A Case Study in the Use of Soft Systems Methodology: Restructuring an Academic Organisation to Facilitate the Education of Systems Agriculturalists*

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ABSTRACT

A programme of reform of educational programs began at Hawkesbury Agricultural College in 1978. The new programs are based on experiential learning and systems thinking and practice and are a major departure from the previous didactic and discipline-based curricula. Problems associated with servicing the needs of the new curricula and dissatisfaction with attempts to overcome them led to a series of situation improving projects in 1983–4 that led to a radical restructuring of the School of Agriculture in 1985. The projects were guided by soft systems methodology. The projects and a subsequent evaluation of the changes are described. The way soft systems methodology and associated techniques were used to guide the process is included, and an assessment of their usefulness made by the authors.

INTRODUCTION

The School of Agriculture at Hawkesbury Agricultural College with 40 academic staff and 480 students, was one of the largest and oldest in Australia until it was split into separate Faculties of Agriculture and Horticulture in 1987. In 1978 a new Head of School was appointed and a series of decisions on major reforms of the School's programs were made.

* This paper is based on one presented at the Australian Society for Operations Research Conference, Adelaide, 1985.
The aim was to produce a graduate who would be an effective problem-solver and situation improver in the complex and dynamic world of modern agriculture. The new programs emphasise systems thinking and practice and the development of students as problem-solvers, learners and communicators. The graduates are systems agriculturalists and Bawden & Valentine (1984) have defined their attributes and Bawden et al. (1984) have described the framework of systems thinking and educational principles that underpins the programs, and the way it has been applied. Macadam & Bawden (1985) have outlined the rationale for the change and reflected on the change process.

The programs are based on the concept of experiential learning (Kolb, 1984; Bawden, 1985) and situation-improving projects undertaken by students and staff are the core of the programs. The projects are centered on real rather than contrived problem situations in agriculture. A useful concept for organising the programs has been that of a hierarchy of problem-solving methodologies for situations of increasing complexity and ambiguity and Fig. 1 illustrates this concept. The situations at the top of the hierarchy are 'soft situations' as defined by Checkland (1972, 1981). The methodology developed by Checkland and his colleagues at the University

![Fig. 1. A hierarchy of problem-solving methodologies (from Bawden et al., 1985).]
of Lancaster for approaching these situations fits well within the Hawkesbury paradigm and Fig. 2 shows the relationship between the experiential learning cycle and soft systems methodology.

This paper will focus on the use of the methodology to facilitate organisational changes needed to accommodate the new programs.

THE SITUATION

At an early stage in the review initiated in 1978 the Head of School had foreshadowed a need to review the management and structure of the School to more closely reflect the functions that would emerge. In 1979 he recommended the abolition of the existing discipline-based departments and they were four Centres which were, however, still primarily discipline-based, viz.: Engineering, Horticulture, Animal Production and Plant Production.

From 1979 to 1983 the emphasis in the School was on the design, conduct and evaluation of new undergraduate and graduate programs. By 1983 there was a chronic sense of dissatisfaction among staff and students with the way the School was meeting the needs generated by the new programs.

During this period there was an increasing awareness of the need for more radical changes in the way the School was organised and managed. No-one, however, took the initiative to launch a major review. This was probably a reflection of the magnitude and complexity of the task, an awareness of the latent depth of feeling around the issues involved, and an inability to articulate how the review would be done and to what end.
As a result of a series of initiatives taken during 1983–4, however, a consensus was reached and decisions made on a major re-structuring of the School. The change process was guided by soft systems methodology and can be viewed in retrospect as three sequential projects.

PROJECT 1—PROBLEM SITUATION AND INITIAL ANALYSIS

The starting point for the project was dissatisfaction among both technical support staff and academic staff with the situation surrounding the provision of technical services for the programs. Numerous attempts had been made to solve problems associated with technical services, but none had resulted in any lasting improvement. As such the issue was typical.

