information about the sciences, rather than science as such. To be placed in a position where a generalist view prevailed was to breed a climate of insecurity. We believe that the rationales of such programs constitute a threat to the teacher's assumed expertise where a required change in role is likely to lead to conflict between the beliefs, attitudes and values of the teacher and the rationale of the innovation. To accept and adapt to such a situation can lead to a compromise of the teacher's belief in his view of science, thereby generating self conflict. Pressures from his peer group can also lead to uncertainty and doubt as to the new role. We believe, then, that the specialist teacher's desire to work in his field of expertise may well prevent the initial acceptance and/or implementation of new approaches in the teaching of science.[2]

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1. Trial Science Syllabus for School Certificate (See Schools Board of Tasmania Manual, 1974).

2. The fact that science teachers are still permitted to run specialist science courses is likely to work against a real movement towards contemporary approaches.

4.2 A New Role for the Teacher

We find that a concomitant of the non-specialised nature of the Trial Syllabus, and of "new" programs in general, is a lack of prescriptive statements. The syllabus is very non-directive, placing responsibility for "what is taught" and "how it is taught" on the teacher. A rigid framework has been rejected and replaced by a non-prescriptive model. Security and dependence are threatened as decision making typically within the province of upper echelons is transferred to the workface. Of course, this decision-making shift is probably more illusory than real since there are constraints such as the moderation scheme and the fact that the first four years of secondary education are still seen as laying a foundation for higher education.

Despite the fact that prior to new approaches in science becoming available teachers had often supported, in theory at least, the idea of greater autonomy in what was taught, there was a marked reluctance to experiment with new ideas and in particular to seriously consider the more radical approach of syllabuses such as the Trial Syllabus.

In a search for security, it is interesting to note how avidly science teachers accepted the Junior Secondary Science Project (JSSP) materials as they became available. Although such a program is very non-specialist in nature it does contain sufficient structure as to be self-directive to both teachers and students. In a sense the prescriptive syllabuses of the System were replaced by a programmed card system of JSSP. However, JSSP was a stop-gap measure with materials prepared for only two years. Although gaining a fair degree of acceptance initially it has for a variety of reasons declined in popularity; the reasons for this decline would make a study in themselves.

In the sense then, of what and how to teach, contemporary innovative programs are very non-prescriptive.[1] Under the circumstances it is likely that the rationales of programs will be subverted as teachers are challenged and, we suspect, threatened by being cast in the varied roles of initiating, guiding and evaluating experiences in science teaching.

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1. With respect to how to teach, such programs, at least implicitly, give some clues as to the most desirable approach. The very fact that individual programs are based on particular learning theories guarantees this. This point is discussed in section 4.4

4.3 Science and a World View

The traditional view of science has rested on the belief that natural phenomena could be explained by empirically derived sets of laws and principles established through careful and objective observation. Science became a search for universals, for the supposed "order of things" and the explanation of events and associated causes; that reality could be found and described was rarely doubted.[1]

Unfortunately, objective observation depends on the human observer so that we are all part of the world we observe. It also seems likely that much of our view of reality is, in part at least, an expression of security needs; we see the world very much the way we wish to see it.

The apparently ordered, predictable and authority-filled world of science has been a dependence symbol for both scientist and citizen. The science teacher too, has derived great security from his belief in science as a source of explanation, sharing in its authority and potential for explanation. He has subscribed to a world view which often confused possible models of reality with the "real world". But the new science presents a very different image.[2] Rather than being seen as separate processes, "...the rational [reasoning] and the empirical are knotted together. Science is fact and thought giving strength to one another".[3] Science is seen as a continuous pursuit of models which are fluid and dynamic and testable and able to accommodate change. As part of its human-oriented approach it recognises the importance of inspiration, "hunches" and creativity. It asserts a unity with the so-called "humanities" in its search for knowledge. Uncertainty (now statistically described), probability and chance become important components of its vocabulary.

To adjust to this more liberal view of science as reflected in contemporary science programs means a change in the security base for the encumbent; a move from the trodden path of authority of both science and System to the quicksands of change. It is asserted

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1. In the early part of the twentieth century, through the work of Einstein and Heisenberg, ideas of universals and certainty in science were to be substantially modified, particularly when considering matter and energy, time and space on both the "very small" and "very large" dimensions.

2. See section 3.1

3. See Bronowski, J. The Common Sense of Science, Pelican, 1968, p.104

that tensions will develop in this situation where the world view of
the encumbent is at variance with the philosophies and methodologies
of science in its modern form.

It is to be expected that such a situation will drive the encumbent
to re-establish a security base and this is likely to be through a
closer identification with the System, thereby either subverting or
bringing about an institutionalisation of the innovation.

We see the process as cyclic.   To move from the "comfort" of the
System is to stray from security and certainty into the unknown.   In
turn, the very nature of this "environment" can create powerful feelings
of threat which may be countered by the encumbent's regression to his
former state.

4.4   A Host of Learning Theories

It is fashionable today, and it adds respectability as well, if the
educational enterprise is supported by one or more learning theories.
Such in-vogue psychologies suggest the type of approach, the nature
of experiences and the sequence which are likely to bring about
worthwhile responses from children.   In the field of science education
a few examples will suffice to make the point.

The authors of the Elementary Science Study materials were influenced
by the work of Bruner with emphasis being placed on a discovery
rationale and the importance of "messing about".

> "... ESS puts physical materials into children's
> hands from the start and helps each child investigate
> through these materials the nature of the world around
> him.   Children acquire a great deal of useful
> information ... through their own active participation".[1]

Emphasis is placed on the child's exploration of situations of his own
making, with little obvious direction from the teacher.

In direct contrast to this approach is the work of Gagne, where the
emphasis is on an hierarchy of intellectual processes.   This is well
illustrated by Science - A Process Approach where the teacher, with

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1.   Introduction to the Elementary Science Study.   McGraw Hill Book Co.,1966.

the aid of very specific instructions introduces children in a
sequential way to basic processes such as observing and inferring
and higher order skills such as interpreting and experimenting.[1]

The work of Piaget[2] has been used extensively in such programs as
The Science Curriculum Improvement Study (U.S.A.) and the Australian
Science Education Project.   The design of these materials follows
stages of intellectual development, the degree of abstraction required
increasing as one progresses through the materials.

> "We believe that it is more important to relate
> our materials to the stages of intellectual
> development of the children for whom they are
> designed.   In an attempt to achieve this, we
> turned to the findings of Piaget..."3.

A common feature then, of contemporary science programs is the emphasis
placed on various learning and/or developmental theories and the attempt
to design experiences which are based on them.   Although particular
programs do not explicitly commit the encumbent on "how to teach", the
use of materials in accordance with their design does mean that
experiences provided are in line with underlying "learning" theories.

But the traditional pattern in our System has been quite different.
For all disciplines and science in particular, the tendency has been
to subscribe to a _teaching_ theory.   This has been predicated on the
"one best way" method, authoritarian and discipline-oriented.

The teaching of science was basically a matter of communicating a
static body of knowledge best done by a master-pupil relationship.
Most of the emphasis was placed on transfer of content; the more
difficult and fundamental ideas concerning process were largely avoided.
The teacher has, through past experiences, developed a feeling of security
in what is still basically an _instruction_ role.   The role of the teacher
today is far less specific.   There is an attempt to provide situations
and experiences for learning and guidance and encouragement for the
learner.

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1. See Science - A Process Approach, _Commentary for Teachers_,
    American Association for the Advancement of Science, 1968.

2. As a "developmental" theory rather than a learning theory.

3. Australian Science Education Project (ASEP),   Newsletter No.2
    November, 1970, p.7

We would assert that this change in teacher role from teacher-as-instructor to teacher-as-stimulator[1] may produce a climate of threat and uncertainty. It is not easy for one to change one's beliefs and attitudes, for such are largely the product of an internalisation process over a number of years. In a way, "... most of us remain to some extent prisoners of our family background, of our social class, or of our nationality".[2]

Innovative science materials which appear to lack prescription and which tend to change the traditional role of the teacher are likely to bring about dysfunctions at the innovation-System interface.

4.5 The Peer Group

The teacher of secondary science, is, within the confines of his school, a participator in various kinds of groups. In a general sense he may be a member of a transitory, functional group where the common denominator is the task at hand or he may be involved in a more diffuse friendship group which has developed through certain expressive activities.

In a particular sense, our interest lies in the group formed from a "science fraternity". We are referring here to a group of peers who take each other into account and who are aware of certain commonalities. Members of the group share certain interests, motives and purposes, subscribe to common beliefs and norms of behaviour, have the potential to maintain interpersonal relations and, finally, have the capacity to bring about exclusion from the group.

