# Higher Education Management and Operational Research

## Demonstrating New Practices and Metaphors

Gary Bell, Jon Warwick and
Peter Galbraith (Eds.)

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# Higher Education Management and Operational Research

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**Michael A. Peters,**
Professor Emeritus, *University of Illinois at Urbana-Champaign, USA*
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# Higher Education Management and Operational Research

*Demonstrating New Practices and Metaphors*

*Edited by*

**Gary Bell and Jon Warwick**
*London South Bank University, United Kingdom*

**Peter Galbraith**
*University of Queensland, Australia*

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PART 1


**INTRODUCTION**

GARY BELL, JON WARWICK AND PETER GALBRAITH

# 1. THE NEED FOR NEW HIGHER EDUCATION MANAGEMENT PRACTICES AND METAPHORS

INTRODUCTION

UK Higher Education (HE) is currently operating within an environment of continuous change and uncertainty. Vice-Chancellors, Executive Managers, Deans, Departmental Heads and Administrative Managers are encountering an acceleration of varied and difficult managerial problems. Morgan (2006) asserts that successful managers are "open and flexible", suspending decisions whenever possible, until a better understanding of the problem is attained. He believes that modelling insights may lead to a range of informed decision scenarios that may solve the identified problem. Furthermore, Morgan goes on to suggest that less effective managers are seen to explain and interpret from a "fixed angle", and to continually hammer at persistent problems using the same old methods – which can facilitate disillusionment and conflict amongst academic, administrative and technical staff.

The aim of this book is to assist HE managers in becoming more open and flexible. To help them explore "new angles" for addressing some of the many difficult problems of HE management through the use of approaches[1] associated with the Operational Research (OR) and Systems disciplines. Furthermore, the book explores the connectivity between a selection of OR techniques and metaphorical thinking in order to strengthen the notion of "fitness for survival" (Boulding, 1981) of the HE organisation. Six objectives have been identified to help with attaining our overall aim and these are addressed both in this first chapter, and also in the various chapters that follow. The six objectives are:

- to provide an appreciation of complexity and uncertainty within a quickly evolving environment;
- to consider some important developments within the growth of the OR and Systems disciplines;
- to outline key aspects of metaphorical thinking for organisations together with the key metaphors in use;
- to consider the connectivity between OR approaches, metaphors and HE management;
- to describe the use of a selection of OR approaches to identified HE problems – which may suggest new management practices;
- to consider the idea of a toolbox of OR approaches and metaphors for HE managers.

A paper by the Higher Education Funding Council for England (HEFCE) asserts "Higher Education changes lives. It is enriching and inspiring for students and it is vital to social mobility, future economic growth and our international standing" (HEFCE, 2011). This succinctly captures the need (or "the why") for Higher Education. In the past, UK HE organisations were considered to have a relatively stable and certain future (Morgan, 2006). However, HE has to evolve to meet the now rapidly changing demands of society and government. Over the last two decades employment patterns have changed significantly, and there is a need for a more highly trained and educated workforce. This workforce must continuously update its skills to meet the changing requirements of the labour market. Recognition of employment changes that affected HE initiated, in the United Kingdom, the Dearing Report (Dearing 1997) which was highly influential in shaping UK HE in the early part of this century. Subsequently, the debt crisis in various European countries has begun to impact on HE. In the UK, a new strategy is being implemented (BIS, 2010) to fund HE institutions more directly through student tuition fees and this has essentially "privatised" certain subject areas as government funding for some disciplines such as the humanities is removed. This will have a significant impact upon departmental, faculty and institution budgets, as income becomes directly related to student numbers.

In the last decade or so the Government has demanded greater university accountability for the public funds they spend, which has in turn placed an emphasis on management practices and the measurement of education quality. Trow (1994) coined the terms "hard" and "soft" managerialism which characterise the different government and university management approaches respectively. The ideas associated with managerialism are described in chapters 2 and 3 of this book which set the scene by reviewing ideas of quality and organisational culture within HE institutions and bring to the surface some of the distinctive features of HE management which limit the effectiveness of "hard" managerialist approaches. A further component of scene-setting is consideration of how the role and purpose of learning may be redefined as we move into the 21st Century (chapter 4) before we consider (in chapter 5) aspects of institutional funding in the UK. Subsequent chapters offer a variety of examples in the use of models, systems thinking and OR methods within the HE environment. They are themed broadly into two sections: the first (chapters 6 to 10) explores the management of student learning and support and these chapters emphasise the changing nature of learning and teaching and how institutions should work to engage "new learners"; the second (chapters 11 to 16) reflect on how we should perhaps manage aspects of the business of HE in a turbulent environment.

In this first introductory chapter, we briefly discuss what we consider to be two key characteristics of the HE management domain, namely complexity (Checkland, 1993; Rosenhead & Mingers, 2001), and uncertainty (Lehman, 1991; Rosenhead & Mingers, 2001) both of which are related to rapid environmental change. Developing an understanding of these key characteristics helps to guide

the selection of appropriate methodologies and models which in turn impact upon our problem solving and decision-making capabilities.

We then touch on the development of Operational Research (OR) as an established discipline that encompasses a broad range of approaches that assist in controlling and improving the management of organisations, and this theme is further expanded in chapter 16 which illustrates the changing nature of OR with a contribution within a particular domain of HE management. Further chapters in the book illustrate the application of some of these OR techniques.

Finally, we turn our attention to metaphors. Morgan (2006) asserts that theories of explanation of organisational life based on metaphors allow the understanding of the organisation in a partial but nevertheless distinctive way. Fundamentally, Morgan offers metaphorical thinking as an approach to dealing with the complexities, ambiguities and paradoxes of an organisation. Metaphorical thinking can enhance a manager's ability to deal with the different aspects of organisational life, and we briefly outline a number of metaphors and their respective strengths and weaknesses.

Throughout this first chapter we have tried to convey a sense of the current state-of-play of operational research and systems thinking as they relate to HE management. We have also tried to identify the key historical contributions of those practitioners and researchers who we consider to have been instrumental in shaping current thinking.

Taken as a whole, this book demonstrates the use of various OR approaches that are applied to identified HE problems within the context of an educational organisation. We believe that the approaches used and the findings described will help to generate "new angles" leading to informed HE management solutions or decisions. We further believe that the offered novel OR insights positively contribute to fitness for survival, and enrich organisational life leading to the consideration of the use of new OR practices to assist the management of HE organisations.

COMPLEXITY AND UNCERTAINTY

HE management must address both the problem-setting process (Schon, 1983) and the problem-solving process (Keys, 1991). Whilst we believe the former process requires greater attention, both need consideration for effective management. Schon (1983, p. 40) outlines the problem setting process:

> When we set the problem, we select what we will treat as the 'things' of the situation, we set the boundaries of our attention to it, and we impose upon it a coherence which allows us to say what is wrong and in what directions the situation needs to be changed. Problem setting is a process in which, interactively, we name the things to which we will attend and frame the context on which we will attend to them.

The problem setting process should consider issues of complexity and of uncertainty. Academics, researchers and practitioners associated with various management related disciplines such as Operational Research (Ackoff, 1979a; Checkland, 1993; Rosenhead & Mingers, 2001), Organisational Behaviour (Morgan 2006), or Project Management (Winters & Szczepanek, 2009; Winters et al., 2006) are exploring these important concepts, and three reasons are identified as to why there is a need to provide an overview of complexity and uncertainty. First, to facilitate awareness of these important notions. Second, to assist with the problem boundary setting. Third, to guide selection of appropriate OR approaches leading to informative management decision-making.

The notion of complexity is one which has generated new paradigms for decision making within the OR domain. Rosenhead and Mingers (2001) briefly address complexity suggesting that organisations and individuals operate in "densely interconnected networks" in which the ramifications of decisions should not be ignored. Moreover, they argue that there is a dichotomy of problem situations that need to be considered in the selection of decision modelling approaches. Schon (1987, p. 3) discusses the dilemma of problem solving through the swampy versus high ground metaphor:

> In the swampy lowland, messy, confusing problems defy technical solution. The irony of this situation is that the problems of the high ground tend to be relatively unimportant to individuals or society at large, however, great their technical interest may be, while in the swamp lie the problems of great human concerns. The practitioner must choose. Shall he remain on the high ground where he can solve relatively unimportant problems according to prevailing standards of rigour, or shall he descend to the swamp of important problems and non-rigorous inquiry?

Checkland considers decision making from a systems perspective and highlights the distinction between "Soft" and "Hard" systems thinking (Checkland, 1993; Checkland & Poulter 2006). Hard systems thinking is associated with methodologies and techniques that are connected with RAND[2] systems analysis and systems engineering. It assumes the world consists of systems that can be objectively modelled, there are agreed goals, and the aim is to determine the most effective and efficient way to attain the goals. Soft systems thinking, on the other hand, accepts the rich complexity of the world and systems concepts are applied to assist with structuring thinking and learning about a problematic situation. Describing problem situations highlights the tension between the objectivist stance, which considers problems as independent of an individual stakeholder's perspective, and the subjectivist stance which acknowledges the impact of a stakeholder's perspective in defining or constituting the problems.

Related to complexity is uncertainty (especially with respect to social phenomena) and Rosenhead and Mingers (2001) offer three reasons why uncertainty needs to be considered. Firstly, not knowing the impact of other decision-makers, whose choices may affect our decision choices, may seriously

undermine the efficacy of decisions made. Secondly, the dynamics of the network within an organisation may not be fully understood and can be turbulent, hence forecasting the consequences of actions becomes problematic. Thirdly, organisations are continually evolving in their mission and this can be very unsettling for staff. Hence, problem setting can be extremely fluid. Schon (1983, p. 40) states:

> In the real-world practice problems do not present themselves to the practitioners as givens. They must be constructed from the materials of problematic situations which are puzzling, troubling, and uncertain. In order to convert a problematic situation to a problem, a practitioner must do a certain kind of work. He (or she) must make sense of an uncertain situation that initially makes no sense.

Complexity and uncertainty are two important concepts which require consideration during the problem setting process (see figure 1).

