Swings and Roundabouts: Riding the Punches of University Management Dilemmas

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ABSTRACT: *Pressure on Australian universities to meet priorities of the major funding authority continues to exert a dominant influence on institutional management decision making. Because faculties are unequally positioned with respect to the alignment of their core business with changing government initiatives, stresses are created whenever an institution moves to change its own priorities in line with external pressures- exacerbated by internal policies of debt and surplus management. This paper describes a model built to examine future implications of internal management decisions conditioned by short-term decision making priorities. Problematic outcomes derived from model output are discussed, together with their implications.*

Keywords: Conference, system dynamics, resource allocation, university management decisions

INTRODUCTION

In addressing this issue it becomes clear that there is no single generic definition of 'University' that encompasses the wide range of institutions that share this name, and the national contexts in which they are located. So it is proposed here to delimit the problem by defining the context to be that associated with publicly funded institutions that over the last decade or so have faced a more stringent operating environment. This has included funding curbs and increased demands for accountability, leading to the development and application of a range of performance indicators, and devolution of managerial responsibility such that academic aspirations have come into increasing conflict with fiscal goals. These circumstances apply to the British and Australian contexts among others.

Trow (1994) has drawn attention to a discourse that indicates an increasing tension between dollarship and scholarship. Thus there has been downsizing and closure of academic units, voluntary or forced redundancies, the replacement of tenured positions by short-term appointments, debt management strategies, and the acceptance of national priorities in directing and rewarding research effort. Trow usefully introduced the terms *hard* and *soft* managerialism to describe associated characteristics.

Hard managerialism involves the re-shaping of higher education through the introduction of new management approaches at national level that become continuing forces in directing the future.

Soft managerialism seeks to provide higher education at its lowest cost and focuses on improving the "efficiency" with which an institution fulfils its stated mission.

The *hard* approach includes the establishing of performance indicators, criteria, and mechanisms, by which outcomes of educational activities are assessed with consequent "reward" and "punishment" of institutions through the linking of assessments to funding. The *soft* approach operates at institutional level where university managers tend to act as brokers translating (and overseeing) national policies and mechanisms into suitable analogues for institutional use. This is typified, for example, in the way that competition has been promoted between organisational sub-units within universities. The argument runs that schools or departments in competition will maximise their efforts, so enhancing the performance of their faculty or division. Maximizing faculty performance in turn is viewed as contributing to maximizing institutional performance, thus meeting government goals leading to funding rewards, or at least reducing the likelihood of funding cuts. There is no question that funding cuts have imposed extreme stresses on institutions and that institutional managers act in good faith to develop and implement policies for difficult times. The purpose here is to examine some characteristic responses of institutional management in terms of their medium to longer-term implications.

Senge and Sterman (1994) relate management difficulties experienced by executive administrators challenged to respond to simulated operating conditions representative of their organisational contexts. Thus business managers generated costly supply-demand cycles even when consumer demand was constant; experienced executives in a simulation of a failed airline destroyed their company just as their counterparts had done in real life; executives from a publishing industry bankrupted their magazine just as circulation reached an all-time

high; fire department managers burned down their headquarters despite their best efforts to put out the blaze; and doctors ordered increased tests while their patients sickened and died. The point is that understanding and managing the dynamics of a complex system is not a natural by-product of field experience and disciplinary expertise, whether the enterprise is manufacturing, service, or education. In particular expertise in academic pursuits of teaching and research, however valuable for certain aspects of leadership, does not necessarily provide a familiarity with the concepts appropriate for an understanding of the system dynamics of a university in its operating environment.

Soft managerial strategies are chosen for the most part on rational grounds and supported by arguments linked to institutional goals, usually set out in strategic plans. Formula funding is the common method of resource allocation of central funds to faculties, and the formulae reflect the specifics of local priorities. Formulae tend to be activity based, as a means of reflecting and encouraging the major components of teaching and research in various proportions. Cost differentials are provided for, by applying funding indices, to reflect estimated variations in costs of providing parallel services in different faculties. Student load may be smoothed over a period (e.g. 3 years) to even out irregularities that enable gradual adjustment to changing circumstances. Another view argues that faculties experiencing rapid growth need funds more quickly, so one-year retrospective funding is appropriate. The federal funding component for research output has a two-year smoothing period, so it makes sense to use a similar period for internal purposes. However universities have been encouraged to vary the weightings from the federal formula on the grounds that national aggregations may not best reflect local needs and incentives. In practice internal managers apply combinations of local policies in ways reminiscent of the actions of business managers in classic system dynamics literature.
Figure 1 depicts essentials of the causal structure of the model designed to address the problem outlined.