It is this last mentioned characteristic which concerns us here for not only does the innovator feel a need of support from authority, for example, his superordinates, but he needs support and security from the peer group itself. Ridicule, lack of support, both open and implied, can bring about "exclusion" from the group and hence act as a strong deterrent to the individual's interest in change. When one speaks of the need for a "supportive atmosphere" in relation to innovation, one is referring largely to the creation of conditions conducive to the "trying our something new" which is thought of as being worthy in some way.

1. See Crane, A.R. writing in The Preparation of Teachers in Australia, Richardson & Bowen (ed.), Cheshire, 1967, Chapter 1.
2. Storr, A. The Integrity of Personality, Penguin Books, 1972, p.86

Once the need for change is recognised, support from the peer group is vital for successful implementation. Groups working in support of innovative ideas are likely to constitute extremely potent agents for the acceptance of change. This acting in concert where decisions result from concensus allows the individual to express his ideas within the security and supportive framework of the group.

But where innovation is left to the individual, through failure on the part of the System to give guidance and provide the machinery for the introduction of change (and in this state, the spasmodic attempts at innovation in secondary education have been characterised more by enthusiasm than by sound thinking), he is placed in a situation which involves a conflict of loyalties.

Loyalty to the System and adherence to its rules guarantee him the realisation of his expectations. On the other hand, satisfaction of his psycho-social needs, both professional and personal, is likely in part to be provided by membership of his peer group, since, in a way, his "science" peer group embodies the current beliefs in, and attitude to, science, and he can be expected to have a feeling of belonging and sense of pride in its achievements. In a deeper sense the individual invests part of his self in such a group. Exclusion denies the individual that intercourse so necessary for the realisation of his needs, particularly security and self-esteem.

We believe, then, that the teacher considering a change in his teaching strategy that is demonstrably different from the accepted pattern is likely to make a decision which is less influenced by the inherent characteristics, and his own assessment, of the program than by the feelings of threat attributable to the expected behaviour of his peers.

The continued interest on the part of science teachers in maintaining a familiar pattern in their teaching roles in very evident. The very slow and infrequent attempts to innovate, the often critical approach to the "rebel", the unwillingness to publish new ideas or discuss at gatherings "experiments" in science education, all these are indicative of a reticence to challenge custom. The reasons for this are probably legion, but we believe that peer group pressure is high on the list. Loss of security through possible group exclusion is a high price to pay for the sake of new ideas, untried and uncertain.

4.6 Expectations of the System.

The encumbent in the System has certain expectations particularly with respect to the organisation's norms, goal structure and code of rules. Situations which threaten one or more of these expectations are likely to jeopardise what are in fact sources of security for the individual. The resulting conflict is likely to lead to behaviour which will minimise the source of annoyance. It will be argued that attempts to innovate may create situations of threat as the initiatives interact with the norms and goals of both System and individual and the individual's status and progression along the promotional pathway.

4.61 Norms and the System.

> "Norms are situationally specific standards of
> behaviour, they are principles, premises, or
> expectations indicating how individuals in
> specific circumstances ought to act."1.

In the school situation, expectations as to how individuals or groups ought to behave in certain circumstances, suggest the existence of norms. Of particular interest to us are certain social norms involved in interpersonal relationships within the school as a social institution and for which the teacher has been the instrument of transmission between the System and student.[2.] The norms having relevance for us here are dependence, universalism and specificity.[3.]

Traditionally, both "content" and teaching methods were closely prescribed for the teacher in the System. Content-wise, syllabus committees decided on what should be included in the courses while teaching methods were often determined by the need to prepare students for external examinations. Under such conditions the tendency was strongly oriented towards a universalistic approach, towards the treatment of students as members of a group. Although categorisation should not be seen as necessarily an undesirable process, it can, in education, lead to a failure to recognise the need for development of a climate in which the norm of independence may develop. We are asserting that, traditionally, the educational view has tended strongly towards clients being treated universalistically rather than particularistically.

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1. Dreeben, R. On What is Learned in School, Addison-Wesley (Reading) 1968, p.44

2. We do not believe that these social norms have been deliberately espoused by the System. Rather, they are expectations of behaviour which follow more or less logically from the nature of the System.

3. Dreeben, R. op.cit., pp 63-84

Further, the emphasis has been largely on the individual's development
in the cognitive sense.   Here, the role of the science teacher has been
to communicate a body of dogma in an objective way across the System-
client boundary with very limited personal involvement on his part.
The task has been a specific one, the norm of specificity operating in
such a situation.   This is in direct contrast to the norm of diffuseness
where the stress is placed on the development of the "whole person" in
both a cognitive and affective sense where the nature and depth of the
teacher-client relationship contributes to self-realisation.

The largely formal and technical System has therefore been characterised
strongly by norms of universalism and specificity.[1]   These in turn have
led to the development of dependence as the norm, both for the encumbent
in relation to the System and for the student in his relationship with
the teacher.

Innovative curricula, and here we are interested in science in particular,
place emphasis on individual achievement through the provision of self-
paced, enquiry-oriented experiences.   Implicit in their rationales is
the belief that science literacy may be developed through a multiplicity
of experiences initiated by the learner and "guided" by the teacher.
In this context science is viewed as a personal endeavour, a process
directed towards understanding and self-satisfaction.   This particular-
istic concept is quite contrary to the traditional view of science as an
unchanging product which can be most "efficiently" transmitted in the
group situation.

Commitment to the "new science" programs will involve the teacher's
relationships with students in far more than a mere transmission of
the cognitive aspects of science.   He will need to develop in students
the desire to search for explanations and test possible answers rigor-
ously, to appreciate the aesthetics in a proof or in a pattern and to
develop personal attitudes and values.   The teacher will need to give
not only of science but also of himself, the nature of the interactions
between teacher and student being governed by a norm of diffuseness.

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1. Pusey, M.R. op.cit., p.151

Innovative science programs are premised on norms of particularism
and diffuseness with the concomitant development of independence
for the client.   In a social sense the fostering of such norms
will encourage individuals to relate to each other more for what
they are than what they know.

Quite clearly, a potential exists for conflict and friction for
the encumbent committed to change, in that a shift in normative
behaviour is seen as being unavoidable.   We believe that this
may develop threat overtones for the encumbent as he attempts to
satisfy both the expectations of the System and those implicit in
the "new science".

4.62 System/Encumbent Goals

"The [System's] basic organisational requirement is for dependable
role performance".[1]   This requires that the encumbent conform to
standardised procedures with highly predictable outcomes.   Account-
ability in this rational sense[2] involves the individual in an obligation
to obey the dictates of Authority under a system of both explicit and
implicit sanctions.

For the encumbent there will be a conflict of roles between the
competing bases of obligation to obey and the professional's obligation
to his clients and self.   This dichotomy of loyalties, with its
attendant conflicts and anxieties, will become more extreme where the
encumbent invests in those initiatives whose intended behaviours and
end-points are not defined.   This is particularly so in the case of
many of our major science innovations where both behaviours and goals
are not closely specified.

Such a conflict of loyalties is likely to lead to feelings of threat
and uncertainty for the individual as he tries to accommodate both
System and professional demands.

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1.   Katz, D. & Kahn, R.L.   The Social Psychology of Organisations,
                             John Wiley & Sons (N. York) 1966, p.208

2.   Behaviour directed towards the achievement of the organisation's
     purposes;   refer to section 3.2

4.63 Rules and Status

We have asserted previously that the System under consideration is organised in a formal way where rules, both written and implied, encourage the encumbent to behave in certain ways.

> ".The fact is that unbalanced or exclusive emphasis
> on ·the formal structure leads to 'authoritarianism'
> (in the popular sense of the term).   Subordinates
> are then quite plainly fearful of the consequences
> of any deviation from official procedures".1.

The individual does have, however, through the maintenance of routine certain expectations of the System.   The individual can reasonably expect, for example, that movement upwards through the echelons is assured so long as he does not deviate to the extent that his behaviour becomes incongruent with that expected by the System.

In general, the System assesses teachers by the degree to which they conform to its rules and adhere to the invariant pattern of its expectations.   Innovation, because of its potential to act as a carrier of novelty and uncertainty into the System, may well place the encumbent-as-innovator in a situation of conflict: to remain loyal to the dictates of the System and thereby feel secure or to put at risk one's investment in the past and expectations for the future through the encouragement of change and its agents.

The encumbent, if he is to support change, must make a decision as to the effect such an involvement might have on his future.[2.]   We suspect that for many individuals the fear of losing their reasonable expectations for the future may be much more potent than the attraction or challenge of new ideas.