**High Complexity**

Problem
    Interconnected
    Static

Situation
    Problematic

Example
    Establishing faculty research
    strategy

Problem
    Interconnected
    Dynamic

Situation
    Problematic

Example
    Managing the student
    experience

**Low Uncertainty** — **High Uncertainty**

Problem
    Isolated
    Static

Situation
    Unproblematic

Example
    Allocating teaching resources
    to modules

Problem
    Isolated
    Dynamic

Situation
    Unproblematic

Example
    Attracting student numbers to specific
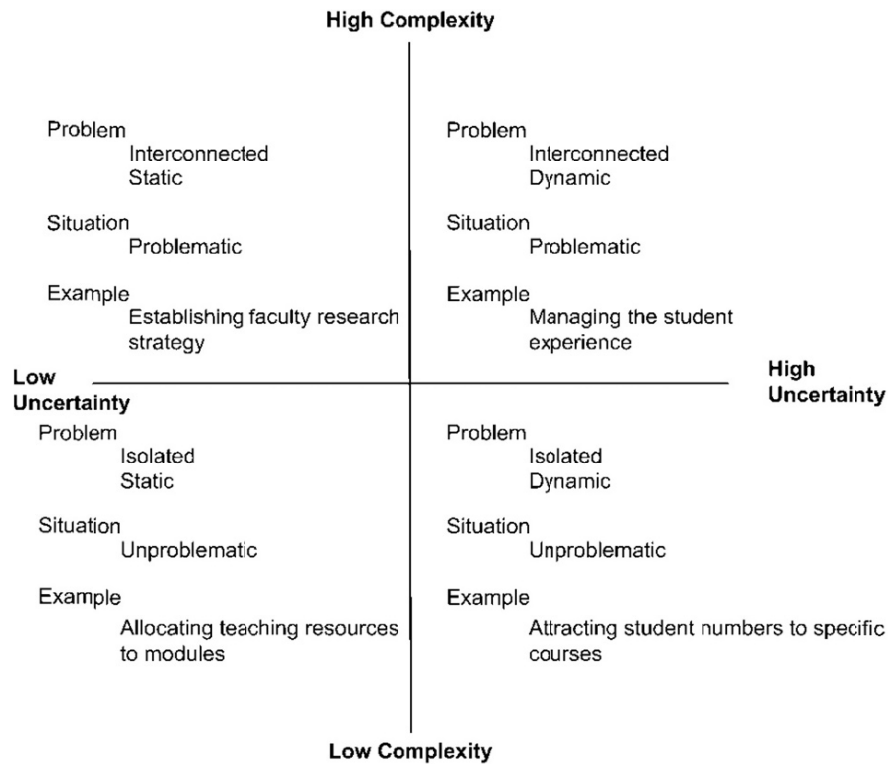    courses

**Low Complexity**

*Figure 1. Identifying four distinctive problem situations using the complexity and uncertainty concepts.*

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Each concept can be delineated to generate high and low complexity and uncertainty. High and low complexity can be linked respectively to subjective and objective ontology. Additionally, the concepts have connectivity with the dichotomy of problems (Rosenhead & Mingers, 2001), with high and low uncertainty associated with dynamic and static situations respectively. The two concepts can generate four problem situations which have distinctive characteristics and these can assist in the problem setting process, and feed forward to assist in the selection of methodologies and techniques used in the problem solving process.

## OPERATIONAL RESEARCH AND SYSTEMS

Turning now to the problem solving process puts us within the domain of OR and its related techniques. The term Operational Research was first coined in the 1930s, and associated techniques were developed, refined and applied for the purposes of military planning during the Second World War. Many of these techniques were subsequently used in UK organisations after the war when effective planning using scarce resources was still a key objective. The OR discipline aims to apply "advanced analytical methods to help make better decisions" (OR Society, 2012) which facilitates practical action. Traditional OR is considered analytic and reductionist in its approach, and is linked to positivism and the scientific method that underpins the Natural Sciences. We view traditional OR as strongly rooted in scientific management, which is underlined by the work of Frederick Taylor (1911). Significant interest in OR led Churchman, Ackoff and Ansoff (1957) to produce one of the first important OR books highlighting several industrial operational processes in which common problems were identified, which engendered the use of various techniques and the inception of new theoretical ideas. The identified common problem areas included: inventory processes, allocation processes, waiting-line processes, replacement processes and competitive processes. Techniques such as the simplex method and linear programming were applied, and theoretical developments such as game theory and queuing theory were established. This traditional OR process can be viewed as sequential and is illustrated in table 1.

The OR discipline is continuously evolving over time and this has been reflected in the development of decision making approaches that focus both on problem-solving and problem structuring to assist with management decision-making. OR currently has two distinctive intellectual "camps", namely Hard OR and Soft OR (Jackson, 1991). The former is linked with the traditional reductionist view of OR and the latter (which includes Soft Systems Thinking) with more recent developments in problem structuring and exploration methods reflecting the need to address uncertainty and complexity in organisations. We believe a third area is now emerging which has been labelled Methodological Pluralism[3] which we will return to later.

*Table 1. The six phases of the traditional OR problem-solving process (Keys, 1991)*

| Phase | Description of the Phase |
|---|---|
| 1 | **Formulating the problem:** Identifying the decision-makers, their objective, the process involved, the alternative courses of action to be investigated, and the criteria for measuring the effect of these upon the process. |
| 2 | **Constructing a Mathematical Model:** The model expresses the measure of effectiveness as a function of the variables in the process and contains any relationship that operates between variables. |
| 3 | **Deriving a Solution From the Model:** The model is used to find the value of the measure of effectiveness given when each of the alternative actions occurs. It is assumed that each action corresponds to changes being made in the controllable variables. We must identify the action that produces the best measure of effectiveness. |
| 4 | **Testing the Model and Solution:** Actions that provide the better measures of effectiveness need to be tested for the occurrence in practice of their predicted effects. If experiments show errors between predicted and actual performance, the model may be reconsidered and new analysis undertaken. |
| 5 | **Establishing Controls over the Solution:** Establish a set of rules by which the action can be changed in response to changes in uncontrollable variables. |
| 6 | **Putting the Solution to Work:** The handing over of advice should be supported by the details of any necessary changes in existing practice by the provision of training. |

In the evolution of systems thinking, concerns about dealing with issues of complexity (Checkland, 1993) have generated interest in the Systems Movement and a systems approach to problem solving which is further strengthened by consideration of Ackoff's commentary on the deficiencies of the traditional OR process (see table 2).

Systems thinking focuses upon "wholes" rather than "parts" (Ackoff, 1979a). It employs the expansionism rather than reductionism principle to understand the complex problem situation. In Ackoff's view systems approaches produce knowledge through emphasising the wider environment in which the problem situation operates rather than analysing each internal component in isolation. Checkland (1993, p. 318) defines systems thinking as:

> An epistemology which, when applied to human activity is based upon the four basic ideas: emergence, hierarchy, communication and control as characteristics of systems. When applied to natural or designed systems the crucial characteristic is the emergent properties of the whole.

The expansionist nature of systems thinking allows it to adopt a central role in the learning organisation (Senge, 1990). What Senge terms "the primacy of the whole" (Senge et al., 1994) emphasises the importance of systems thinking in providing a breadth of organisational view that allows system behaviour to be modelled endogenously. By this we mean that the problem boundaries are drawn in such a way as to allow the system to be considered as "causally closed" in terms of the

cause and effect relationships and feedback loops we describe to explain observed system behaviour (the study of such feedback processes is at the heart of system dynamics modelling – see for example Morecroft, 2007). Thus Ackoff's notion of wholeness and the modelling of system structure through the application of system dynamics allows for the exploration of system behaviour (often revealed as counterintuitive) as a manifestation of that system structure – what Checkland termed the "emergent properties of the whole".

Thus systems methods employ the notion of synthesis and expansionism in their approaches. Richardson (2011, p. 241) considered system thinking as "... the mental effort to uncover endogenous sources of system behaviour" and we too view systems thinking as interested in the explanation of the behaviour observed in complex organisational structures. Keys (1991) suggests that OR is traditionally focused upon the "world of action", whilst systems thinking is focused with the "world of ideas". He argues there is a critical distinction in purpose grounded in the theory/practice dichotomy existing between the two disciplines. However, this dichotomy can be bridged by the disciplines to ensure mutual benefit.

*Table 2. Summary of traditional OR deficiencies (Ackoff, 1979a)*

| Deficiency | Summary |
| --- | --- |
| The need for learning and adaptation | There is a greater need for decision-making systems that can learn and adapt, than there is for optimisation systems that cannot. |
| The omission of aesthetics | Decision-making should account for aesthetic values – stylistic preferences and progress towards ideals – for they are relevant to quality of life. |
| Beyond problem solving | Problems are abstracted from systems of problems, messes; Messes require holistic treatment. They cannot be examined effectively through decomposing them analytically into individual problems to which optimal solutions are sought. |
| The paradigmatic dilemma of OR | OR's analytical problem-solving paradigm 'forecast and prepare' involves a dilemma and should be replaced by a synthesising planning paradigm, *i.e.* '*design a desirable future and invent ways of bringing it about.*' |
| The disciplinarity of OR | Effective treatment of messes requires interaction of a wide variety of disciplines. |
| Objectivity in OR | All those who can be affected by the output of decision-making should either be involved in it so they can bring their interests to bear on it, or their interests should be represented by researchers who serve as their advocates. |

## METHODOLOGICAL PLURALISM

The diversity of methodology within the OR and Systems Movement has led to the problem of knowing which approach to apply and when. There have been, for a number of years now, examples of case studies appearing in the literature which combine approaches from the Hard and Soft camps. For example, at the

International Systems Dynamics Conference in 1994 there was a significant number of papers outlining the connectivity between System Dynamics (associated with Hard OR) and Soft Systems Methodology (associated with Soft OR) implying that practice was taking the lead over theory. Mingers and Gill (1997) conceived the idea of multimethodology (rooted in the social science notion of methodological pluralism) which, in essence, is mixing methodologies from the same or different paradigms in the course of a problem-solving intervention.