Early in 1983 a School Co-ordinating Group was formed in an attempt to more effectively allocate resources and co-ordinate activities within the School. In July 1983 the Group agreed to ask students enrolled in the Bachelor's program to analyse the situation surrounding the provision of technical services. This was a response to the realisation that:

- problems associated with this issue were deep-seated;
- a detailed analysis of the situation was needed;
- the staff resources to do it were not available;
- students were an untapped resource;
- it would be a vote of confidence in the concept that learning in the School's programs be based on attempting to solve real rather than contrived problems;
- it would promote the concept of staff and students being co-learners;
- there was a desire among some group members to put systems methodology into practice in solving our own problems.

Senior under-graduate students were invited to 'contract' with the School Co-ordinating Group to do the analysis. One of the authors had an interest in, and some experience with, soft systems methodology and agreed to act as a resource person to the student group. Five students volunteered.

The students' analysis was guided by the questions (Checkland, 1972):

1. What resources are deployed in what operational processes under what planning procedures within what structures in what environments and wider systems, by whom?
2. How is the resource deployment monitored and controlled?

The analysis by the students involved a comprehensive series of interviews with technical, academic and administrative staff within the School of Agriculture and the College as a whole. They carried out the task in a
A case study in the use of soft systems methodology

sensitive and professional manner and continued until they considered they could adequately answer the guiding questions. The results were presented in a report to the School Co-ordinating Group in December 1983 (Evans et al., 1983). A technique outlined by Barnett & Mackness (1983) was used to illustrate the situation they had encountered and to synthesise the symptoms and lesser problems into a core problem. This is reproduced in Fig. 3.

PROJECT 2—DEFINITION AND DEVELOPMENT OF CONCEPTUAL MODELS AND FURTHER ANALYSIS

Members of the School Co-ordinating Group responded in different ways to the report. All agreed it was an accurate reflection of the situation. Some, unaware of the nature of the methodology, were looking for recommendations to accept or reject. Others were uncomfortable with the realisation that students were as aware of the situation as they obviously were. There was, however, a willingness to continue with the use of the methodology and the group let a contract in February 1984 to the two authors of this paper, and a group of five senior under-graduates. The focus of this project was to be the definition and development of conceptual models (Smyth & Checkland, 1976; Checkland, 1979) to improve the situation the students had reported on. Whereas the students had been the main actors in the first project the staff members played this role in the second project—contributing factors being student preoccupation with preparations for their assessment for graduation in July 1984, and the technical nature of the modelling techniques, with which the students had had no experience.

In terms of the Checkland methodology Project 1 was based on steps 1 and 2 in Fig. 2, and Project 2 on steps 3, 4 and 5. One of the lessons learned, however, was that although the methodology appears to be a series of sequential steps this is not the case. The authors and students found themselves moving constantly from conceptualisation to analysis to comparison, and vice versa. Accompanying this was increasing comprehension and insight. They often found themselves retracing their steps as their awareness grew.

Initially the aim was to define and develop a conceptual model of a system to focus debate on means of improving the technical services situation. The final result, however, was not one, but six, models, with technical services subsumed within them.

Project 2 culminated in a report (Macadam & Packham, 1984) which contained an analysis of the situation in the School of Agriculture and its environment, the conceptual models, a comparison of the models with the situation revealed in the analysis and the insights the authors had gained in
Ad hoc and erratic demands for technical services

Under utilisation of lab. facilities

Confusion about what constitutes technical services and who are technical staff.

Belief among many technical staff that students are poorly trained in science areas compared with old programmes

Pervasive feeling among academic and technical staff that 'technical resources' are not being used effectively

Feeling among technical staff that they are second class citizens relative to academic staff.

Technical staff don't have a strong commitment to the new programmes and are not well informed about them

* Lack of experience with the new programmes

* Reduced emphasis on structured practical classes in laboratories.

* Laboratory organisation not yet compatible with new programmes

* Break-down of the subject-matter specialisation characteristic of old programmes.

* Lack of structured practical classes in laboratories in new programmes and reduced emphasis on science subject matter.

* Reduced emphasis on work done in past and uncertainty about what is required in new programmes.