4.7 Routine and the Environment

For the encumbent, life in a formally organised system is characterised largely by routine and habit.   Since routine implies a stable and predictable task, it offers the individual security and freedom from

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1. M. R. Pusey. op.cit., p.115

2. The "future" for a teacher may be determined by (a) a decision on the part of the Education Department that he be transferred to another school or (b) if the teacher holds the position of Senior Master or above, his application for positions (usually promotional) elsewhere. In either case, the strong possibility that a teacher will enjoy a relatively short period in a particular school actively works against innovation, since the effective time for worthwhile implementation and incorporation is likely to be far too short.

uncertainty, guaranteeing him protection from both arbitrary decisions within the System and environmental pressures from without. Thus adherence to routine provides the individual with a strong security base, a refuge into which he may retreat when threatened.[1]

A belief in routine behaviour makes it less likely that the task at hand will be seriously challenged by "outside influences". This is not to say that such influences, many of which will be _innovative_, will necessarily be rejected. But it does imply that those which appear to be congruent with the _tasks_ of the organisation, which will fit an existing structure and which, at least initially, are judged to reinforce the existing _climate_ of the system, are likely to be accepted. In other words, innovative ideas which can easily be institutionalised are candidates for implementation.

But change which threatens the very roots of the organisation, and here we include commitment to routine, is likely to be subverted, diluted and possibly discarded.

Innovative science programs are likely to be categorised in this way for the expression of their rationale is the very antithesis of behaviour which is routinisable, predictable and certain. It is to be expected that in certain cases the interaction of innovative ideas with the maintenance of routine will breed anxiety and threat.

4.8 In Summary

It would appear to us that the dynamics of innovation are extremely complex and that resistance to change is to be expected. It would be naive to deny that this resistance is in part a product of the inadequacies of planning and developmental procedures, a general failure to provide the "services" support for the planned change.[2] But undue emphasis on such procedures can divert one's attention from the fact that innovation is a carrier of uncertainty into the target system where the encumbents have certain investments in the maintenance of its routines. Although we would not deny the existence of the so-called "initial resistance to change", it seems in our

1. Crozier, M. The Bureaucratic Phenomenon,University of Chicago Press, Chicago, 1964, passim.

2. For example, teacher preparation, ease of obtaining printed materials and associated equipment and provision of necessary funds.

experience that resistance is more likely to develop as the implementation
stage proceeds; there is a creation of a rejection process which intensifies
with time.

In our analysis we have asserted that the attempt to use innovative science
programs within the largely stable, unchanging climate of our System is
likely to lead to feelings of threat, anxiety and insecurity, that is,
the creation of a threat dimension. We have argued that adherence to
the expectations of the System guarantees the encumbent a feeling of
security and a sense of mission in his transactions with the System
and its clients.

We have identified what appear to us to be important sources of
security for the secondary science teacher, although the list is not
meant to be exhaustive. We believe that the teacher will react in
such a way as to minimise or overcome any threats to his security and
the System on which he has become dependent. Such reaction will be
towards the status quo, towards reducing the entropy of his environment.[1]

At base, these threats are antagonistic to the encumbent's springs of
motivation whether these be a conscious drive towards the realisation
of planned goals or the satisfaction of physiological, social and
psychological needs. We suspect the former drive has a more important
effect on the behaviour of the encumbent in our System than the latter.
However, the need to develop and be oneself[2] is ever present and is
likely to be encouraged through subscription to the challenge of new
ideas. The possibility of conflict between these two sources of
motivation is real and the creation of threat overtones may yet be a
further outcome of such friction.

We believe that, in general, threat situations, no matter what their
origins, are dysfunctional in nature for they have the potential to
destroy the integrity of new programs whether this be by total rejection,
modification or subversion to the point where the innovation is made to
fit the framework of the institution. And yet it is of interest to note
that the System has encouraged certain curriculum innovations. However,

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1. Entropy - degree of disorder or uncertainty in the environment. (In
   nature, matter tends to a state of greatest disorder, that is, increased
   entropy, if no constraints are placed on it).
2. "becoming", "self-actualising", "self-realising" are terms used in
   expressing similar ideas.

this support has been largely in those areas where there appears
to be little or no threat to the existing structure and its
encumbents.[1]   Some of the attempts have been piecemeal, ill-
prepared and eventually engulfed by the massiveness of the existing
structure, finally foundering through lack of support.   In Tasmania,
for example, the use of J.S.S.P.[2] materials has been justified to us
by some Principals and teachers as providing non-teachers of science
with a ready prepared course, thereby allowing them to fill the gaps
in science staffs!   This in itself is likely to create anxiety for
science teachers as they see both their positions threatened and science
education compromised.   Such a situation must lead to the destruction
of such a program and its materials.

It appears to us that as long as innovation does not imply any significant
change in organisational structure or a major revision of educational
philosophy then it may be accepted as a peripheral adjunct to the System.

There are some remaining points which should be made.   In the first place,
we have discussed the individual sources of security as though they were
isolated variables.   This has been done as a matter of convenience.
However, it is quite obvious that, in practice, any feeling of threat
is likely to consist of a complex of anxiety situations and indeed this
complexity may lead to behaviour which is quite destructive and thus
detrimental to the change process itself.

In our reference to the science teacher as a specialist[3] we asserted
that the more generalist, integrative approach of contemporary science
may well pose a threat to this expertise.   But a concomitant of such a
situation is the different view of science[4] and in a practical sense,
methodology[5], therein implied.   Decisions, then, relating to whether
science is to be considered as a congeries of specialisms or a unitary
study in its own right will also involve the teacher in a re-appraisal
of his view of science and education and further the selection of
relevant teaching strategies.   The importance of such interrelationships
needs to be recognised when we seek to understand the effects of inter-
active patterns between encumbent, innovation and System.

1.   e.g. the introduction of Social Science courses to replace
     Social Studies;   basically, an expansion of content and an updating
     of teaching methods.

2.   Junior Secondary Science Project - see earlier references,
     particularly chapter 3 and section 4.2

3,4,5.   see sections 4.1, 4.2, 4.3

Second, it should be obvious that the threat situations for the science teacher-innovator are not confined to the area of science alone. The sources of security identified earlier are probably equally relevant to all teachers in the System. This does not make feelings of anxiety any less likely for the science teacher but may exacerbate the problem. For example, mathematics teaching is often considered part of the dual role of the science teacher. For several years now in this State, innovative programs in mathematics have not been uncommon and one must wonder as to whether such further commitment to innovation does not compound a feeling of unease for the "maths-science" teacher.

Third, there is in our experience the not uncommon situation of innovative ideas and materials being introduced into the schools but meeting with an ever increasing resistance to them as time passes.[1.] This is despite the fact that often such ideas have been welcomed with enthusiasm and certainly with little evidence of any overt resistance. It appears that there has been less of an initial resistance to the programs than of a developing lack of commitment; initial enthusiasm followed by indifference; even hostility. Although this is in part likely to be attributable to the System failing to give adequate support to the change we also suggest that increasing commitment to innovation has the effect of displacing the encumbent from his security base, this in turn leading to dependence tensions[2.] and reversion to the original state either by total rejection of the innovation or subversive action which may "neutralise" and institutionalise the change.

The effect is cyclic occurring over a period of time (see fig. 3).

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1. e.g. J.S.S.P. in the secondary school, use of Cuisennaire (teaching of mathematics through the use of coloured rods) in the elementary school.