Mingers and Gill offer three arguments to justify pluralism. Firstly, real-world problem situations are highly complex and multi-dimensional. Different paradigms can be likened to viewing the world through different lenses. Each lens reveals an aspect of the real-world but is blind to others. Thus in applying just one paradigm it is inevitable that a limited understanding of social situations is gained. Therefore, a methodologically pluralist approach is required to deal with the full richness of the real-world.

Secondly, an intervention is not usually a single discrete event but a process which has several phases. As the intervention unfolds it is likely that questions will be raised that require a change of emphasis from analysis to synthesis, from observation to interpretation. Thus, a combination of approaches may be required in order to provide a comprehensive outcome and produce better results.

Thirdly, consideration of philosophical and theoretical aspects of pluralist approaches is timely since practitioners are already combining methodologies for organisational interventions.

In summary, we believe problem situations within organisations are associated with different levels of complexity and uncertainty and methodological pluralism to be a broad and powerful way to facilitate organisational problem-solving. The ability to move back and forth from analysis to synthesis, from observation to interpretation seems a natural process of enquiry and this has lead to our interest in Morgan's (2006) Images of the Organisation, which utilises metaphors as a means for understanding organisations. We believe that linking OR methods and techniques to the metaphors established by Morgan provides an accessible structure or framework through which methodological pluralism can be realised by those involved in HE management and decision making.

Morgan's work has already influenced various OR academics (see, for example, the work of Jackson, 2003) and following this thread we now examine the metaphors identified by Morgan and their connectivity with OR methods and techniques, and methodological pluralism.

METAPHORICAL THINKING AND ORGANISATIONAL METAPHORS

The role of metaphor has contributed to the development of both natural and social sciences (Brown, 1977, Schon, 1963). Lakoff and Johnson (2003, p. 158) state:

> In all aspects of life ... we define our reality in terms of metaphors and then proceed to act on the basis of the metaphors. We draw inferences, set goals, make commitments, and execute plans, all on the basis of how we in part

structure our experience, consciously and unconsciously, by means of metaphor.

The metaphor suggests "a way of thinking" and "a way of seeing" which assists in understanding our world. It is acknowledged that metaphor is inherently paradoxical. Morgan (2006, p. 5) believes it can provide "powerful insights that also become distortions, as the way of seeing created through a metaphor becomes a way of not seeing". However, metaphorical thinking offers a useful approach to inquiry and produces new ways of viewing the world. Morgan has identified several metaphors for organisational study which may lead to fresh ways of understanding and shaping organisational life. Thus, we believe the metaphor concept can be applied at university, faculty, departmental and other hierarchical levels. Eight metaphors are now briefly described together with some of their strengths and limitations. We also show links to chapters in this book that demonstrate a view of HE management through each metaphorical lens – sometimes as a strength but also sometimes as a weakness.

### 1. Machine Metaphor

The machine metaphor (often considered as the orthodoxy) is connected with the bureaucratic organisation, classical management theory and scientific management and table 3 highlights some of the strengths and limitations of the machine metaphor.

*Table 3. Description of the machine metaphor (Morgan, 2006)*

| Metaphor Attributes | Description |
|---|---|
| Strengths | Works well under the following conditions:<br>– When the task is clear and the environment is stable;<br>– A need to produce exactly the same product time and again;<br>– Precision is a premium;<br>– People are compliant and behave as their roles intend. |
| Weaknesses | This organisational form has difficulty in adapting to a changing environment;<br>Mindless and unquestioning bureaucracy;<br>There may be unanticipated and undesirable consequences as the interest of those working in the organisation take precedence over the organization;<br>There may be dehumanising effects upon employees. |
| Examples of associated OR method or technique | Mathematical programming, Linear Programming, Systems Analysis, Cost/benefit analysis and cash/flow spreadsheets. |
| Book chapter | 2, 5, 15, 16 |

Scientists have developed mechanical interpretations of the natural world, philosophers and psychologists have constructed mechanical (cause/effect) theories

of the mind and behaviour, and mechanical principles are evident in many organisations. Within this metaphor, organisations are expected to operate with mechanical precision, and organisational life is routine. Staff are expected to work at a given time and perform specific activities. The organisation is designed like a machine and people are elements (linked by roles and responsibilities) of a machine. According to Morgan (2006), organisations designed as a machine are sometimes labelled bureaucracies. Scientific management (Taylor, 1911) is embodied by the principle of delineating the planning and design from its execution, i.e. splitting the brain from the hand.

## *2. Organism Metaphor*

Organisations can be considered as a "living system" which exists in a wider environment and aims to satisfy both organisational and staff needs. Furthermore, different species of organisation can exist in very difficult environments. Some organisations work effectively in stable and protected environments, e.g. the civil service, whilst others thrive in more competitive and rapidly evolving environments, e.g. high technology and communications organisations. Many organisational theorists have shifted away from machine science to Biology as a source of new ideas, and this has contributed to the inception of systems science. Organisational theorists have developed a form of biological thought in which distinctions and relations between molecules, cells, complex organisations, species and ecology are congruent with individuals, groups, organisations, populations (species) of organisation, and their social ecology.

This metaphor emphasises the notion that individuals and groups operate more effectively when their needs are satisfied (Argyris, 1964). Therefore, coaching (or nurturing) of staff is an important concept. Hence, staff are motivated and the organisation encourages them to exercise their capabilities of creativity and innovation.

Differing schools of thought have emerged that relate to this metaphor. As we have previously described, the work of Ackoff (1999) and Senge (1990) views the organisation as seeking to satisfy and balance internal needs, and adapt to environmental circumstances.

On the other hand, the population-ecology perspective of the organisation (Freeman & Hannan, 1983) is underpinned by Darwin's theory of evolution. Organisations (like organisms) survive by finding adequate supplies of resources (inputs). However, organisations face competition from other organisations which eventually lead to a scarcity of resources – therefore only "the fittest survive".

A further view is that of organisational ecologists (Emery & Trist, 1973) who assert that organisations are not isolated entities – but exist as elements in a complex ecosystem. Some biologists conjecture that the whole ecosystem that evolves and the process of evolution can only be explained at the total ecology level (Bateson, 1972). This implies that organisms do not evolve through adaptation to environmental change, or by natural selection of the organisms that

are to survive. Instead, it suggests that evolution is a pattern of relationships with other organisms and their environments. It is the pattern, not just the separate entities comprising this pattern, that evolves (Morgan, 2006). Boulding (1981) contends evolution involves the "survival of the fitting" not just the "survival of the fittest" so that when explaining the ecology of organisations it is necessary to understand that organisations are involved in a pattern of coexistence. Some of strengths and limitations of the organism metaphor are identified in table 4.

*Table 4. Description of the organism metaphor (Morgan, 2006)*

| Metaphor Attributes | Description |
|---|---|
| Strengths | The understanding of relationships between organisations and their environments. Organisations are open systems and are best understood as ongoing processes rather than as collections of parts; |
| | Using the image of an organism in constant exchange with its environment so organisations need to be open and flexible. |
| Weaknesses | The metaphor facilitates the view that organisations and their environments are too concrete. Organisms live in a natural world with specific properties that determine the life and welfare of its inhabitants. We can see this natural world. Organizations, on the other hand, can be viewed as socially constructed phenomena, and the topology of that landscape is more difficult to observe and navigate. |
| Examples of associated OR method or technique | Systems Engineering, Quantitative System Dynamics, Systems Thinking, Cybernetics. |
| Book chapter | 3, 4, 6, 7, 9, 10, 12, 14 |

## 3. Brain Metaphor

The brain metaphor aims to enhance an organisation's ability to promote flexibility and creativity. Therefore, the organisation must improve its capacities for intelligence gathering and action. The brain metaphor is strongly linked with the process of strategic management and control. The metaphor for organisational understanding is explored in two ways, namely: information processing systems that are capable of "learning to learn", and which reflect holographic principles.

Strategic managers make decisions based upon formalised and/or ad hoc processes, generating policies and plans and providing a point of reference for the information processing and decision making of others. Thus, organisations are information systems, communication systems and decision-making systems. The principle is to assist management in rational decision-making. The decision-making approach to understanding organisations was originally conceptualised by March and Simon (1958).

They argue that organisational decisions are not completely rational because of the limited information processing ability of their staff, and conclude that

individuals and organisations settle for good enough decisions based upon simple rules and limited information (so-called heuristic decisions). Hence, the theory of decision-making is fragmented, routinised and bounded in order to make the process more manageable. Since, the inception of the decision-making approach considerable research into understanding organisations from the information-process standpoint has been undertaken. Much work has focused upon dealing with complexity and uncertainty.

This metaphor also links to holography which emphasises the diffusion of information across the organisation and building patterns of rich connectivity between similar parts. This can produce systems that are both specialised and generalised, and are capable of reorganising internal structures and functions as they learn to meet environmental challenges. Table 5 highlights some of strengths and limitations of the brain metaphor.

*Table 5. Description of the brain metaphor (Morgan, 2006)*

| Metaphor Attributes | Description |
|---|---|
| Strengths | The metaphor contributes to the understanding of organisational learning and the organisation's capacity for self-organisation, so meeting the challenges and demands of environmental changes; |
| | The metaphor provides concrete guidelines as to how this can be achieved. |
| Weaknesses | This metaphor ignores the tensions between the requirements of learning and self-organisation on the one hand, and the realities of power and control on the other; |
| | A move from bureaucracy toward self-organisation has implications for the distribution of power and control within an organisation, since increasing the autonomy of self-organising units undermines the control of those in power. |
| Examples of associated OR method or technique | Quantitative System Dynamics, Heuristics, Cybernetics. |
| Book chapter | 3, 4, 7, 8, 9, 12, 13, 15 |

### 4. Culture Metaphor

There is significant interest in understanding the relationship between culture and organisational life. Culture usually refers "to patterns of development reflected in a society's system of knowledge, ideology, values, laws and day-to-day rituals" (Morgan, 2006, p. 146). The cultural metaphor has considerable relevance for our understanding of the organisation – particularly with the increased globalisation and internationalisation of business.