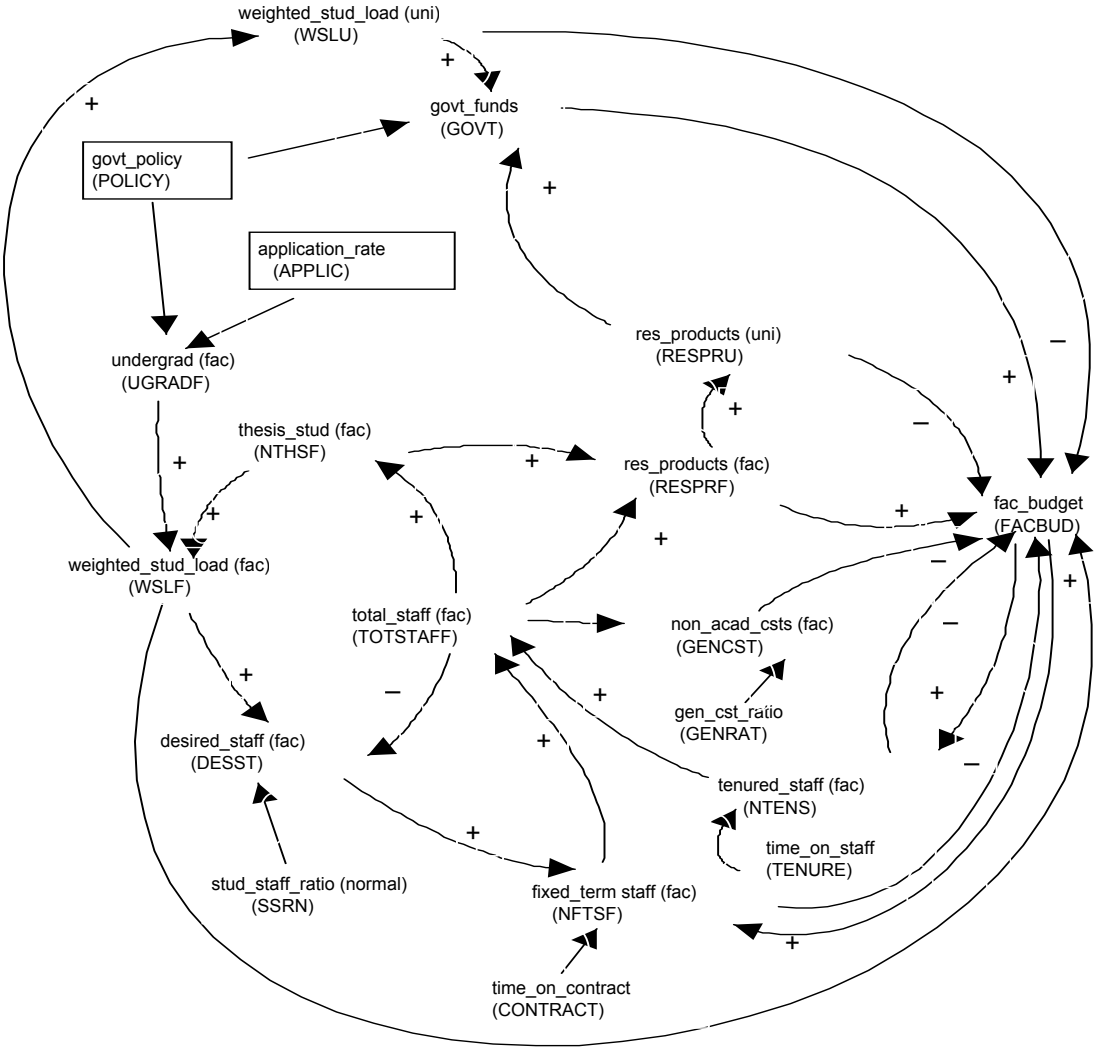

Figure 1: Basic Generic Structure of the University Management Model

MODEL STRUCTURE

The model is not designed to forecast precise numerical futures for variables. Its purpose is to provide insight into the medium and longer-term consequences of immediate decisions based on short-term goals. Hence it lies within the genre of *policy analysis* . A simple three-faculty model is the smallest that contains requisite competitive internal structure sufficient to generate all behaviours of interest in response to a range of policy implementations. The simplified diagram in Figure 1, as a causal loop structure, broadly depicts characteristics which the full model contains in stock and flow form. Some of these are described below.