2. Situations of unease which develop as the encumbent moves away from the System on which he depends.
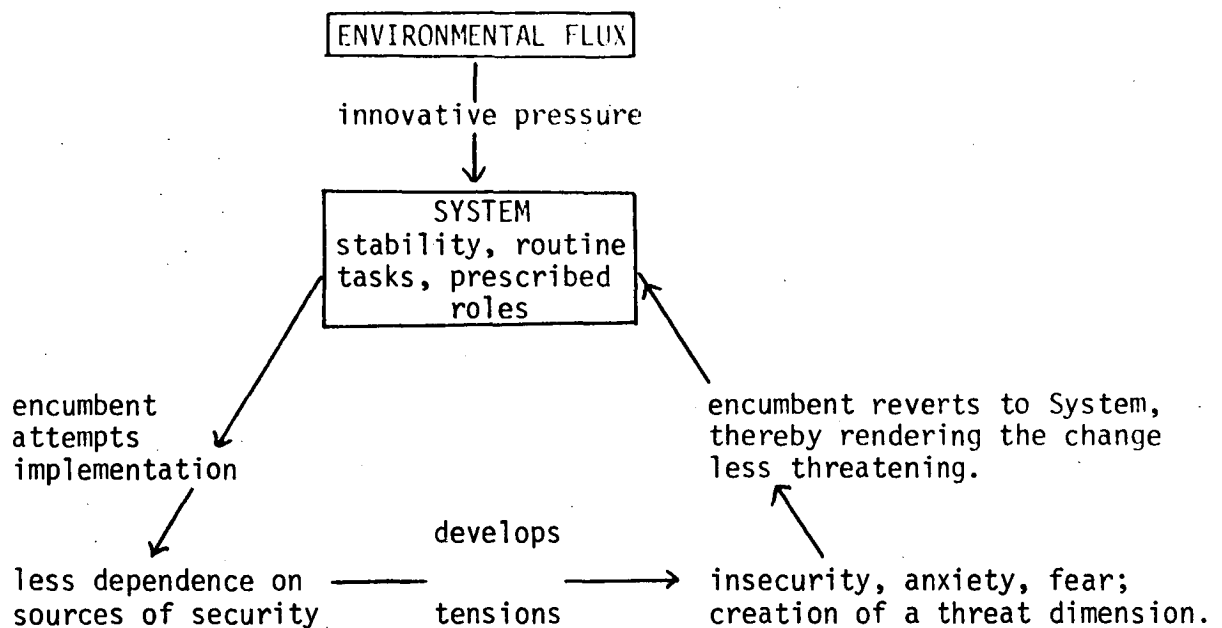
fig. 3   INNOVATIVE CYCLE

The rate at which factors inimical to the innovation come into effect will depend on the degree to which the encumbent perceives the change as a threat.   Changes which are largely formal, structural and impersonal are unlikely to become threatening.   However, those changes to which we have alluded earlier and which threaten his security are likely to be dealt with quickly in a way which makes a final incorporation of the change unlikely.

We have now proposed an answer to the question posed at the beginning of this study:

The interaction between the innovation and the System may lead to the creation of threat and associated states which in turn will exert strong pressures on the encumbent to revert to his former state of security.   This feeling of threat is likely to lead to the emergence of behaviour destructive to change and renewal.

It is now our final task to suggest strategies of management which may lessen or overcome the effects of such dysfunctions and in particular comment on the likely success of implementation of the Australian Science Education Project into the System.

Chapter 5

The Management of Innovation

At base, the management of innovation concerns the resolution of potential conflicts between the expectations of system and encumbents and the inherent uncertainties of innovative ideas. Since we have asserted that adherence to the System guarantees security for the encumbent we need to know how to alter the formal structure to accommodate "change" without creating insecurities and further, how to lessen the feeling of threat which such change is likely to generate[1]. For we believe that if teachers are to be free to innovate then fundamental changes must occur in the System. "Surface" modifications such as decentralisation are not enough, for such changes are akin to painting a house; the outward appearance changes but the basic structure remains unaltered.

It is not just a matter of changing the formal structure that is needed but rather a different view of social relationships within the System; the development of a meaningful integration between the formal and social frameworks such that System authority might be tempered by the strength of individuals acting in concert[2]. We have to create a conducive, supportive climate within which innovators feel free (and encouraged) to operate; we have to "subvert" the structure so as to erode unquestioned assumptions on which it rests.

We must recognise the need for increased importance to be placed on interpersonal relations with more decisional power placed in the hands of those at or near the work face.

In suggesting specific strategies for managing innovation within the field of science, it will not be feasible or desirable to isolate our discussion from those strategies which may apply in an"across-the-subjects" way. It will be obvious that our solutions are not necessarily confined to science education even though most emphasis will be placed on that facet.

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1. It is an interesting thought that those teachers from the University with a fourth-year Honours qualification (in place of a Diploma of Education) are much freer to experiment in the classroom since they are not so dependent on the System for employment as are "Dip. Ed. students". This applies particularly in the case of science graduates!

2. For example, peer group strength.

5.1 Strategies

The point has been made that innovative success requires change without creating insecurities or conflict situations for the encumbent.   While seeking support from the System this should not be seen as "an exchange" for the individual's subservience to System authority.

There are further points that seem to us to be basic:

(a)   Change efforts must be directed to the organisation and its basic assumptions, not just to the consideration of desirable changes in the behaviour of encumbents.

(b)   Change efforts must be multi-directional, emanating from both within and without the System;   that is, determined by a view of both task and environment.

(c)   There must be a recognition of the complexity of situations arising from the interactions of variables.   For example, the infusion of Karmel funds is likely to enhance change today because of an already existing contemporary climate characterised by rapid change and uncertainty.

With the above in mind, we suggest that among the possible strategies for managing innovation, there are six fundamental ones which are listed below.   Although all of the strategies apply in a general way to innovations across the spectrum of areas within the System, the latter three hold particular meaning for science and science teaching.[1]

a. Internal support for renewal   5.11
b. External validation of innovation   5.12
c. Community support   5.13
d. Teacher education strategies   5.14
e. Career reform   5.15
f. Involvement in the innovative process 5.16

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1.   We will conclude this chapter with a brief analysis of the Australian Science Education Project, noting in particular how ASEP intends to manage its program.   The likely success of its management strategies will be discussed.

5.11 Internal Support for Renewal

In searching for strategies for managing innovation we have asserted that these actions must be directed at re-organisation of the System, thereby providing a conducive and supportive climate for change. We must look both within and without the System for such initiatives for we believe that contemporary forces now taking shape in the environment will help sustain and give legitimacy to attempted changes within the System. We believe initiatives from both areas must proceed pari passu and must in part be directed at basic assumptions of the organisation, particularly those relating to authority and leadership.

Traditionally, authority in our System has resided within the formal structure, where, "Every official in this administrative hierarchy is accountable to his superior for his subordinate's decisions and actions as well as his own ... he has authority over them [subordinates], which means that he has the right to issue directives and they have the duty to obey them".[1] Behaviour is thus very much circumscribed and the roles of individuals frozen.

But organisations are people having social and psychological needs as well as a commitment to certain norms and values. For teachers as professionals, such norms are very particularistic and diffuse in nature, suggesting that "means and ends" are likely to be indeterminate and unpredictable. Since bureaucratic structures are committed to the status quo, how do we develop strategies which will free their members and change their role perception so that psycho-social needs of encumbents may be fulfilled and personal traits of creativity and spontaneity released to initiate and nurture novelty and diversity?

In the first place, we believe that a displacement of, and a change in, the authority structure is vital. Stated simply, the impersonal task-oriented authority of the hierarchy needs to be replaced by authority emanating from the professional expertise and consciousness of individuals. This represents, for the individual, a movement of the security base from dependence on the System to a belief in one's ability to make responsible decisions and evaluate their outcomes.

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1. Blau, P. M. & Meyer, M. W. Bureaucracy in Modern Society, Random House, N. York, 1971, p.19

We see as a concomitant of this the development of viable peer groups
where the individual will have a normal expectation of support and
respect from his fellow members and where innovative ideas might
mushroom away from a climate of fear and jealousy, suspicion and
criticism.   Such groups, conducive to change, will gain cohesiveness
through a desire to serve the needs of clients rather than the existing
expectations of serving the System.   Such groups will grow in power as
the interaction of professional colleagues clarifies and strengthens the
convictions of individuals.   We believe it is this collegial authority
that will free teachers to experiment and give innovation respect.

But peer groups already exist in our schools.   How do we "activate"
them to this new role of both initiating and supporting change?   How
do we validate their actions?   We see two possible and certainly not
exclusive answers to these questions.   The first relates to pressures
in the contemporary environment and the second to potential leadership
roles operating within the System itself.

It is not intended to elaborate on the first point since this field of
what we will call "external validation", particularly in respect of
political initiatives and community involvement, is covered in
succeeding sections.[1.]   Suffice to say at this point that there is a
growing awareness on the part of society and its leaders that fundamental
changes are needed if schools are not to become entirely divorced from,
and irrelevant to, the needs and expectations of contemporary society.

The second point refers to leadership.   Authority without leadership
is likely to be sterile and unproductive.   The terms may connote
opposite ideas.   Authority in relation to the System, implies control
from above in keeping with a rational structure while the latter (leader-
ship) suggests a shared enterprise where individuals are willing to follow
and act in the interests of the group.   We believe successful innovation
requires leadership, particularly in the sense of initiating and/or
sustaining new ideas, since the change process is likely to meet
obstacles from structures already established.   Members of the group
must feel respect for and confidence in such a person and feel that they

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1. See sections 5.12, 5.13

can _identify_ with his beliefs and values. Not least there should develop a supportive relationship and a feeling of belonging.