People in a culture have different personalities but have much in common, and so with groups and organisations. This phenomenon is known as "corporate culture". Organisations are micro-societies that have their own patterns of culture and sub-cultures. One organisation may be a team that collectively work together.

Another might be fragmented, divided into groups that view the world differently. Patterns of belief (or shared meaning) fragmented or integrated, supported by various operating norms can influence the overall ability of the organisation to deal with environmental changes. Moreover, aspects of culture usually have historical explanations for the way things are done. Organisations can have different cultures which are underpinned by distinctive leadership styles.

There are links between leadership styles and corporate culture which provide insights into why organisations work in a particular manner. However leaders do not monopolise the emergence of an organisation's culture. Organisational cultures emerge through the course of social interactions and there are usually different and competing values that can generate a mosaic of organisational realities and cultures. Table 6 highlight the strengths and limitations of the cultural metaphor.

*Table 6. Description of the culture metaphor (Morgan, 2006)*

| *Metaphor Attributes* | *Description* |
|---|---|
| Strengths | Organisations are shared systems of meaning, and thus shared interpretive schemes that create and recreate that meaning; The metaphor provides a new focus and avenue for the creation of organised action; |
| | The culture metaphor elevates the importance of attending to changes in corporate culture that can facilitate the required forms of organisational activity. Since organisations ultimately reside in the minds of the people involved, effective organisational change implies cultural change. |
| Weaknesses | When observing culture, researchers are observing an evolving form of social practice that has been influence by many complex interactions between people, events, situations, actions, and general circumstances. Culture is continuously evolving; |
| | Culture is often viewed as a set of distinct variables, such as belief, stories, norms and rituals that somehow form a cultural whole. Such a view is mechanical, giving rise to the idea that culture can be manipulated in an instrumental way. |
| Examples of associated OR method or technique | Soft Systems Thinking/Methodology. |
| Book chapter | 3, 4, 7, 13, 14 |

## 5. Political Metaphor

Organisations can be viewed as systems of government which vary depending upon political principles. The political metaphor can highlight the politics of organisational life. The idea of politics is rooted in the view that divergent interests naturally occur and society should enable individuals to reconcile their differences

through negotiation. Politics can be the interplay of competing interests that creates a non-coercive form of social order.

Political science has observed several variants of political rule in organisations. Technocratic organisations (flexible and ever-changing) thrive in turbulent environments and power and accountability are linked to individual technical knowledge and expertise. By contrast in autocracies and bureaucracies the pattern of power and authority is clearly defined due to the stability of the environment. Technocracies tend to be in continuous flux as different individuals and groups rise and decline in power reflecting the value of their technical contributions.

The strengths and weaknesses of the political metaphor are identified in table 7.

*Table 7. Description of the political metaphor (Morgan, 2006)*

| Metaphor Attributes | Description |
|---|---|
| Strengths | The metaphor encourages the view that all organisational activity is interest-based and to evaluate all aspects of organisational functioning with this in mind; The model of interest, conflict and power is a means of understanding the relationship between politics and the organisation and emphasizes the role of power in determining political outcomes; The metaphor places knowledge of the role and use of power at the centre of organisational analysis. |
| Weaknesses | When organisations are analysed in terms of the political metaphor it is almost always possible to see signs of political activity. This mode of understanding often leads to an increased politicization of the organization; When we understand organisations as political systems we are more likely to behave politically in relation to what we see; We begin to see politics everywhere, and to look for hidden agendas even where there are none. |
| Examples of associated OR method or technique | Soft Systems Thinking/Methodology. |
| Book chapter | 3 |

Organisational politics focuses upon the relationship between interests, conflict and power. Organisational politics emerge when people think and wish to act differently and ensuing tensions can be resolved through political means. This metaphor conceptualises organisations as a loose network of people with different interests that gather together for mutual benefit, e.g. making a living. Coalitions emerge when groups cooperate with respect to issues, events and ideologies. Often coalitions of two or more groups are working against a rival network. Many organisations foster the development of cliques and collaborations. From the perspective of organisational theory we can contrast the unitary, pluralist and radical frames of reference (see table 8).

*Table 8. Description of unitary, pluralist and radical frames of reference (Burrell and Morgan, 1979)*

|  | *Unitary* | *Pluralist* | *Radical* |
|---|---|---|---|
| Interests | Emphasis on the achievement of common aims. An organisation is viewed as being united under the umbrella of common goals and striving towards their attainment in a well-integrated team. | Emphasis on the diversity of individual and group interests. The organisation is regarded as a loose coalition which has just a passing interest in the formal goals of the organisation. | Emphasis on the oppositional nature of contradictory 'class' interests. Organisations are viewed as a battleground where rivals (e.g. unions and management), strive for incompatible ends. |
| Conflict | Regards conflict as a rare and transient phenomenon that can be removed through appropriate managerial action. Where it does arise it is usually attributed to the activities of deviants and troublemakers. | Regards conflict as an inherent and ineradicable characteristic of organisational affairs and stresses its potentially positive or functional aspects. | Regards organisational conflict as inevitable and as part of a wider class conflict that will eventually change the structure of society. Recognition that conflict may be suppressed and thus often exist as a latent rather than manifest characteristic of both organisations. |
| Power | Ignores the role of power in organisational life. Concepts such as authority, leadership, and control tend to be preferred means of describing the managerial prerogative of guiding the organisation towards the achievement of common interests. | Regards power as a crucial variable. Power is the medium through which conflicts of interest are alleviated and resolved. The organisation is viewed as a plurality of power holders drawing their power from a plurality of sources. | Regards power as a key feature of the organisation, but a phenomenon that is unequally distributed and follows class divisions. Power relations in organisations are viewed as reflections of power relations in society at large, and as closely linked to wider processes of social control. |

## 6.  Psychic Prison Metaphor

Morgan (2006) asserts that people can get trapped in their web of creation. This has led to the inception of the psychic prison metaphor for understanding organisations. Organisations might be viewed as socially constructed realities that can have constraints and these constraints can have an existence and power that exercises a measure of control over their creators. People in organisations can become trapped by their favoured way of thinking. Additionally, they can be trapped by an unconscious process which has hidden significance. Examples of these traps (from Morgan, 2006) are illustrated in table 9.

*Table 9. The trap of favoured ways of thinking (Morgan, 2006)*

| Traps | Description |
|---|---|
| Trapped by success | The OPEC oil crisis of 1973: the Japanese automobile industry began to make inroads on the North American market. Caught in the mind-set of the American way of producing cars, the large US manufacturers were ill equipped to meet the Japanese challenge. They perceived their superior resources, technical competency, and skills in engineering and marketing as taken for granted. They were oriented to the large car market, ignoring the potential of small, fuel efficient cars. |
| Trapped by organisational slack | 'Create certainty', 'build in margins for error'. These ideas have been guiding principles in the design of manufacturing organisations. The result: institutionalised inefficiency. Buffer stocks of inventory and work in progress allows systems of production to absorb uncertainties in the production process. But they can be extremely expensive, and provide leeway for people to engage in sloppy work and to hide their mistakes. |
| Trapped by group think | In 1961 the Kennedy administration launched an abortive invasion of Cuba. The plan was completely misguided. The plan was never seriously questioned or challenged, being carried along by the process that that psychologist Janis called 'groupthink'. A strong sense of 'assumed consensus' inhibited people from expressing their doubts. |

Being trapped by group process is a good example of "groupthink" – when false assumptions, taken-for-granted beliefs and unquestioned operating rules combine together to create a self-control world-view that provides both resource and constraint upon organisational actions. Methodologies are being developed to avoid cognitive traps and groupthink by engaging in dialectical and other modes of critical thinking, and fostering the idea of learning-to-learn and of the learning organisation.

Many psychoanalysts believe the rational and taken-for-granted reality of everyday life should be explored through understanding what lies beneath conscious awareness. Thus, an understanding of "what we do and say" in going about our daily business must take into account the hidden patterns and dynamics of the human psyche. The challenge is to understand the unconsciousness in the organisation and realise trapped energy that promotes creative transformation and change, and improve relations among individuals, groups and organisations. A vision of confinement is normally accompanied with a vision of freedom. This metaphor offers an understanding of organisations as distinctive human phenomena. It recognises that people can feel trapped in problems that are of their own making. The metaphor assists in understanding ways out of these self-created traps.

The strengths and limitations of this metaphor are identified in table 10.

*Table 10. Description of the psychic prison metaphor (Morgan, 2006)*

| Metaphor Attributes | Description |
| --- | --- |
| Strengths | The metaphor presents a set of perspectives for exploring the hidden meaning of our taken-for-granted worlds; It encourages digging below the surface to uncover the unconscious process and related patterns of control that trap people in unsatisfactory modes of existence. |
| Weaknesses | The metaphor places an emphasis on understanding unconscious patterns of behaviour and control and people are often locked into cognitive traps because it is in the interest of certain individuals and groups to sustain one pattern of belief rather than another; The psychic prison metaphor embraces ideological processes which create and sustain meaning. |
| Examples of associated OR method or technique | Cognitive Mapping, Qualitative System Dynamics, Soft Systems Methodology. |
| Book chapter | 8, 11 |

## 7. Flux and Transformation Metaphor

The orthodox systems approach to organisational theory is underpinned by the idea that change originates from the environment. An organisation is conceptualised as an open system in constant interaction within its environment, transforming inputs into outputs as a way of developing conditions required for survival. Manturana and Varela (1980) challenge the orthodox systems theory.

They see the organization as part of the environment, rather than as distinct from it. So instead of viewing the organization as a separate system that adapts to the environment, this metaphor allows us to look at organizations as simply part of the ebb and flow of the whole environment, with a capacity to self-organize, change and self-renew in line with a desire to have a certain identity. This view implies that managers can nudge and shape progress, but cannot ever be in control of change. Morgan states (2006, p. 262), "In complex systems no one is ever in a position to control or design system operations in a comprehensive way. Form emerges. It cannot be imposed".