Total student load, comprised of undergraduates and postgraduate thesis students is the major basis of the block grant provided from federal funds. Thesis students have double weighting in calculating faculty load. Academic staff comprises two components-permanent tenured staff and staff employed on short-term contracts. Debt and surplus management strategies at faculty level are the main agencies controlling the numbers and balance within the total staff profile. Faculties in debt typically have permanent appointments frozen. This means that tenured staff who leave are not replaced until faculty funds are deemed to be able to support new commitments, and short-term contracts are used to service urgent teaching needs that arise as a consequence.
Measures such as *student staff ratios* are typically recorded for monitoring, but not used as decisive decision variables for determining staffing policy. In practice increases in these ratios do indicate staffing needs (courses must have teachers), that are addressed by making short-term appointments that serve a purpose of 'mopping up' demand. When conditions allow, the preference is for tenured appointments, for these are the staff members who generate the bulk of research income through publications, grants, and thesis supervisions. Non academic staffing and other operating costs vary across faculties, and in this model are aggregated into components representative of expenditure ratios that are faculty specific. The number of thesis students enrolled is basically proportional to (mainly tenured) staff numbers, modified by a multiplier that amends their rate of enrolment as the number of such staff varies from its 'normal' value. Such variation indicates either an enhanced or a reduced capacity to provide the research culture desired for productive thesis activity.

Research output is composed of a range of measures that can be weighted and combined in various ways. The measures provided for in the model are *publications* (staff and graduate students), *grants* (staff*), number of thesis students enrolled*, and *number of thesis students graduating*. These are aggregated annually, and averaged over a period that can be varied –for the basic model runs this is two years. There is freedom to vary the weights assigned to the different measures, both for external purposes of federal funding, and for internal allocation of resources to faculties. In the basic formulation the former have been chosen to be consistent with the December 1999 federal policy decision to weight grants: publications: thesis student enrolments = 6:3:1. Internally (reflecting institutional autonomy) the standard run weights for faculty distribution purposes are grants: publications: thesis graduations = 3:4:3. There is model provision to alter either or both sets of weights during a model run. Under standard conditions individual staff research activity is assumed to have the same average values across the institution, but provision is included for the balance of activities to vary between faculties, and some model runs explore the implications of such variations. The research productivity of individual staff is modified if *student staff ratio* changes are such as to increase or decrease a staff member's teaching responsibilities relative to the average values assumed as 'normal'.

As constituted for this application the model boundary contains all variables except for undergraduate applications, which flow in from outside the university system, and the impact of research activity taking place in other universities. The latter has the potential to change the amount received per research product by changing the number of products in the national pool, from which pro-rata grants are made from an essentially constant amount. More activity nationwide means less funding per product for institutions. Such an effect can be included, by using ramp functions to slowly alter the dollars received per product over time. Additionally the federal funding agency can act in relation to student load variations within institutions. Increased enrolment may be supported if accepted as a legitimate portent of increased demand, or punished by a reduction of funds if judged to be in reckless conflict with funding load agreements.

Internal allocation policies are the means by which *soft managerialism* is practised within institutions. In all universities student load is a major basis for allocation of funds, and large research institutions also use research performance to distribute a significant and variable proportion of funds to faculties. (The basic model formulation assigns 15% of faculty operating grant funds on the basis of research performance, with the balance on the basis of student load). The form of the allocation policies, model those in widespread use: that is funds are distributed on a pro-rata proportional basis by means of funding formulae. In these formulae student loads are adjusted by disciplinary weights, to reflect internal differences between faculty costs of providing instruction and associated overheads. These allocation policies generate 'tragedy of the commons' microstructures throughout institutions as increased effort results in less return per unit effort in an environment of fixed total funds. The staffing policies described above, operate through debt and surplus management strategies overseen by faculty administrators, commonly carrying titles of Executive Deans or pro Vice-Chancellors. The detail of these strategies involves activity at individual *school* level and such *within faculty* activity has been the subject

of another modelling exercise (Galbraith 1998). The present model addresses the problem of competition between faculties, for which the activities of individual schools are aggregated into faculty contributions.