From whence do such leaders arise?   We believe they already exist, by and large, within the school environment.   But, what has been lacking in the past, is the opportunity and encouragement for such people to invest in legitimate change.   Overall leadership needs to be given by principals who, because they now fill what are essentially autonomous positions, are able to provide the necessary psychological support, the climate and freedom for "progressives" on the staff.   Such overt support is likely to bind the staff together in common endeavours and inter alia develop a feeling of group cohesion.   It is quite apparent that principals now have the freedom to encourage the creation of such groups or teams.   Since promotion rests largely on the principal's recommendation, the contributions of individuals could be judged, at least in part, on their ability to work co-operatively towards change as demonstrated through their use of professional expertness, enthusiasm and initiative.   The leader under such circumstances is more of a co-ordinator, a catalyst and a focal point for the group's exertions. He is without authority in the traditional sense for this is now seen as synonymous with the strength of the group.

There are two further thoughts on leadership.   First, as will be suggested under section 5.15, Career Reform, principals and staffs need the freedom to hire staff for their schools, especially in relation to particular positions.   This would allow schools to appoint professionals to positions created by the schools themselves and in this context such positions could relate to the field of "innovations" either in a subject area or broadly based such as team teaching or interdisciplinary studies.

Second, there is a need to identify and support those "radicals",[1] who see alternatives to traditional schooling, giving such teachers the opportunity to conduct, and evaluate, programs outside the System.[2] Support for such schemes should provide _valuable feedback_ for the management of programs within the more structured schools of the System.

We have laboured the points relating to authority and leadership but we believe that traditional assumptions underlying these fundamental

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1.   We do not use the word in a deprecatory sense.
2.   e.g. The Tagari Community School in Hobart.

organisational characteristics need to be questioned and altered if we
hope to manage innovation effectively.   At base, the implication is for
a major change in role perception, that the educational task is not just
a "job" but a professional undertaking.

5.12 External Validation of Innovation

The point has been made that if teachers are to be free to support
innovation then fundamental changes must occur in the System.   Such
changes will have their origins in re-appraisals of the tasks of role
encumbents and in pressures from the environment, both political and
social.   In relation to this latter external domain we see developments
which, in association with other pressures in a changing society, are
likely to support the pursuit and implementation of innovation.   We
refer here particularly to the effect of political validation on the
encouragement and support of change within our schools.

In the Australian context governments have in the past commissioned
groups to enquire into various aspects of education at all levels.
While none has been reticent about recommending what seemed at the
time to be desirable changes, the recent Karmel Committee's report
marks a milestone in the history of education in this country.

The Interim Committee has been able within its terms of reference, to
argue strongly for the implementation of an innovative program predicated
on the fundamental principles of quality and equality in education.   But,
such proposals without resources for implementation serve little practical
purpose.   Legitimacy has been given to this desire to "foster change"
with the setting up of a National Innovations Committee (and state bodies)
and the provision of funds for recommended projects.   Much responsibility
will devolve on the individual state committees to maintain the impetus of
change and give encouragement to what are seen as exciting initiatives.[1]

That the importance of the Education Department has been recognised is
indicated by the fact that about sixty percent of the Special Projects
Committee's members are associated with the Department.   In addition to
an independent chairman and a representative of the Catholic Education
Service, there are two "community" representatives.[2]

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1. Within the area of fostering change four main strands were recommended:
    Research into change in education, Special Projects at school level,
    Special Projects at Systems level and development of National programs.
2. See section 5.13 for the role of the community in supporting innovation.

The Commission[1] has shown in its appointment of persons to the Special
Projects area that it believes worthwhile change can occur through the
involvement of those within the system, at which change is directed, in
association with representation from outside the system.   We believe that
this endeavour will be the vehicle by which further legitimacy may be
given to change from within and without the structure.

The Commission's thoughts are not confined to projects at only the school
level but it recognises as a concomitant of these the need to encourage
change at both the system and national level.   This should not lead us to
underestimate the success of innovation at the school level for it is here
at the workface that continuing grass-roots, small-scale thrusts, supported
through legislation, will force openings in the systemic armour.

We believe that external validation of innovation, in this case politically
initiated, will do much to provide a conducive, supportive climate for
change and a productive outlet for would-be innovators.   This strategy
of change is already with us and hence does not have to be proposed.
However, its existence does not automatically guarantee its success
and we believe that if it is to reach its full potential as a "change
strategy" then what it sees as legitimate innovation is of paramount
importance.

In general terms the Karmel Report sees support available for "...
field-based experimentation and the implementation of ideas which have
a direct application", for example, " ... the development of inter-
disciplinary programs; new approaches to the teaching of particular
subject areas ..."[2]   In fact, funds should be available for projects
which are innovatory or have implications for change.

Although we have been unable to get actual details on the types of
projects acceptable as innovatory it does appear from a Check List of
Reasons for Rejection (of projects) issued by the Schools Commission that
great care is being exercised to see that only truly innovative ideas are
adopted.[3]   This should ensure prestige for the status of decisions made
and a guarantee for worthwhile change in the System's schools.

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1. That is, the Australian Schools Commission.
2. Schools in Australia, op.cit., p.127
3. Twelve bases of rejection are listed with provision for further
    comments.   For example, in order to qualify for funding a project
    must be innovative in its setting, fulfil a felt need and be of
    educational value, to mention but three provisions.

5.13 Community Support

We believe that parents and the public in general are largely ignorant
of what goes on in schools.   There has been a fairly successful effort
on the part of the schools to prevent the formal structure being affected
by outside social influences.   True, parents have been allowed to
participate in the "life of the school" but only in peripheral and
non-judgmental areas such as raising money and helping-out in activities
if a strictly non-curricular nature.

We see the deliberate involvement of parents in a para-professional role
in the school program as a positive step towards encouraging innovation.
At present, due to inadequate communication between school and home,
there is a natural inclination for parents to continue to expect for
their children very much the type of education they received.   "New-
fangled" subjects, perhaps the forerunners of worthwhile innovation,
may not be supported by parents.   Thus paradoxically many parents who
would support up-to-dateness and relevance in education for their children
may oppose change because of the communicative shield that schools often
build around themselves.

On the other hand, by a realistic involvement of parents in the school
program, we believe that they will become aware of the ferment in education
characterised by change and spontaneity.[1.]   We see here the creation of a
powerful <u>supportive</u> group for in fact there is likely to develop through
the interests, participation and experience of parents and others a
further source of validation for teachers and their programs.

Schools have the dual responsibilities of both being responsive to
changes in society and in turn contributing to the direction society takes.
Unless there is a meaningful dialogue between the school and community,
schools will alienate young people from membership in a rapidly changing
world through failing to involve those valuable community resources of
<u>people</u> and their <u>experiences</u>.

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1.   See Pusey, M.R. <u>op.cit.</u>,   pp. 228-230 for some suggestions concerning
     the effective use of parents and the general public in the work of
     the schools.

5.14 Teacher Education Strategies

It seems reasonable to assume that teacher education and re-education
programs will play a major role in encouraging participants to spearhead
renewal and innovation in the System's schools.   This "new blood"
source of enthusiasm and idealism, if adequately sustained, can act
as an important change agent on both the System itself and the programs
within it.

Let us consider the overall area of pre-service education first.   It
seems a fairly widespread observation, both here and overseas, that
teacher education programs in general do little to prevent the
systematising and moulding effects of the school on the novice.   In
this respect important questions arise.   Can we "prepare", once-and-
for-all, teachers to withstand these systemic pressures?   If not, what
type of in-service ("retreading") programs are needed?   Further, how
do we overcome the very powerful tendency of young teachers to teach
as they have been taught, a tendency which may in fact be strengthened
by pre-service experiences?[1.]

What strategies, then, may be of value to beginning teachers in counter-
acting the pressures of the System?   How do we help develop in young
teachers powerful and personal security bases which the System will find
difficult to subvert?

Teacher education programs traditionally consist of general and
professional studies components notwithstanding the definitional
problems.   For the secondary teacher these include study in depth
of usually one discipline (for example physics, geology) and alongside
this studies which involve "education" subjects and curriculum-oriented
work.   In general there are few deliberate attempts made to provide
students with opportunities to develop self-identity, to develop
confidence in themselves and a conviction in their beliefs and values,
both educational and personal.   This is particularly important, for
the young teacher is likely to be subject to many pressures in the
school, particularly from peer groups of teachers, many of whom will
have already found security within the System.

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1. Paradoxically, experiences during practice sessions can confirm
    them in their already strongly internalised views of the nature
    of teaching.   This is particularly true today in secondary science
    classes.