The key beliefs are: order naturally emerges out of chaos; organizations have a natural capacity to self-renew; organizational life is not governed by the rules of cause and effect; key tensions are important in the emergence of new ways of doing things; the formal organizational structure (teams, hierarchies) only represents one of many dimensions of organizational life. This leads to the following assumptions about organizational change: change cannot be managed. It emerges; managers are not outside the systems they manage but are part of the whole environment; tensions and conflicts are an important feature of emerging change; managers act as enablers for exchanges of views and focus on

significant differences. The strengths and limitations of the flux metaphor are identified in table 11.

*Table 11. Description of the flux and transformation metaphor (Morgan, 2006)*

| Metaphor Attributes | Description |
| --- | --- |
| Strengths | The metaphor attempts to understand the nature and source of change, so we can understand the logic; If there is an inner logic to the changes that shape our world, it becomes possible to understand and manage change at a new and higher level of thought and action. |
| Weaknesses | The approaches generated by this kind of thinking are far too idealistic. For example, any problem solution that requires a reframing of the logic of a social system is likely to encounter the resistance of the system. |
| Examples of associated OR method or technique | Cognitive Mapping, Interactive Planning, Qualitative System Dynamics, Soft Systems Methodology, Strategic, Options Development and Analysis. |
| Book chapter | 8, 9, 10, 11, 16 |

## 8. Instruments of Domination Metaphor

It is important to understand organisations as instruments of domination – hence the inception of the instruments of domination metaphor. Organisations are considered as rational enterprises pursuing goals and aspiring to meet the needs of all. They can be viewed as an ideology rather than a reality. Organisations are often used as instruments of domination that satisfy the interests of a few at the expense of others. Moreover, there is an element of domination in all organisations. Some organisational theorist believe a combination of achievement and exploitation is a feature of most organisations. Hence, organisations can be understood as a process of domination, and instruments that reflect variations in the mode of domination employed.

The instrument of domination metaphor can be viewed as the dysfunctional or unintended consequences of an otherwise rational system of activity. The negative effect of organisations upon employees or the environment are not necessarily the intended impacts. Morgan (2006) asserts they are usually consequences of rational actions through which a group of individuals attempt to advance a particular set of aims e.g. increase profits or corporate growth. Actions that are rational for increasing profitability may impact upon employees' health. What is rational from one organisational perspective may have a negative effect upon another. Viewing organisations as a mode of domination which advances particular interests at the expense of others highlights an aspect of organisational reality which is that in discussing the rationality of decision making the question must be addressed – rationality for whom? Table 12 identifies the strengths and limitations of the instruments of domination metaphor.

*Table 12. Description of the instruments of domination metaphor (Morgan, 2006)*

| Metaphor Attributes | Description |
| --- | --- |
| Strengths | The metaphor draws attention to the double-edged nature of rational action, illustrating that when we talk about rationality we are always talking from a partial point of view. Actions that are rational for increasing profitability may have a damaging effect on employees' health. |
| Weaknesses | The domination metaphor may lead us to focus on the negative aspects of the organisation in an extreme way thus unbalancing the managerial perspective. |
| Examples of associated OR method or technique | Systems thinking, Heuristic Thinking, System Dynamics. |
| Book chapter | 3, 11 |

### Other Metaphor Descriptions

We have presented here a brief outline of eight classical metaphor descriptions which resonate with views of the organisation. There is a rich literature describing the evolution of Morgan's ideas that extends metaphorical thinking in at least three directions.

Firstly, additional metaphors have been suggested that reflect the changing terrain of organisational behaviour and systems thinking. Such an example would be that of chaotic systems in which the results of research into chaos theory form the basis of new conceptions of organisational behaviour (Sloan, 2011). In this case there are strong links with systems thinking and system dynamics since from even relatively simple non-linear systems apparently chaotic behaviour may emerge (Galbraith, 2004).

Secondly, managers have been encouraged to be creative and to explore the use of their own metaphors. Morgan himself encouraged managers to move beyond the metaphors he described and to develop their own organisational images – what is important is that the metaphor used has some meaning for the individual within a particular problem context (Morgan, 1993).

Thirdly, authors have explored the use of multiple metaphors in situations where, for example, the design and implementation of a new information system requires a rich understanding of the organisational context, stakeholder views, requirements etc. so that systems developers can better "read" the social context in which the system development will occur (Oates & Fitzgerald, 2007).

In this chapter we have only considered Morgan's eight original organisational metaphors as we consider these to have stood the test of time, be well represented in the literature and well understood by practitioners. Other metaphors will, no doubt, continue to emerge over time and may in due course become part of the orthodoxy of metaphorical thinking. For the time being, however, we consider that the eight described, along with the links made in the next section to OR paradigms and methods, provide a sufficiently rich vocabulary for the description both of the

issues faced by HE organisations and their management teams and of the potential resolution of the issues. Consistent with this viewpoint that reflects the significance of considered priorities, we leave the consideration of other preferences (for example, post modern perspectives), to those who find such approaches correspondingly helpful.

## CONNECTING OR PARADIGMS, APPROACHES AND METAPHORS

We now look at the connectivity between paradigms, metaphors and OR approaches as we believe that such connectivity will promote approaches to the understanding of problem situations which will lead to more informed problem solving solutions. The term paradigm denotes a view of reality in which various schools of thought offer approaches to exploring situations. These different schools of thought can be linked with a suitable metaphor and we further connect the metaphors to a relevant OR approach (see figure 2).

Paradigm
(alternative realities)

Metaphor
(basis of schoolsof thought )

OR approaches
methods, models and
techniques
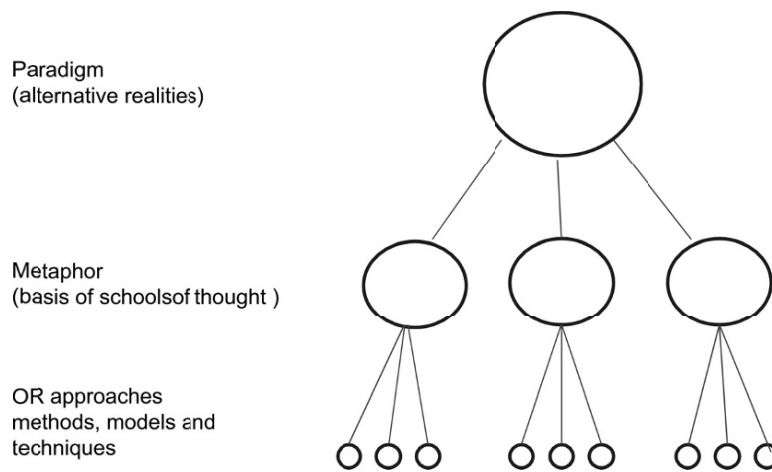
*Figure 2. Connectivity between paradigms, metaphors and OR approaches for problem-solving (based on Morgan, 1980).*

Tables 3 to 12 described above link the metaphors with various OR approaches and techniques and in table 13 below we summarise how the various authors of each chapter of this book feel that their work reflects, or is rooted within, the various metaphor descriptions given above. It should be noted that many chapters span more than one metaphor type. We also suggest in table 13 how the metaphors might be considered as representative of the Hard and Soft OR paradigms.

*Table 13. Book chapters as they connect to metaphor types*

| OR Paradigm | Organisational Metaphor | Relevance to Book Chapters (% of chapters) |
|---|---|---|
| Hard OR | Brain | 53 |
| Hard OR | Organism | 53 |
| Soft OR | Culture | 33 |
| Soft OR | Flux and Transformation | 33 |
| Hard OR | Machine | 27 |
| Soft OR | Psychic Prison | 13 |
| Hard OR | Instrument of Domination | 13 |
| Soft OR | Political Systems | 7 |

The predominance of the brain and organism metaphors in shaping the nature of current OR interventions is somewhat symptomatic of the sway that Hard OR holds in current interventions. Both metaphors address the need for organisations to respond to an evolving environment: the brain metaphor, emphasising organisational learning and the organisation's capacity for self-organisation; and the organism metaphor viewing organisations as open systems and best understood as ongoing processes that need to be responsive and agile.

Yet at the same time we must be aware of the weaknesses of these metaphorical views. For example, the tensions between the requirements of learning and self-organisation on the one hand, and the realities of power and control on the other, so that a balance between the distribution of autonomous powers to faculties and a maintenance of centralized responsibility and accountability must be struck. Or in the case of the organism metaphor, a poor understanding of the subtleties of HE organisations as socially constructed phenomena.

A brief review of table 13 illustrates that the book chapters are spread across all metaphor types and across both Hard and Soft OR paradigms. Thus the work illustrated in this book demonstrates the methodological pluralism that we feel represents the most effective way of combating the complexity and uncertainty that currently pervades HE management, leading to a rich understanding of problematical situations and informed management decisions.

Looking forward over the next ten years, authors were also asked to describe the extent to which they felt each metaphor would retain relevance as a way of conceptualising HE organisations, and this data is shown in table 14.

Furthermore, the table illustrates the increased importance of two metaphors that we feel exemplify Soft OR paradigms. The culture metaphor recognizes that effective organisational change implies cultural change and so HE institutions should attend to changes in corporate culture that can facilitate required forms of organisational activity. The flux and transformation metaphor attempts to understand the nature and source of change, so that by understanding the forces that shape our environment, it becomes possible to understand and manage change at a new and higher level of thought and action.

*Table 14. The sustained relevance of metaphor types*

| OR Paradigm | Organisational Metaphor | Sustained Relevance (% of authors) |
|---|---|---|
| Soft OR | Culture | 67 |
| Soft OR | Flux and Transformation | 53 |
| Hard OR | Brain | 53 |
| Hard OR | Organism | 53 |
| Hard OR | Machine | 47 |
| Soft OR | Political Systems | 47 |
| Soft OR | Psychic Prison | 40 |
| Hard OR | Instrument of Domination | 27 |

Table 14 illustrates our belief that metaphors will continue to have resonance as a way of viewing HE institutions and of engaging managers with the multiple perspectives that the metaphors provide.