Sample Loops

Three of the many feedback loops embedded in Figure 1 are summarized below to communicate a sense of the dynamic properties of the model.
Loop 1 (+ve): FACBUD → NTENS → TOTSTAFF → NTHSF → WSLF → WSLU → GOVT → FACBUD
Increase in a faculty's budget enables an increase in staff, and thence in thesis students. This leads to an increase in the weighted student load for the faculty, which feeds an increase in the corresponding variable for the university. An increased total student load receives federal funding support, which in turn increases the funds to the faculty. This is an example of a 'cooperative' loop where the separate efforts of faculties combine to attract (or tend to attract) additional funds to the university as a whole. In fact the external POLICY parameter may render the link WSLU → GOVT either positive or negative, or assign it a neutral role. In general however institutions fear loss of funds through under enrolment, which if confirmed will lead to funding being reduced. This 'reverse' way of viewing the causal effect indicates this link is appropriately viewed as positive for purposes of loop discussions at a general level.
Loop 2 (+ve): FACBUD → NTENS → TOTSTAFF → RESPRF → FACBUD
This *research* loop describes how an increase in a faculty budget sustains an increase in academic staff, whose additional research activity further increases the faculty budget through the system of pro rata funding on the basis of output.
Loop 3 (-ve): FACBUD → NTENS → TOTSTAFF → RESPRF → RESPRU →FACBUD
The structure has an additional variable (RESPRU) compared with the previous loop. The final link is negative as an increase in faculty research output also increases the total output for the university. This means that funds per product are reduced leading to a reduction in contribution to the faculty budget.
These latter two loops illustrate one of the 'tragedy of the commons' structures that permeate the model-similar effects also occur in the student load sectors.

Delays

Both pipeline delays and smoothing delays play prominent roles. The former occurs in consequence of quantities such as degree courses with fixed durations, and time taken for thesis students to work through doctoral programs. Smoothing delays occur when student load or research output is averaged to provide input to funding formulae, and when time-scales are set for the elimination of debts or surpluses. Loop delays vary widely. Loops linking faculty budgets with direct staffing costs contain no effective delays. However loops that encompass the effects of increased undergraduate enrolments, working through to increased PHD graduations with smoothing applied for funding purposes contain total delays of the order of a decade.

Parameters

Two types of parameter are involved: those associated with system conditions and those defining policies. System conditions may be divided further into those that are outside the control of the institution, such as federal funds received per research product; and those that are characteristic of the operating environment, such as average number of thesis students per staff member, and the average length of time spent in the institution by those holding tenured appointments. This latter parameter also contributes to loop delays.
Policy parameters describe management decisions taken within the institution, such as averaging times used to smooth inputs to funding formulae, weights assigned to research products for internal funding purposes, and times over which debts and surpluses are targeted for elimination.

MODEL OUTPUT

Following common practice initial values have been chosen so that the (Powersim) model runs in equilibrium, from which it is disturbed by a series of 'shocks'-for example step increases to intake variables. This ensures that the behaviour patterns generated are consequences of the model structure, and not due to idiosyncrasies of input signals. Parameter values are chosen to be representative of the system, for example averaging times, salary levels, degree completion rates-it is important that this policy analysis model is not confused with one that sets out to model the operation of a particular institution. A run time of 25 years has been chosen. This is not to suggest that such a system would run unchecked for this period, but the substantial delays inherent in the system, mean that response modes may have extended time-scales. The run time needs to be long enough to capture the significance of these. Figures 2 to 5 contain output from base runs as described below.