For the trainee science teacher there needs to be essential change in those areas of study relating to science if he is not to be a perpetuator of the traditional view of that "discipline". In addition to a study in depth of one of the sciences, which is seen as essential, units need to be planned which will give him an insight into science and its methods. This would involve units such as Nature of Science, Ideas in Science (historical) and Science and Society or Science and Technology (that is, science and environment). From such studies the traditional "methods" courses would become museum pieces. For if a teacher has an understanding of science and its relationships with other human endeavours his "methods of teaching" become merely the ways in which he decides such ideas can be fruitfully translated into the learning situation. In distinction from the finite "recipe" approach his responsibility will lie in the planning of experiences which will be in harmony with his view of science.

Support during the early years of teaching will be essential if dedication to change is to be maintained. Although, in part, this may come from within the school, we believe a more likely area of support will come from outside the boundary of the school. Opportunities should be sought to "get together" with contemporary colleagues, for example in subject associations, and in informal social gatherings, perhaps in conjunction with training institutions, with both staff and students.

But we doubt if this is a sufficient safeguard to protect young people who are, if not potential "seeders" of innovation, certainly necessary caretakers and participants in the implementation process. While in-service programs do provide useful re-education of teachers, they tend to be initiated, planned and conducted by "officers of the Department", many of whom have internalised the norms of the System. One wonders whether "real" change can be an outcome of such programs.

We would suggest that programs need to be devised which will "lift" the teacher out of the school environment relatively early in his career so that the ever-present pressure of systematising may be reduced. This could involve teachers in a re-entry system to tertiary education facilities for further study in contemporary education and a general up-dating of ideas.[1]

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1. This would require lecturers also to keep up-to-date with modern developments and to initiate research in relevant areas.

Currently, the Education Department is granting re-entry scholarships
so that teachers might have the opportunity to gain higher qualifications
and status.   This plan is likely to have the side advantage of making
teachers more independent of the System and hence more likely to support
change.[1.]

The area of in-service education has been touched on above and it has
been suggested that it may in fact become merely another outlet for
the System's authority.   Programs in this field must develop far more
from the expressed needs of those in the teaching field, a concomitant
being the active involvement of teachers, particularly those who with
encouragement may be seen as opinion leaders.

We suspect that pre- and in-service education programs must move closer
together and become a combined force to provide life-long education for
the teacher.[2.]   We believe such a concept will provide a powerful base
for initiating worthwhile change, where the responsibility for re-education
will be shared between the teacher education units and the System and its
schools.   Teachers will find a new security within this collegial
fraternity and a new freedom to experiment and initiate.

5.15 Career Reform

The nature of the appointment and career structures for the System's
encumbents will, in part, determine the viability of innovative attempts.
This is particularly relevant in considering the type of psychological
support that new ideas might be given in the secondary school environment.
In a sense, the secondary school teacher is an itinerant whose
associations with schools and children are at best transient ones.
From his first appointment through subsequent moves, promotions and
responsibilities he is rarely in a position for a sufficient length
of time to identify with and influence programs based on diversity.

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1. Such re-entry experiences may well just pre-date promotion to more
    senior positions in the school, thereby diverting the power inherent
    in such positions from maintenance of the structure to encouragement
    of diversity.

2. e.g. the Centre for the Continuing Education of Teachers in Tasmania.

In the early "survival years" of his program the teacher is occupied with the day-to-day practices and problems associated with teaching[1]. and is often subject to the vagaries of systemic decisions which may, at short notice, require his services elsewhere.

His first promotion to Senior Master status, often on the basis of seniority, will in most cases require him to take up an appointment within a different school. His new found duties as well as those related to a subject department will also involve him in general administration, most of which is likely to be outside his field of expertise. His only avenue for further promotion, that is, appointment as Vice-Principal, removes him almost completely from his field of competence. The System therefore acts like a conveyor belt moving along a career continuum. At one end we have the in-put, the rookie teacher with his field of expertise. The nature of the System will inexorably move him further away from this situation towards the other end of the continuum: a field of administrative inexpertise. His behaviour patterns are now relatively stable and are locked into the System. He is no longer psychologically vulnerable to change; for him security is a way of life.

From what has been said it is possible to identify factors which make fundamental change difficult. In the first place the teacher will find it difficult to invest in new ideas if his position in a school is uncertain in terms of length of occupancy. Second, the promotional structure gradually removes him from the possibility of worthwhile contribution to his original field since his very dependence on the career structure will make it unlikely that he will trade his security for untried ideas. (see section 4.63)

We believe there are two major strategies which will both aid successful implementation of innovations and at the same time maintain a security base for the encumbent.

(a) There is a need for the development of a structure whereby teachers become "free agents" able to apply for advertised positions on a "period"

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1. Any professed interest in new ideas or changing the system are not always kindly received. "New" teachers are to be viewed as apprentices rather than initiators. A process of "systemisation" in these early years works actively against initiative and novelty.

or contract basis.[1.]   This would enable an applicant to support his
case in relation to professional expertise rather than in terms of
adherence to the System's expectations.   This would allow the "employer"
to select people specifically for innovative programs so that the concept
of change could become meaningful.[2.]   The effect of a period appointment
would be to encourage the appointee to invest in novelty and diversity,
for his continuing ability to succeed in his profession would be judged
now on his initiatives and his expertise in managing and evaluating change.

The security base would move from dependence on the System and its
norms to the security of professional competence.   This would in fact
be just the opposite of the present system where professional goals are
often repressed at the expense of organisational ends.

(b) As a concomitant of this change there would need to be a review of
the promotions structure.   There would need to be the development of
a _career grade_ model so that promotion did not inevitably lead to a
movement away from one's field of competence.   This means that within
the science field a teacher could continue to advance status-wise, but
by choice remain within the field of science.   This would be of great
value in the retention of an already small number of trained science
teachers in the state.   Not only that, but teachers in training would
be able to look forward to a career grade in science teaching which
could help to counter the often lucrative offers for their services
from industry.   It would allow the building up of a pool of teachers
with experience and up-to-date ideas for there would be the incentive
to reach for professional excellence knowing that this process would
not be terminated by the existing uni-dimensional promotions structure.[3.]

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1. Period or contract appointments would relate to tenure for a specified
    time.   This method of appointment would also apply to beginning
    teachers although selection criteria would differ for those who had
    a background of professional experience.

2. There may be difficulties here with the staffing of schools in remote
    areas but an "allowance" for such isolation may partly overcome the
    problem.   The present trend towards a surplus on the "teacher market"
    may well encourage teachers to apply for positions in areas they would
    not normally consider.

3. Change in this direction is likely to be slow.   In the Interim Report
    on the Organisation of the Education Department, Hobart, October, 1973,
    five recommendations concerning the promotion system are stated.   In
    essence they recommend the decentralisation of promotional procedures;
    in practice they affirm the present "Department" controlled structure.

We believe this change in conjunction with the right to "hire" teachers would do much to remove the threat barrier that teachers at present face in their attempts to innovate.

5.16 Involvement in the Innovative Process

If teachers are to feel a commitment to innovative programs it is essential that they become involved as early as possible in such developments. As well as providing some of the necessary expertise and experience from within their area of competence, involvement provides the opportunity for participants to invest a part of themselves in new programs. Although many of the new mathematics and science programs developed in the United States during the last decade or so were initiated by university scientists, the development of programs was very much a task undertaken by practising teachers. This involved the initial planning, selection of content, suggestions for teaching strategies, trialling in schools, re-writing and final evaluations. In Australia too, J.S.S.P. and particularly ASEP, have involved the classroom teacher.[1]

Although a considerable number of teachers can be involved in the trialling of materials and thereby come to understand their basic premises, the number that can be reasonably involved in actual development is small. However, program developers, by initiating guideline conferences, setting up advisory committees and developing communicative competence between interested parties, can involve a considerable proportion of a system's relevant work force.

This is in addition to the secondment of those from within the organisation who may have special interests and experience within the field of the innovation. In fact there needs to be a close liaison between state education bodies and the project planners. This would allow fairly free movement of personnel and ideas between the two bodies. It should also promote the possibility of those who have worked in a project on a seconded basis to act as consultants and resource people on their return to the system. Such a strategy would enable a meaningful and mutually advantageous link to be developed between the educational task and the environment so that the System and its encumbents could become participants in change rather than potential resisters.

1. see section 5.2

But most importantly it would in the case of science teachers, give
them an insight into, and an understanding of, the contemporary view
of _science_ as distinct from the traditional view of science as a
collection of specialisms. The associated involvement in the development
of relevant teaching strategies would do much to increase the versatility
of the science teacher. We believe such participation would help to
diminish the threat to the science specialist as he becomes aware of,
and contributes to, contemporary science and its programs.

5.2 The Australian Science Education Project

The point has been made that in looking for management strategies in
the field of science innovations we are really searching for actions
which apply generally across the secondary school area. In many
ways the threats which face the science teacher in his search for
freedom in the System are much the same as those for other teachers.