CONCLUSION – A TOOLBOX OF OR APPROACHES AND METAPHORS?

The chapters in this book address a range of contemporary issues in HE management and explore the use of OR methods, tools and techniques for their resolution. We believe that the interlinking of HE issues, OR methods and organisational metaphors can form the basis of a powerful and pluralist approach to HE management. The use of organisational metaphors to frame thinking about an issue invokes a particular OR paradigm and suggests associated OR methods that can guide thinking and analysis (in the case of Hard OR) or learning and problem structuring (in the case of Soft OR).

In figure 3 we have tried to illustrate where examples from the existing literature fit within this three-way interaction (issues, methods and metaphors) and also where the chapters of this book fit and contribute to the evolving literature in, we hope, new ways (denoted in square brackets in figure 3). We have tried to highlight the connectivity between issues, methods and metaphors through the work of the authors contributing to this book and believe that the distinctive nature of the work presented here is illustrated by its positioning within the hitherto unpopulated regions of figure 3.

Although we have placed some of the book chapters outside the "Operational Research and Systems" set, this is primarily to distinguish those chapters (inside the set) that are more closely aligned to our earlier definition of OR as encompassing the use of advanced analytical and/or systems methods. In truth we regard all the chapters of this book as having roots within OR in that they contain insights and perspectives that enhance organisational decision making.

The OR discipline is continually evolving. We have argued that there seems to be three distinctive intellectual areas in OR (Hard, Soft and methodological pluralism) and that the use of metaphors to understand and change organisational life is a powerful theoretical concept. It can be seen that metaphorical thinking is also evolving as highlighted by the identified scholarly contributions shown in figure 3.
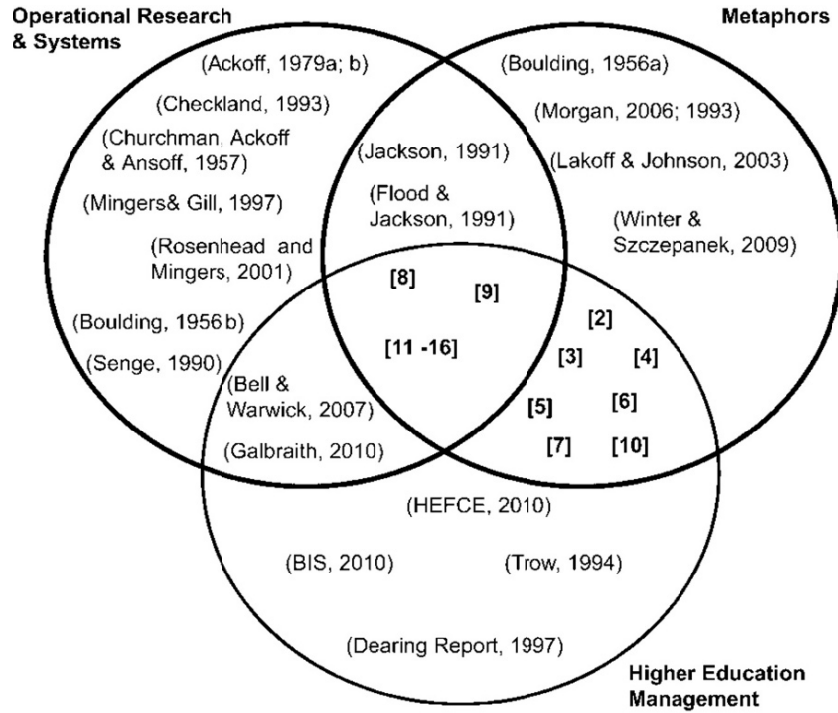
*Figure 3. Connectivity between issues, methods and metaphors.*

Currently, HE Institutions (particularly in the UK) are experiencing strong turbulence from the economic and social environments within which they operate. Problem situations within universities are characterised by complexity and uncertainty and we believe that the OR discipline together with the views characterised by organisational metaphors can assist management with these difficult situations and facilitate more informed HE management decision making.

## NOTES

1   The term "approach" encompasses methodology, method and technique.
2   Research And Development (RAND) systems analysis is the cost appraisal of various ways to attain the identified requirement.
3   Methodological Pluralism is a term first coined within the social sciences (CDOS, 1994).

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## AFFILIATIONS

*Gary Bell*
*Faculty of Business*
*London South Bank University*

*Jon Warwick*
*Faculty of Business*
*London South Bank University*

*Peter Galbraith*
*School of Education*
*The University of Queensland*

PART 2

# THE CONTEXT OF THE EVOLVING HIGHER EDUCATION ENVIRONMENT

CHRIS CLARE

# 2. DO INDUSTRIAL APPROACHES TO QUALITY MANAGEMENT AND PERFORMANCE INDICATORS WORK FOR HIGHER EDUCATION?

## INTRODUCTION

There is a considerable amount of energy and resources in UK higher education that are devoted to quality assurance, review and audit. This has resulted from a variety of initiatives, many of which started to emerge some thirty years ago. At the start of the 1980s a belief in the need to increase efficiency in higher education emerged, as a consequence of general Government policies to increase public accountability and performance through a more market-oriented approach to all public services. In this chapter we explore some of the issues and debates that this has raised within higher education as they have emerged in the literature over this period.

Attempts at more direct involvement in higher education by various government bodies including the Department of Education and Science, the Department of Trade and Industry and the Department of Employment (through the Manpower Services Commission) (Maclure, 1989) was one aspect of the pressures to bring greater Government control to the sector. Both the Green Paper in 1985, and the 1987 White Paper emphasised that higher education should be geared towards the needs of business and industry and that there should be greater scrutiny of the performance of universities (Department of Education and Science, 1985; 1987).

Much of the initial criticism was directed towards the universities as opposed to the polytechnics who were under the jurisdiction of the Council for National Academic Awards (CNAA). They were also scrutinised by the Department of Education and Science and were subject to formal inspection of teaching and other operations by Her Majesty's Inspectors (HMI). However, the White Paper, and the subsequent Education Reform Act (1988), followed by the Further and Higher Education Act (1992) effectively led to the removal of the CNAA as a national quality assurance body through the granting of autonomy to the ex-polytechnics (Department of Education and Science, 1988; Department of Education and Science, 1992).

The 1992 Act unified the higher education sector by removing polytechnics from the direct control of Government or local authorities. The Act also enabled the polytechnics to adopt university titles, and have the full degree awarding powers of the traditional universities. Funding for the new unified sector was channelled through the Higher Education Funding Council for England (HEFCE)

which was also charged with ensuring value for the money that was allocated to the universities.

During the debates of the 1980s, there appeared to be a need to develop clear systems of quality assurance, in part to justify Government expenditure on higher education (Kells, 1999). This resulted in pressure for the development of metrics and performance indicators as part of the system of monitoring universities (Harvey & Knight, 1996). As a consequence, the use of performance indicators for higher education was one of the thrusts of Government plans to emphasize efficiency and effectiveness in the management of universities.

Various groups and committees had made proposals for the development of metrics and indicators (Cave et al., 1997). These included the Jarratt report (CVCP, 1985) that proposed the introduction of a set of performance and other indicators for use by institutional managers. The National Advisory Body for Public Sector Higher Education (NAB) also published a report, which recommended a series of performance indicators for use in the polytechnics (NAB, 1987). The Warnock report proposed the development of metrics to be used in assessing teaching quality (PCFC, 1990a). In the same year, another group, initiated by the Polytechnics and Colleges Funding Council (PCFC), undertook a study into the potential use of performance indicators for institutional management (PCFC, 1990b).

These moves towards increased measurement of the activities of institutions were seen as a symptom of "managerialism", through attempts to increase efficiency and reduce costs using methods to assess institutional performance (Trow, 1994). This trend towards managerialism was also felt to be symptomatic of a lack of trust by Government in the academic community to maintain appropriate levels of quality control at a reasonable cost (Harvey & Knight, 1996).

## QUALITY ASSESSMENT AND AUDIT IN HIGHER EDUCATION

In order to discharge its duty of ensuring value for money, the newly formed Higher Education Funding Council for England set up mechanisms for quality assessment on a subject basis, focussing on qualitative self-assessment, coupled with inspection visits along the lines of the former CNAA/HMI (HEFCE, 1993). However, approaches to quality management and enhancement also included the measurement and testing of an organisation's own systems of quality assurance and, to achieve this, a separate organisation for higher education was set up. This organisation was the Higher Education Quality Council (HEQC) and it was owned and part-funded by the universities themselves. The responsibility for "quality" in English universities was therefore vested in two essentially separate organisations, each of which adopted a different approach to its work and placed different demands on the universities to prove compliance with defined quality standards (HEQC, 1996).

Both organisations developed systems that required institutions to produce written self-assessments, backed by substantial amounts of evidence in the form of

documentation, and this was followed by a visit from a group of peer reviewers. These reviewers would have the authority to interview staff and students, observe teaching sessions or other activities and request additional documentation. Both assessment and audit resulted in a published report detailing areas of good practice and areas where some improvement was thought necessary.

The HEQC approach centred on institution-wide visits, and was part of a rolling programme of audit. The overall aim was to investigate the institution's own systems of quality management and control in order to be able to satisfy itself of the broad comparability of standards across UK institutions of higher education. The resulting report commented on various parts of the institution's operational procedures. It provided comment and constructive criticism, but did not mark or otherwise rate the institution (HEQC, 1995).

The first HEFCE system for teaching quality assessment was established in 1993, and involved a rolling programme of subjects to be reviewed. Each academic department or unit covering the subject under review was required to write a self-evaluation, which addressed a number of areas relevant to teaching and learning. Departments were allowed to claim that their provision was "excellent" and if so, they were expected to provide evidence to back the claim. All departments claiming excellence were subject to a visit by a team of auditors who would interview staff, observe teaching, speak to students and look for other forms of supporting evidence. Departments deemed likely to be unsatisfactory from their document were visited as were a random sample of other departments. At the end of the process, all departments were graded "excellent", "satisfactory", or "unsatisfactory" (HEFCE, 1993).