* Hierarchical and dependent relationship between academic and technical staff.

* Their not being involved as members of course teams

Symptom of

The innovative nature of the new programmes and the uncertainty this entails

Ill defined purpose of technical services in the new programmes

Symptom of

THE RATE OF ADJUSTMENT IN THE PROVISION OF TECHNICAL SERVICES NOT KEEPING PACE WITH THE DEVELOPMENT OF THE NEW PROGRAMMES THE 'CORE PROBLEM'

Symptom of

Lack of participation of the technical staff in the design and planning/evaluation of the new programmes
Poor cross-use of facilities between Centres
Poor maintenance of some facilities
Peaks and troughs in demand for resources in different centres, but resources not moved between centres to even this out
Low morale of technical staff in PPC and Hort. Centre.
Distrust among staff in PPC and Hort. Centres over access to and utilisation of technical resources
Uneven use of technical services by academic staff
Poor cross-use of tech resources between Schools

- Lack of information about resources in the different Centres and what use is being made of them.
- No mechanism for co-ordinating resources across School.
- Centre rather than School-based orientation.

- Lack of recognition for effort.
- Lack of feedback.
- Uncertainty about what is required

- Perceived 'sweet-heart' deals and favouritism.
- Confusion over the rights and obligations of academic and technical staff in relation to requests for technical services

- Differences between the nature of programmes.
- School rather than College orientation.
- Lack of a co-originating mechanism

Fig. 3. A synthesis of the core problem.
the process. It again contained no recommendations and was presented to the School Co-ordinating Group as a basis for debate within the School in July 1984.

In the report on technical services in Project 1 the authors (Evans et al., 1983) came to the conclusion the core problem was that the 'rate of adjustment in the provision of technical services was not keeping pace with the development of the new programs'. Macadam & Packham found that in

![Conceptual model of the School of Agriculture as an educational system.](image-url)
going back over this material and linking it with the wider view of the School, a different definition of the core problem emerged. This was stated as:

'There is a mismatch between the organisation structure and organisation functions of the School'. (Macadam & Packham, 1984).

This view was based on a realisation that problems similar to those with technical services were widespread in the School and were a result of a bureaucratic structure that was incompatible with a rapidly evolving set of educational programs where problem-solving projects were replacing...
academic subject matter as their focus. The existing structure was based on academic disciplines and was no longer consistent with the activities occurring within it, hence the frustration with decision-making and resource allocation apparent throughout the School and documented in Project 1.

The conceptual model that was developed and the root definition on which it is based is illustrated in Fig. 4. Each of the sub-systems was defined as a system and an expanded conceptual model of it developed and included in the report. The expanded model for the Interfacing and Policy-making Subsystem is shown in Fig. 5 as an example.

As previously mentioned the original focus was the provision of technical services, but the authors soon realised that changes in the way support services were structured and organised was impossible without accompanying clarification of academic functions. This led to a consideration of the issues of responsibility for the organisation and activities of the School. It was becoming increasingly apparent that it was vital to think of the School as a whole; including the means by which resources were allocated, activities co-ordinated and School policy determined. It was an irony that the last system to be defined was that of the School as a whole. In spite of determining the need for a systems approach to tackle the problem of technical services, the investigators were led only slowly to the point of widening the boundary of their focus, to view the School as a system.

PROJECT 3—DEBATE ABOUT DESIRABLE AND FEASIBLE CHANGE

The report on Project 2 was the basis for a third project based on the three final steps in the methodology (Fig. 2). The investigators were, however, nonplussed by their inability to decide on a means of initiating and orchestrating the debate. In particular, there appeared to be no way of terminating the debate and getting decisions made. The reasons emerged in subsequent discussions with the Head of School.

The report implied a need for fundamental change and had served to raise the level of tension within the staff group between those who favoured change and those who were opposed or uncertain. The Head of School was not a member of the School Co-ordinating Group which had sponsored the two earlier projects, but was ultimately responsible for what happened in the School. Without his support there was little prospect of change or even of serious debate about the possibility of it. Conversely, although sympathetic to the thrust of the report and the process it was based on, he was concerned that the debate would be difficult to focus. The issue was one of
responsibility and the judicious use of power. As a result of the discussions that led to this insight it was decided that the Head of School would facilitate the debate around the report.