Since our special interest lies within science education in its
contemporary setting it is pertinent at this stage to briefly examine
a very recent innovative science program and to comment on its likely
success in the schools. To do this we will focus on its management
strategies, viewing them in relation to what we have asserted as being
potentially fruitful ways of managing innovation.

> "The Australian Science Education Project (ASEP)
> was the first national curriculum project set up in
> Australia. It was funded from October 1969 to March
> 1974 - by the Commonwealth and six State Governments.
> The purpose of establishing ASEP in this way was to
> enable the organisation to cut across State and education
> system boundaries while remaining linked to them".[1]

ASEP had the brief to prepare science materials for the first four years
of secondary education in Australian schools. It was planned around an
"environmental scheme" with enquiry-based units written at levels
corresponding to modified Piagetian stages, concrete, transitional
and formal. During 1974 about twenty of the first units were published
and are now in use in some of our secondary schools. The initial
reaction seems very favourable but this is to be expected due to the
"newness" or novelty effect of the materials.[2]

1. A _Guide to ASEP_, Government Printer, Melbourne, 1974, p.5

2. Discussions with several secondary science teachers in the Hobart area
   suggest that students are reacting very favourably to the new materials.
   It has been suggested that the use of both ASEP and other science
   materials will do much to maintain this favourable reception to ASEP
   by avoiding the deadening effect that can come from the continuing
   use of the same type of instructional material.

What of the long term chances of success?

There are two points to be made prior to commenting on the management strategies of ASEP. In the first place ASEP is a national curriculum project funded through both the Commonwealth Government ($750,000) and the six State governments ($450,000). It was thus a participative venture between the states and the managing and executive bodies of ASEP itself. Because of the autonomous nature of education within the states it was not possible (nor desirable) for ASEP to be directive about how its plans for management of ASEP materials in the schools should be conducted.

For example, in relation to teacher education Les Dale has this to say,
> "ASEP was in a difficult position with respect to
> implementation for two reasons.
> 1. No provision had been made in the budget for
>   teacher education activities.
> 2. The States had made it clear that teacher
>   education was their prerogative and ASEP
>   should not encroach on their preserves."[1]

Thus ASEP relied largely on the state education departments to work co-operatively with the Project in servicing its program. That this support was forthcoming during the development and trialling of materials is recognised.

Second, the ASEP staff structure reflected a recognition of the need to manage or service the materials produced. In addition to the position of Assistant Director (Development), the position of Assistant Director (Service) was created with special responsibilities for teacher education and services, evaluation and technical production of materials.[2] In fact, "The functions of the Service branch in bringing about change are to
> 1. produce in a technical sense the materials for change;
> 2. stimulate the change process among teachers;
> 3. monitor and describe the change process;
> 4. evaluate changes produced".[3]

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1. Personal correspondence from Les Dale (15.10.74). Mr. Dale was the Assistant Director (Development) for ASEP.
2. See Australian Science Education Project, Organisation Chart.
3. ASEP Report of the Guidelines Conference, Monash University,
    January, 1970, p.19

Although teacher education has obvious implications for the success or otherwise of ASEP materials it is also essential to their success to have materials which have been adequately trialled and evaluated and further for materials to be produced that are acceptable to teachers (acceptable in terms of accuracy of information, readability and communicability, overall "attractiveness" and so on).[1.]

With the above two points in mind let us now consider the management program of ASEP specifically in relation to four of the six strategies of managing innovation discussed in section 5.1   We intend to relate the discussion to four areas only, namely, external validation, teacher education, involvement of teachers and community support.   The remaining two areas of internal support and career reform are not seen as directly relevant to our discussion, although we believe that realisation of the former will be enhanced through involvement with programs like ASEP, while in a converse way implementation of the latter would do much to increase the likelihood of acceptance of the program.

5.21   ASEP and External Validation

As we have noted, ASEP came into existence as a national curriculum project funded by the seven governments with a monetary allocation of 1.2 million dollars.   This political acceptance of the potential value of its product gave legitimacy to its endeavours since in essence ASEP was set up by the Commonwealth Minister for Education and Science and the six state Ministers for Education.   ASEP was administered by a Committee of Management with a representative from each state education department and the Commonwealth.   In addition, the Australian Council for Educational Research was represented by its Director.[2.]   Such representation ensured the closest co-operation and involvement of individual states so that the overall success of the Project was to depend in large measure on the investment and support of the various educational systems.   An indication of this support was the excellent co-operation given the Project by the involvement of "trial teachers" in the various states (see section 5.23).

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1.   From discussions with some ASEP staff members and others closely associated with the Project, there emerged the feeling that ASEP materials should be of such a calibre as to "sell themselves". This might be looked on as an in-built management strategy.

2.   ACER was asked to manage ASEP in an organisational sense.

ASEP then, was nationally accepted and supported and was seen to be a valid endeavour for the involvement of educationists throughout the country. We believe such validation encourages teachers to transfer their commitments from the expectations of the System to investment in the program and the clients it will serve.

5.22 ASEP and Teacher Education

Since no provision was made in the budget for teacher education and since the states saw teacher education in general as their responsibility, ASEP prepared a model teacher education program and offered to help the states in its implementation. ASEP quite clearly saw, as a fundamental pre-requisite for success, the "preparation" of those who would be closely associated with the classroom use of materials and on whose shoulders would rest, by and large, the success of those materials.

> "As part of its program for the development of its
> materials, ASEP developed a model teacher education
> program. ASEP recognised the teacher as the key to
> the learning environment".1.

The teacher education model was planned around five phases, initiated by ASEP, but in general controlled through the State Advisory Committees (SAC's). These phases related to the use of materials by teachers in the following categories: first trials, national trials, practising, trainee and teachers with ASEP experience. Each phase was divided into steps.

> "Teachers were introduced to ASEP by newsletters
> and articles in journals, oriented to its philosophy
> and approach at conferences, and familiarised by
> participating in workshops. They gained experience
> through teaching with the materials - and were then
> challenged to extend their teaching roles and feed back
> information to modify the materials".2.

The important point here is that ASEP produced and had implemented a most comprehensive teacher education plan, a strategy which we believe will enable teachers to identify with ASEP and its philosophy and feel confident in the use of its materials. Further, we believe that although the Project has now terminated, there will be a continuing impetus given by pre-service programs in teacher education institutions throughout the nation.

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1. A Guide to ASEP, op.cit., p.109 (underlining is ours)
2. Ibid., p.110

5.23 ASEP and Teacher Involvement

The teacher education program set out to acquaint teachers with the nature of ASEP, its rationale and its materials.   But in addition to this "initiation" stage, ASEP, with the co-operation of teachers within the states, involved teachers in three main areas: trialling,[1] setting up of State Advisory Committees, seminar participation and, on a lesser scale, appointment of teachers to the Project.

A most intense trial program was undertaken by just over 500 teachers in about 450 schools in both Australia and New Zealand.   Rural and metropolitan, state and independent schools acted as trial schools and about 19,000 students were involved.   About half of the units were trialled twice, once locally (first trial) and once nationally in a second trial.[2]

In addition to the importance of feedback and evaluation, there was the vital involvement of a large number of teachers in the process in that a

> "... result of national trials was the establishment
> of a nucleus of teachers experienced in ASEP
> philosophy and the use of ASEP materials, who would
> be able to help with the introduction of the
> published materials in the various states".3.

Further involvement occurred for teachers through membership of State Advisory Committees set up to monitor the running of ASEP in each state, participation in seminars, writing of new units and finally, for some, the opportunity to work on the ASEP staff.

Such independent involvement will do much to ensure the success of ASEP materials since any hint of failure would be interpreted as a threat to the considerable personal investments on the part of many teachers.

5.24 ASEP and Community Support

ASEP can be thought of as a teacher-based Project, but it also depended, purposefully, on expertise from other sources.   The use of consultants from institutions, industry and the general community did much towards

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1. We have not selected out "trialling" as a separate strategy for although it is a necessary part of any new program, assisting towards the development of more acceptable materials, we are more interested in the <u>involvement of teachers</u> which is a concomitant of the process.

2. <u>Ibid.</u>, p.106

3. <u>Ibid.</u>, p.106

providing a cross section of opinions on contemporary science and its social implications.

One unit, Males and Females, was subject to exhaustive community involvement.[1] Although somewhat atypical of ASEP units in general, its development illustrates the desire of ASEP to gauge the tenor of public feeling.   In addition to the normal trials of this unit, each SAC was asked to get as wide a set of opinions as possible from the community.   In this state comments were solicited from such bodies as Medical and Life Science Faculties of the University, the World Council of Churches, Catholic Education, Marriage Guidance Councils, the Health Department and Parents and Friends groups.   Individual opinions were also sought.