A revised method for teaching quality assessment, on a subject basis, was introduced in 1995. Six core aspects of provision were specified and these had to be addressed in the self-evaluation document. Under the revised scheme, all departments were subject to a visit by a team of reviewers. They looked for evidence on which to judge the six aspects and, at the end of the visit, the department was awarded a mark out of four for each of the six aspects, together with detailed commentary on each aspect and comments on the standard of the provision (HEFCE, 1994). Departments scoring 22 or more out of the possible 24 were unofficially deemed as excellent. This was the first form of "metric" widely used in teaching quality assessment.

In response to the recommendations of the Dearing report (National Committee of Inquiry into Higher Education, 1997), and in order to maintain an independent review function, it was agreed to merge the two bodies. Consequently, the Quality Assurance Agency for Higher Education (QAA) was formed in 1998. The QAA also reassessed its approach to quality assessment and audit in an attempt to reduce the time and cost burden on institutions.

Throughout 1999 and 2000, a new methodology of academic review was developed and announced by the QAA (QAA, 2000b). The methodology attracted a considerable amount of criticism from various stakeholders who regarded it as placing excessive demands on institutions for what they viewed as a flawed method of quality review. As a result, the then Secretary of State announced that

the approach should be reviewed, allowing for a "lighter touch" in those institutions deemed to have the confidence of the QAA and other stakeholders in the sector in the quality of their provision. Following a sector-wide consultation, it was decided that the emphasis for future activity should be on the audit of an institution's own quality management and enhancement systems as a way of assuring the Government and other stakeholders that the education provided was fit for purpose and conformed to specification.

In March 2002 the QAA published the operational description of their new audit based approach to quality assessment. The method was based on institutional audits that examine three main areas. The first was the determination of how effective the institution's own quality assurance processes are. The second area of examination concerned the accuracy, the completeness and the reliability of the information that the institution published about the quality of its programmes and the standards of its awards. The third aspect of the audit was the examination of a number of the institution's internal quality assurance processes at work. These were at the level of the educational programme or more general processes. Judgements were made about the soundness of the management of the quality of the programmes and the standards of the awards at the institution and at the level of confidence that can be placed in the reliability of the institution's documentation. The auditors reported either "broad confidence" in the institution and its processes or "qualified confidence" with indications of those areas where the auditors may have some concern.

Concurrent to these developments, the QAA also set up a series of working groups to produce "benchmark specifications" for degree courses in each discipline (QAA, 2000c). The other areas of activity of QAA were in the development of a common framework for higher education qualifications and the QAA Code of Practice (QAA, 2000a). A separate form of institutional review was developed for use with higher education institutions in Wales.

The audit methodology was developed further and a revised method was introduced for the period 2006–11. A flexible audit trail procedure, based on the institutions approach to periodic review, was introduced to replace the former discipline audit trails. There was a change in emphasis towards enhancement as opposed to assurance, with a specific commentary introduced in the report on how the institution approaches the enhancement of their systems and procedures for the quality of the student learning opportunities. The method placed a continuing emphasis on student participation; this led to the introduction of student auditors in 2009–10. There was also the introduction of two judgements, one on the management of academic standards and the other on the management of the quality of the student learning opportunities (QAA, 2005).

A feature of the 2002 methodology for institutional audit had been the separate audit of the collaborative provision engaged in by the institution, if that provision was deemed significant. The collaborative provision audit followed a similar process to institutional audit but also included visits by the auditors to a sample of the institution's collaborative partners. This was retained for the 2006–11 cycle but was supplemented by the introduction of a "hybrid model". This was for

institutions with substantial collaborative provision but not enough to justify a completely separate audit. The hybrid model also included partner visits, albeit fewer than for a separate collaborative provision audit (QAA, 2009).

Following the completion of the cycle of institutional audits, a new form of institutional review of higher education institutions in England and Northern Ireland was developed for introduction in 2011. The new method sees the retention of student auditors. There will be two components to the report: a core section leading to judgments, and a thematic element which will not lead to a judgment, with each theme spanning one year of review, and forming the basis of a report with sector-wide conclusions and recommendations on an "issue of public interest". In addition to judgements on standards and quality (and these will be on the actual standards and quality as opposed to their management) the new method incorporates enhancement into the quality judgement and introduces a judgement on the information produced by the institution (QAA, 2011).

## MANAGERIALISM AND METRICS

There was, during the 1990s, a view that the moves towards greater teaching and research assessment were a symptom of "managerialism". This term is used to describe the moves by institutional management to increase efficiency and drive down costs using methods to assess and subsequently reward or punish (Trow, 1994). The term is used to describe "the tendency for professional managers, through their decision-making role, to alter academic processes on the basis of non-academic criteria, amongst which financial criteria have been prominent" (Harvey & Knight, 1996, pp. 68–70). This phenomenon was seen as part of a move towards a more formalised structure and more direct control of higher education through institutional management.

This trend towards managerialism may have been the result of a certain lack of confidence by the Government in the academic community to maintain appropriate levels of quality control at a reasonable cost, as well as a more general concern with the "bottom line" (Trow, 1994). There was a general drive towards continuous quality improvement for a reducing unit cost as part of this trend (Harvey & Knight 1996). The resulting emphasis on audit requirements led to an increase in the attention paid to management and administration within institutions and an increase in cross-institutional units being set up with a role to develop and implement systems and processes designed to manage and enhance quality (Brown, 2004).

Part of the perceived need was to have a rigorous and transparent system of quality assurance as part of the justification of Government expenditure on higher education, regardless of whether or not there were any problems in the sector (Kells, 1999). This in turn adds pressure for the development of metrics and performance indicators as part of the system of monitoring institutions (Harvey & Knight, 1996).

During the 1980s and 1990s, the environment had become more competitive with institutions trying to hit their targets for student recruitment, if necessary at

the expense of their neighbours. Many institutions offered broadly the same type of courses, and therefore it was the quality (perceived and actual) of what they had to offer which would determine whether they were successful in attracting students and other contracts. Traditionally, there has been little argument that this encompasses quality of the academic programmes, but it also includes the quality of how those programmes are delivered and of how well students are treated in all other aspects of the service provided by the institution. This is the quality of the total service package (Clare, 1995). Increased competition between institutions and the need to increase student recruitment and retention was one of the main drivers of increased interest in quality assurance, with institutions using a high quality rating as a weapon of competitive advantage (Welsh & Dey, 2002). Different approaches to the issue became apparent, including focus on academic subject, focus on the quality of pedagogy, on institutional management and on the outputs of the system in terms of the employability of the graduates (Brennan & Shah, 2000).

Processes for quality assessment and management can be affected by subject disciplinary features. Hard sciences and engineering have features that may be more amenable to measurement than humanities subjects (Kekale, 2000). In addition, the benefits of higher education are not all short-term. The performance of a particular lecturer in a certain class session may be rateable in a quality sense. However, the medium term aspects (for example, is the student equipped for further study or appropriate employment) and the longer term (has the student acquired the critical thinking skills necessary for life-long learning) are much more difficult to measure (Lawrence & McCullough, 2001).

A further area where there are difficulties in measuring quality in higher education is the notion of peer review. This is at the heart of most processes of quality assurance in higher education, mainly because of the lack of any universally accepted performance indicators or other metrics upon which to base judgement. The main problem is one of subjectivity in that "the essence of peer evaluation is that it is connoiseurial: evaluators apply their own values, knowledge and beliefs formed within their own practices and experience to the judgements they make" (Cave et al., 1997, p. 117).

Attempts to overcome the issue of reviewer subjectivity by defining various forms of evidence have led to criticisms of institutions being overburdened, for example, with the production of large amounts of documentation. This, together with the often excessive time and staff effort needed to prepare for and participate in quality assessment exercises has been a major area of criticism of the process and its agents in that "quality is taking up a lot of time. Across the world academics are busy assessing each other" (Brennan, 1997, p. 23).

## QUALITY IN SECTORS OUTSIDE HIGHER EDUCATION

One way in which systems and procedures for quality assurance from other industries are influencing higher education is through the import of terminology, and one of the first areas of interest is the notion of "fitness for purpose"

(Clark, 1997). Manufacturing industry defines quality in terms of "fitness for purpose" and "conformance to specification". Fitness for purpose is determined during the design phase and conformance to specification concerns the operational processes that go into the construction of the product. Fitness for purpose and conformance to specification are concerned with how well the design addresses the user requirements and how well the process adheres to the design specification; this combination determines the quality level (Hill, 1991). The two aspects are closely linked in that most of the problems concerned with lack of conformance to specification can also be traced back to design quality: either the design of the product or service itself or the design of the processes to produce it (Richardson et al., 1995).

Thus fitness for purpose was developed from the vocabulary of manufacturing industry and it is relatively easy to see how it is applied to a manufactured artefact. It relates to the questions "Does it (the artefact) work?" or "Does it do the job that it is supposed to?" Conformance to specification refers to whether the artefact performs in the way that the manufacturer says that it should. Unfortunately, there are some products and services where the distinction is not as clear-cut. These occur where the product itself is intangible or where a service is being delivered. A good example of the former is computer software where the definition of quality has always been problematic and where the industry is still striving to find "practical ways of testing for the relative presence or absence of quality" (Hughes & Cotterell, 1999, p. 258).

## FITNESS FOR PURPOSE IN HIGHER EDUCATION

Attempts to import fitness for purpose from manufacturing into higher education have been made (Clark, 1997). Fitness for purpose can be thought of as one aspect of quality in higher education; something that does the job for which it is defined and is associated with the drive for perfection and zero defects. Although "zero defects" is a difficult concept when discussing higher education, the alignment of the manufacturing definition of fitness for purpose as relating to the design stage can be seen to be relevant. There is also an issue of fitness for purpose being seen as meeting the "customer requirements" where there are a variety of notions of who the customers of higher education are and their possible lack of ability to specify exactly what they require (Harvey & Knight, 1996).