The process began when he initiated and attended a series of informal lunch-time discussions with staff in the various Centres that made up the School. This took place in August and September, 1984. During this period there was little discussion of the issues at stake other than at these meetings, and the discussion at these was muted and low-key. Staff did, however, demonstrate, in honest ways, their fear of change and concern for the future with regard to personal relationships and work situations. In early October the Head of School circulated a letter to staff in which he observed:

- The major sub-systems identified in the Macadam & Packham's conceptual model of the School have met with little disagreement.
- The major flows of inputs and outputs between the School and its environment seem equally appropriate.
- The current structural organisation of the School does not optimally reflect either the five major functional sub-systems nor the flows of resources....

He offered a re-stated version of the Root Definition of the system in Fig. 4 as:

'(A system) to develop, practice and evaluate a paradigm of learning which will act as the essential basis for sustainable improvements in agricultural and horticultural (OR rural) systems through the more reasoned management of change.'

He went on to suggest that unless cause was shown why not, that this be accepted as the major function of the School. He also put forward a rough model to suggest a novel way the School might be re-structured to reflect the functions identified in the Macadam & Packham (1984) report.

On 31 October an open meeting of the School was called to consider 'Changes—School of Agriculture'. The meeting was well attended and there was a sense of anticipation that the Head of School would put forward a structural model as 'the solution'. In chairing the meeting, however, he maintained the focus on the issue of the purpose of the School rather than that of structure. This caused a high level of frustration and resulted in an animated debate which continued until another open meeting was called on 28 November to consider 'School Re-organisation'. In a briefing paper for this meeting, the Head of School and Chairman of the Board of Studies put forward a generalised matrix management structural model as an
appropriate one for a School whose purpose was now stated in the context that:

‘Graduates from the Hawkesbury School of Agriculture will have demonstrated their abilities to learn to take effective action at improving problem situations in agricultural systems.’

Once again there was an high attendance and level of expectation. The Nominal Group Technique (Ford & Neminoff, 1975) was used to elicit, categorise and put priorities on the concerns staff had about the proposed structure. Groups formed on the basis of interest in the issues and with a brief to consider the particular issue and report to a plenary session. This process of discussing and reporting continued through the afternoon of Thursday, 28 November and at lunch-time meetings on Friday and Monday. By now it was apparent that there was an informed consensus in support of the proposed purpose and suggested structure.

Although more than 20 issues were identified as important to the debate, once the key issues were resolved there was little interest in pursuing many of the others.

THE CHANGES

The debate within the School culminated in a formal meeting of the School Board of Studies on 5 December at which the Board made a series of recommendations to the College Council. The Council agreed to allow the School to experiment with the new structure during 1985 and subsequently gave approval for a permanent change from 1986.

In essence, the Council supported the thesis that the central thrust in (systems) agriculture and horticulture education at Hawkesbury is based on the paradigm of experiential learning. It approved a matrix organisation structure to support this, as illustrated in Fig. 6.

The structure nominates managers who are responsible for the key functional areas identified through the conceptual modelling and comparison process. It assumes a collegiate, rather than a bureaucratic organisational ethos. It is binary in the sense that the two major functional areas are management of programs and management of resources to support the programs.

The conceptual models developed using soft systems methodology are potentially a powerful evaluation tool because they can be used to monitor changes over time in the functions identified within them. Wilson (1984) has developed a technique for comparing the models with the existing situation and this was used to assess the situation within the School in November 1985 and the end of the experimental period ordered by the College Council (Macadam & Packham, 1985).
Figure 7 is an extract from the report on this. It relates to the conceptual model of a System to Decide School Policy in Fig. 5 and compares the six functions listed in the 'Interacting Sub-system' with the perceived situation within the School in November 1985.