Such community involvement, whether relatively widespread as in Males and Females, or on a smaller scale as in most other units, gave the Project the opportunity to develop in a way which reflected the consciousness of contemporary society.   For the teacher too, knowledge of this community participation should provide added support in his attempts to innovate and in his search for more effective learning strategies.

5.25   ASEP - An Assessment

ASEP has developed within its management program, either explicitly or implicitly, strategies which we believe have the potential for success. This has been done basically by the involvement of people from a wide spectrum of the human resource pool, and the encouragement of teachers, in particular, to internalise the very bases of the program itself. The authority then for the introduction of change into the System rests less on the formal structure than on the convictions of those who have been in many ways teacher-associates of the Project.   It is likely that much security will be found by teachers as members of such a dedicated group.

But management models do not per se necessarily guarantee the realisation of their aims.   Much of the successful implementation still rests with the classroom teacher.   If ASEP materials are seen

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1.   Males and Females, unit 107.   A sex education unit with important social and ethical implications.

as the "elixir to all science education ills" then this faith may
well be misplaced.   As in any teaching situation, teachers must
be selective in the experiences that are chosen so that loss of
novelty and associated boredom do not become the norm.

We believe ASEP has done its homework well; the challenge now
rests with the schools.

Retrospect and Prospect

In retrospect we have suggested that the successful implementation
of innovative programs depends on the establishment of alternative
security bases for the encumbent, implying that situations giving
rise to insecurities should be avoided.   Such a shift of allegiance
from the expectations of the System has a high potential for the
development of threat and anxiety and therefore any displacement
has to be managed circumspectly.

We have asserted that the very nature of traditional science and its
interpretation in the classroom fitted easily into the System's
framework.   It has been the rapid rate of development of a radically
different view of science that has challenged the System's conservatism
and the encumbent within it.   We therefore argued that such a situation
was likely to create dysfunctions as the encumbent searched for behaviours
to minimise the threat of uncertainty and novelty imposed by the environment.

The nature of our management strategies was to suggest <u>ways in which such
a threat dimension might be diminished or even eliminated</u> through the
freeing of encumbents from ascribed roles, locked-in routines and
unquestioned rituals.

In prospect we see a climate for the acceptance of change which is likely
to become more conducive with the passing of time.   We live in a period
of great educational ferment with those traditional bastions of conserv-
atism, the school, the church, and the family, all facing powerful
reshaping forces.   The tone of the futurists, including the deschoolers,
is strident, and it is clear that a new consciousness is stirring within
society.[1.]

It is this enthusiasm for change within contemporary society which we
believe will provide much of the impetus and respectability for new
initiatives.   Hopefully, effective strategies of management will give
this enthusiasm <u>direction</u> and <u>purpose</u>, ease the transition from the
old to the new and support both System and encumbent in a world of
transience and impermanence.

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1.   See the works of Illich, Reich, Toffler and others.

BIBLIOGRAPHY

A. Texts Referred to in the Dissertation

Books

Blau, P.M. & Meyer, M.W.   Bureaucracy in Modern Society,
                                Random House, N. York, 1971.

Bronowski, J.   The Common Sense of Science,
                                Pelican, 1968.

Burns, T. & Stalker, G.M.   The Management of Innovation,
                                Tavistock, 1961.

Carlson, R.O.   Adoption of Educational Innovations,
                                University of Oregon Press, 1965.

Dreeben, R.   On What is Learned in School,
                                Addison-Wesley, Reading, 1968.

Fromm, E.   The Fear of Freedom - Mechanisms of Escape,
                                RKP, 1942.

Goodlad, J. & Klein, M.   Behind the Classroom Door,
                                Jones Publishing Company, Washington, 1970.

Gross, N., Giacquinta, J.   Implementing Organisational Innovations,
& Bernstein, M.   Basic Books Inc., New York, 1971.

Hannam, C. et.al.   Young Teachers and Reluctant Learners,
                                Penguin, 1972.

Hillson, M. & Hyman, R.T.   Change and Innovation in Elementary and
                                Secondary Organisation,
                                Holt, Rinehart and Winston, New York, 1971.

Hoyle, E. & Bell, R.   Problems of Curriculum Innovation I,
                                The Open University Press, Walton Hall,
                                Bletchley, Bucks., 1972.

Hughes, P. (ed)   The Teacher's Role in Curriculum Design,
                                Angus & Robertson, 1973.

Hurd, P. DeH.   New Directions in Teaching Secondary
                                School Science,
                                Rand McNally & Co., 1970.

Katz, D. & Kahn, R.L.   The Social Psychology of Organisations,
                                John Wiley & Sons (New York) 1966.

Lawrence, P.R. &   Developing Organisations: Diagnosis & Action,
Lorsch, J.W.   Addison-Wesley, 1969.

Miles, M.B.	Innovation in Education, Teachers College Press, New York, 1964.
Mort, P.R.	Educational Adaptability, New York, Metropolitan School Study Council, 1953.
Richardson & Brown (ed.)	The Preparation of Teachers in Australia, Cheshire, 1967.
Storr, A.	The Integrity of the Personality, Penguin Books, 1972.

Curriculum Project Materials

ASEP Report of the Guidelines Conference, Monash University, Jan. 1970.

A Guide to ASEP, Government Printer, Melbourne, 1974.

Australian Science Education Project (ASEP),   Newsletter No. 2
   November 1970.

Australian Science Education Project, Organisation Chart.

ASEP.   Males & Females, Unit 107.

Introduction to the Elementary Science Study.   McGraw Hill Book
    Company, 1966.

Science - A Process Approach, Commentary for Teachers, American
    Association for the Advancement of Science, 1968.

Trial Science Syllabus for School Certificate. Schools Board of
    Tasmania Manual, 1974.

Journals

Bassett, G.W.	"Change in Australian Schools", The Australian Journal of Education No. 1, March, 1971.
Breslow, A. et.al.	"Forces Influencing Curriculum", Review of Educational Research, 30, No.3, 1960.
Maslow, A.H.	"A Theory of Human Motivation", Psychological Review, vol. 50, 1943.

Reports

Interim Report on the Organisation of the Education Department,
   Hobart, October, 1973.

Schools in Australia, Report of the Interim Committee for the
   Australian Schools Commission, May 1973.

The School in Society, published by the Education Department of
   Tasmania, Hobart, Tasmania, 1968.

Theses

Johnston, G.L.   State Secondary Education in Tasmania,
                                  M.Ed. Thesis, University of Tasmania, 1962.

Pusey, M.R.   The Tasmanian Education Department
                                  Secondary School System : A Study of
                                  Organisational Processes,
                                  Dr. of Education thesis, Harvard University,
                                  1972.

Miscellaneous

Check List of Reasons for Rejection, Schools Commission, Innovation
   Program.

Personal correspondence from Les Dale (15/10/74): Former Assistant
   Director (Development) for ASEP.

B.   Supplementary References

Books

Crozier, M.   The Bureaucratic Phenomenon, University
                                  of Chicago, Chicago, 1964.

Hoyle, E. & Bell, R.   Problems of Curriculum Innovation II,
                                  The Open University Press, Walton Hall,
                                  Bletchley, Bucks., 1972.

Illich, I.D.   Deschooling Society, Calder and Boyars,
                                  London, 1971.

Lawrence,P.R. & Lorsch,J.W. Organisation and Environment.
                                  Managing Differentiation and Integration,
                                  Harvard University, Boston, 1967.

Luft, J.   Group Processes.   An Introduction to
                                  Group Dynamics,
                                  National Press Books, California, 1970.

Pugh, D.S., Hickson, D.J.   Writers on Organisations,
  & Hinings, C.E.   Penguin, 1971.

Reich, C.A.   The Greening of America,
                                  Penguin Books, 1970.

Rogers, E.M.   The Diffusion of Innovations,
                                  Free Press, New York, 1962.

Romey, W.D.   Inquiry Techniques for Teaching Science,
                                  Prentice-Hall Inc., N. Jersey, 1968.

Taylor, W.   Heading for Change,
                                  Routledge & Kegan Paul, London, 1973.

Toffler, A.   Future Shock, Pan Books Ltd., London, 1970.

Young, M.   Innovation and Research in Education,
                                  Routledge & Kegan Paul Limited, London, 1965.

Thesis

Morris, G.C.   Educational Objectives of Higher
                                  Secondary School Science,
                                  M.Ed. Thesis, A.C.E.R., 1961.

Miscellaneous

The New Curriculum, A presentation of ideas, experiments and
  practical developments, selected from Schools Council publications
  1964-7.   London, 1967.