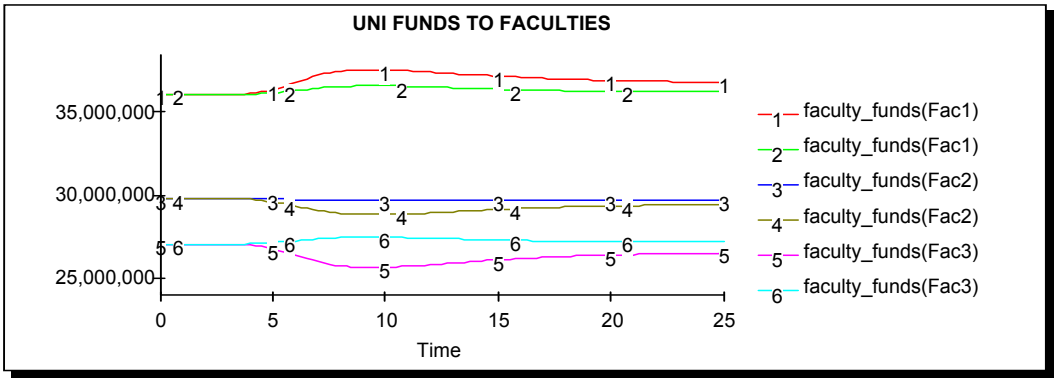

Figure 2: University funds distributed to faculties by formula

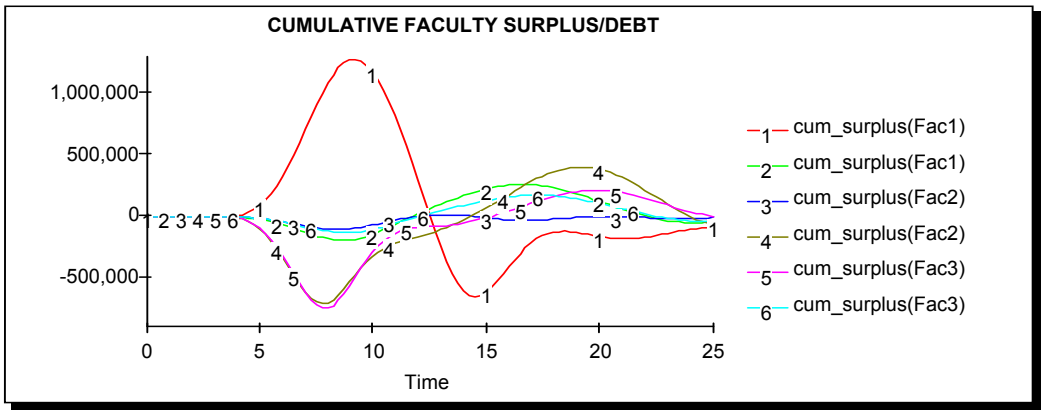

Figure 3: Cumulative debt and surplus by faculty

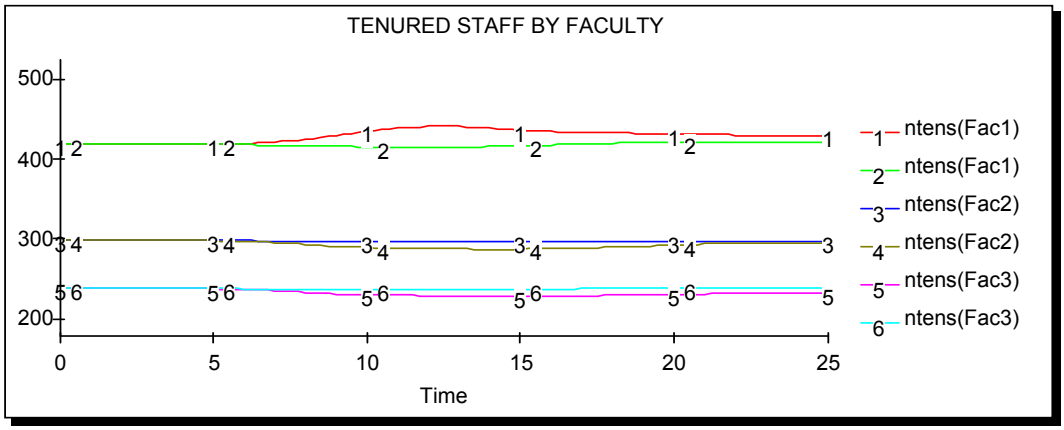

Figure 4: Tenured staff by faculty

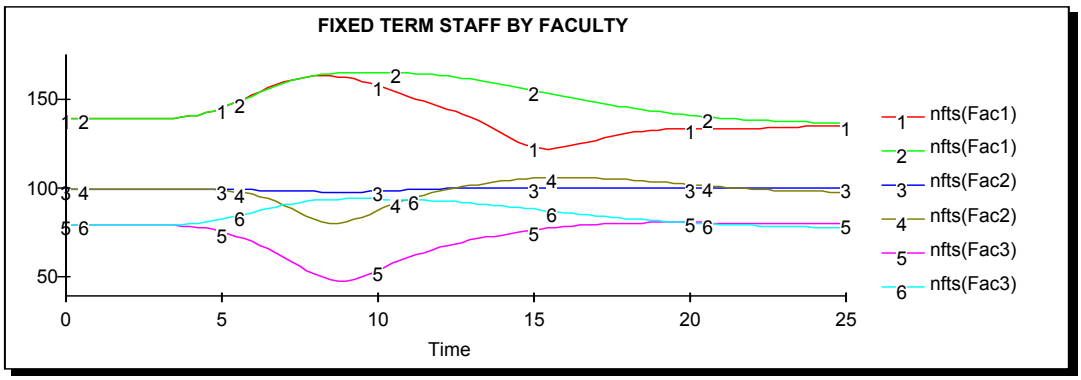

Figure 5: Short term contract staff by faculty

It is assumed that government funding for student load remains fixed. Figures 2 to 5 contain output from two basic model runs. In run A (graphs 1,3,5), faculty1 experiences a step increase in enrolment in years 3 through 5, while faculty3 experiences a similar proportional decrease. In run B (graphs 2,4,6), both faculties experience increases. For both runs faculty2 experiences business as usual, and continues to enrol at its equilibrium rate. In constructing the model the faculties have been varied in size from faculty1 (largest) to faculty3 (smallest). The funding indices have been varied in reverse order, indicating that faculty1 teaching costs and overheads are least; non-academic staffing cost ratios are assigned to be consistent with this.

In run A, faculty1 receives additional funds at the expense of faculty3, and because of compensating effects the impact on faculty2 is relatively small. Major interest lies in time-scales of change for it is clear that these extend far beyond the duration of the enrolment shock. The influence of delays and feedback in combination with debt and surplus elimination times produces the cyclic modes shown in Figure 3. Short-term adjustments of contract staff numbers in response to the budget fluctuations are shown in figure 5. Figures 2 and 4 show that the impact on resources triggered by the enrolment shocks are robust, persisting well after the intake levels return to their original values. Research output (not shown) roughly follows the pattern of tenured staff and helps to maintain the initial advantage enjoyed by faculty1. Likewise the disadvantage to faculty3 persists. Run B demonstrates the severe consequences for a faculty that is maintaining enrolments when surrounded by growing competitors. Figure 3 shows that the creation of debt (graph 4), reaches early levels