The 1985 evaluation suggested that the changes made in 1984 had been effective in clarifying the purpose of the School; articulating the systems agriculture paradigm more clearly; refining an assessment process in keeping with program aims; developing an 'off-campus' perspective among staff, with a dramatic increase in external project opportunities being accepted; and enabling better relationships with other sections of the College, particularly the administration. Major deficiencies highlighted were concerned with the provision of learning resources in a form that was compatible with the experiential learning thrust.

A key area identified in the evaluation was that of staff development. Some staff were having difficulty either accepting or adapting to the demands of the new educational paradigm and this was placing strains on relationship.
<table>
<thead>
<tr>
<th>Activity</th>
<th>Is activity being carried out?</th>
<th>How?</th>
<th>What is measure of performance?</th>
<th>Proposed Change</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Develop an awareness of trends in agriculture and the rural sector — nationally and internationally</td>
<td>yes</td>
<td>Richard Bawden and some staff are monitoring trends</td>
<td>internal published information and levels of discussion</td>
<td>* extend range of issues (Hort. Animals, Crops, etc.); * hold annual review conference</td>
<td>currently effective but patchy coverage of issues</td>
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<tr>
<td>2. Develop an awareness of possible learning projects (situations to be improved) in agriculture and the rural sector</td>
<td>yes</td>
<td>outreach and individual initiatives</td>
<td>listing of potential projects — number and variety</td>
<td>becomes a focussed and programmed activity</td>
<td>currently ad hoc and only some staff aware and participating</td>
</tr>
<tr>
<td>3. Develop an awareness of trends in education</td>
<td>yes</td>
<td>* staff attending conferences and workshops; * interaction with local and international institutions and key individuals</td>
<td>* number of visits, conferences/workshops; * papers published and read; * quality and extent of above</td>
<td>None</td>
<td>high level of interest and involvement throughout School</td>
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<td>4. Monitor the reputation of the School</td>
<td>yes</td>
<td>media exposure, letters received, phone calls, general and rural public interest</td>
<td>extent and tone of feedback</td>
<td>identify sectors we want a good reputation with and check their perception—take appropriate action</td>
<td>* lot of excitement about level of innovation, high profile of Richard Bawden;</td>
</tr>
<tr>
<td>5. Evaluate the impact of learning projects on situations they were aimed at improving</td>
<td>yes</td>
<td>mainly student projects, validated by hosts + staff</td>
<td>whether feedback is +Ve or -Ve</td>
<td>to extend range of learning projects and staff involvement</td>
<td>* not sure about some ‘key’ sectors</td>
</tr>
<tr>
<td>6. Evaluate the reputation of the School’s programmes</td>
<td>yes</td>
<td>start made on formal UG1 evaluation and informal feedback from graduates and employers</td>
<td>qualitative and quantitative levels of satisfaction of employers and graduates for each programmes</td>
<td>extend formal mechanisms to UG3, PG and UG1 (Hort) —when appropriate</td>
<td>early stages—momentum must increase</td>
</tr>
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</table>

Fig. 7. System to decide school policy—an interacting subsystem.
Identification of these issues in this manner resulted in management attention being focused on them, but they continue to be a source of concern. Action research projects are continuing in these areas which will lead to improvement of them and further learning about handling such complex issues.

CONCLUSION

The experience described in this paper has validated the soft systems methodology for the authors. It is consistent with the emphasis on experiential learning and the facilitating of it that is at the heart of the new programs in the School of Agriculture. The methodology is essentially a learning one in which systems thinking and practice guides actors in a situation through a process of reflecting on their experience and then using concepts to consider alternative ways of proceeding. Because the concepts are based on systems thinking the effect is to have the actors consider the situation in an holistic way. The methodology stresses the need for discussion and debate among actors around the issues and concepts. It is this disciplined interaction between concept and reality that is the means by which the actors can share in new ways of perceiving their situation and responding to it.

REFERENCES


Evans, L., Thomas, P., Hincks, R., Bennett, D. & Mattner, H. (1983). An analysis of the provision of technical services within the School of Agriculture, Hawkesbury Agricultural College, Richmond, NSW.