as severe as those experienced by faculty 3 following a loss of enrolments in run A. This illustrates the threats that exist to slowest growing units in a growth environment, when overall funds are effectively fixed, and resources are allocated on a proportional basis. Various parameter changes (including smoothing times for student load, and debt elimination target times) alter the detail but not the form of the response. Shortening adjustment times reduces the amplitudes and periods of debt and surplus cycles, but amplitudes of staff variations are increased. The desirability of containing movements of staff is a matter for consideration both for stability of research output, and on grounds of morale.

Figure 6 contains output for a run where the proportion of funds allocated on the basis of research performance is increased from 15% to 30% after 3 years. Only one set of graphs is provided on account of space.

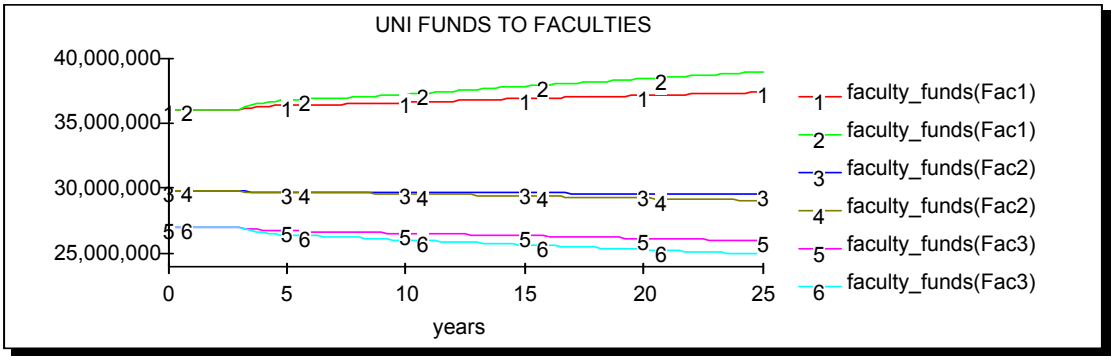

Figure 6. University funds distributed to faculties by formula

Graphs 2,4,6 illustrate how faculty1 is advantaged and faculty3 most disadvantaged. Because of its size and low student load weighting, faculty 1 gains from additional research based income, and the reverse applies in faculty3. We see the long-term impacts of management decisions that change weighting parameters. Overall behaviour modes remain similar, but winners and losers change. Graphs 1,3,5 emerge when a small amount (10%) of the research budget is reserved and distributed on the basis of productivity per staff member rather than per faculty. A more even distribution of resources is noted. Effectively a small part of the research 'commons' has been protected from pure numbers based distribution, and allocated in terms of the quality of the individual performers in the faculties.

The major issue raised by the modelling concerns the long-term impact of short-term decisions. Moves to re-organise and close units on the basis of early data following changes in operating environments, requires insights that non-systemic decision making cannot provide-with likely costs that an institution will never know.

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