The recommendations that emerged following the publication of the Dearing report (National Committee of Inquiry into Higher Education, 1997) suggested a move towards fitness for purpose and incorporating the scrutiny of academic standards as an aspect of fitness for purpose (Brown, 2004). Fitness for purpose can be viewed as the background to the ways in which institutions determine their own aims and objectives (Watson, 1995). None of these authors mention the term "conformance to specification" although there do appear to be aspects of the notions of fitness for purpose that could better be described as conformance to specification.

Interpretations of the "customer" and the "quality" of the product are one of the major difficulties in adapting standard quality models to higher education (Owlia & Aspinwall, 1996). Most quality assurance systems take, as a starting point, the identification of the customer of the product or service. This is a major dilemma in higher education because an inter-related variety of customers can be identified. The customers of most commercial organisations can be fairly easily identified. However, a university's customers fall into four distinct groups: students; employers; Government; and the wider community.

The students of the institution are its customers (as well as its product). They expect the institution to provide a service in the form of a course of study leading to a recognised and valued qualification as well as a general educational benefit. Applicants today are thought to be far more particular about the choice of their course of study and the host institution than their predecessors. Part of the reason is probably the severe pressure on student finance, due to them being directly responsible for the fees for their courses. This led to the necessity to take out loans or be subsidised by parents and this tends to focus the mind towards looking for quality and value for money. Many students are also looking for the flexibility to leave and possibly re-enter higher education at various points, to modify the direction of studies and even to change institutions. This gives further support to the idea of quality as a competitive weapon.

Because of the importance of employers to a university, a careful balance needs to be struck. One way for universities to build courses is to base material around the latest theoretical research and this has been an approach adopted by many institutions. It can be seen to have been successful in providing the UK with first-rate scholars. The direct needs of industry have often been seen as being satisfied with training courses and these are not normally the province of the universities. Some universities, however, have always sought to try to satisfy the needs of industry directly as part of the degree and diploma courses they offer. They have managed to develop a balance between up-to-date material that will enable the graduate to become immediately useful to an employer, and material designed to provide a firm underpinning which enables the student to be flexible and adapt to future changes in the industry or in technology. Consequently, employers are looking for a high quality "product" in the form of the university's graduates (Clare, 2005).

Another group of customers is the Government through the university funding agencies such as HEFCE, other Government agencies (for example, the Research Councils) and the European Union. They should therefore be regarded as customers with needs to be satisfied. The methods by which this is currently achieved are through the institutions recruiting student numbers to target, graduating quality students, completing the funded research and so on. In addition to this, performance indicators and measures of quality have been suggested as a means of moderating the funding applied to the institutions.

The final group of customers for the services of a higher education institute is the wider community. Each institution has obligations in the areas of: contribution to the wider academic community; providing services to the international

community via the enrolment of overseas students, collaborative research, consultancy and other projects; access to the facilities of the institution for the local community; and to the welfare of society in general.

The difficulty of assessing service quality is further complicated by the expectations of customers. There can be distinctions between the explicit service and the implicit service. The former would include such factors as the availability, consistency and comprehensiveness of the service and the latter, the attitude of the service delivery staff and the general atmosphere of the service environment (Hill, 1991). The customer involvement in the service package and its delivery means that his or her own competence as a participant in the transactions of the service can affect the quality. Customers can be thought of as being involved in the creation as well as the consumption of value (Prahalad & Ramaswamy, 2000).

It is important to be able to differentiate aspects of quality assurance from quality control and the different degrees of formality required (Becher, 1999). The quality of a product or service is the responsibility of the producer and that responsibility should not be passed on to an inspector. The role of the inspector should be that of an auditor to ensure that the quality assurance procedures built into the production process are operating effectively (Hill, 1991) and here there are distinct parallels with higher education. Those procedures need to be able to measure the quality of the various stages of the construction of that product or service and measurement is facilitated by trying to develop as many metrics or indicators as possible. Even with intangible products such as software it is important to derive metrics, even if they have to be coerced. The reason for this is that it may be the only way to prove full conformance to specification (Hughes & Cotterell, 1999).

## PERFORMANCE INDICATORS

The development and use of performance indicators for higher education was part of the Government plans to emphasize efficiency and effectiveness during the 1980s. Some sections of the Green Paper "The Development of Higher Education Into the 1990's" and the 1987 White Paper "Higher Education: Meeting the Challenge" illustrate this. It notes:

> The essential purposes of performance measurement in higher education into the 1990's are to introduce into consideration of policy and the management of the educational system at national and institutional level some concrete information on the extent to which the benefits expected from education expenditure are actually secured and to facilitate comparisons in terms of effectiveness and efficiency as between various points of the systems and as between different points in time (Department of Education and Science, 1985, p. 49).

Other groups and bodies have made proposals on the use of metrics and quantitative indicators over the past thirty years. In stating that universities should be expected to work to clear objectives and to achieve "value for money", the

Jarratt report (CVCP, 1985) proposed the introduction of performance and other indicators for use by institutional managers. The National Advisory Body for Public Sector Higher Education (NAB) published a report by its Good Management Practice Group, which proposed a series of performance indicators on both resource management and academic operations for use in the polytechnics (NAB, 1987). From 1987 until 1995, the CVCP and UGC published annual "management statistics" for the universities, which consisted mainly of comparative costing data derived from annual returns (CVCP/UGC, 1987). The Warnock report, sponsored by PCFC recommended the development of metrics to be used in assessing teaching quality (PCFC, 1990a). In the same year, a group undertook a detailed investigation into the potential use of performance indicators for institutional management but also to be published as part of an institution annual report (PCFC, 1990b).

The initial work of HEFCE in proposing systems of quality assurance did not directly involve the use of metrics or performance indicators. It was the publication of the Dearing Report (National Committee of Inquiry into Higher Education, 1997) that provided the impetus for renewed interest in performance indicators. It recommended the development of performance indicators to enable assessments of the efficiency and effectiveness of universities in the delivery of higher education. In response, both HEFCE and the CVCP set up working groups and a number of reports signalled the introduction of sector-wide performance indicators. A group was set up by CVCP called the "Higher Education Management Statistics Group (HEMS)", which produced a report on the topic (Higher Education Statistics Agency, 1999). As a prompt response to the Dearing Report, the HEFCE set up a Performance indicators Steering Group (PISG) that issued an interim report in February, 1999 (HEFCE, 1999a) followed by a more comprehensive response in December, 1999, with modifications in 2000.

The PISG proposed some initial indicators covering four areas: widening access; non-continuation of students (retention); projected outcome and efficiencies; and research, with a proposal for how the indicators can be moderated to take account of the differences between institutions resulting from the diversity of higher education. These are referred to as "Adjusted Sector Benchmarks" (HEFCE, 1999b) The data used as a basis for these indicators are drawn, as far as is possible from common sources such as the Higher Education Statistics Agency (HESA).

Performance indicators measure an object, process or unit in order to appraise it in terms of defined objectives. They can be thought of as "statistics, ratios, costs and other forms of information which illuminate or measure progress in achieving the mission and corresponding aims and objectives" (PCFC, 1990b, p. 110). Distinctions can be drawn between simple indicators, performance indicators and general indicators. Simple indicators were used by the old universities for a number of years under the name of management statistics (CVCP/UGC, 1987). Further classification of performance indicators into "internal" (graduation rates, progression rates etc.), "external" (graduate employability, staff publications etc.) and "operating" (staff-student ratios, unit costs etc.) was later modified to the more

conventional "input", "process" and "output" categories (CVCP/UGC, 1986). Much of the literature concerns itself with this type of categorisation and definition, rather than about how the indicators were to be used effectively in a diverse higher education system. Such discussion is particularly important given that the essence of a performance indicator is some form of value judgement of what the standard for that aspect of performance should be. Consideration of quality assurance and of performance indicators has not been directly linked. Whereas the former has mainly been concerned with academic standards and the quality of the learning opportunities for students, the latter seems to have had its emphasis of the efficiency and effectiveness of institutional management.

There have been attempts to distinguish between management information, statistical indicators and performance indicators. It is only the last that are geared towards the measurement of the achievement of objectives (Sizer, 1992). They tend to act as "signals or guides" to help make operational the theoretical aspects of quality, including efficiency and effectiveness. This gives the performance indicator added status in that it measures the extent to which the objectives of the institution are being met (Sizer et al., 1992). The task of producing an acceptable set of performance indicators becomes more difficult as the range of factors affecting student learning increases. There is a further problem in reaching consensus on performance indicators because of their dual status; they are seen as both tools for institutional management and "public expressions of relative performance" (Cave et al., 1997, p. 225).

There can be different uses of performance indicators, ranging from tools for achieving efficient and effective management to tools for self-assessment by teams of staff. The latter ties in with certain ideas on professionalism. Whereas the trained practitioner who adopts a "technical" view of practice may view performance indicators as a summative assessment of that practice, others may prefer the more formative assessment that comes through reflective practice (McCulloch & Tett, 1996).

The essential pre-requisites to the development of performance indicators for an institution should include a clear definition of the aims of that institution. An increasingly diverse system (and hence institutional aims and objectives) makes it more difficult to develop common sets of performance indicators. The key issues are the purpose of the exercise, what to appraise and who should be responsible for the appraisal.

Consensus is important in that regulatory systems need to be collaborative, involving the Government and their agencies and the institutions themselves (Brown 2004). Furthermore, there is a view that "to be effective, performance indicators need to be owned by institutions…ownership is a necessary (but not sufficient) condition for the development of a valid and useful set of performance indicators" (Sizer et al., 1992, p. 144).

There are a number of commentators who do not see obvious ways in which performance indicators can play a part in quality assessment. The Morris report acknowledged the widespread institutional concern about the use of performance indicators for quality assessment (PCFC, 1990b). Furthermore, when considering

quality assessment and the use of performance indicators, the use of common PIs assumes that institutions are comparable. This may put pressure on institutions to generate common outcomes, which may or may not be appropriate (Barneston & Cutright, 2000).

There are questions about the validity of performance indicators due to the trends in quality assurance systems based around peer review and "comprehensive and holistic evaluative frameworks". There needs to be caution in attaching measures of quality that may not have a foundation in evidence or theory (Cave et al., 1997). Other commentators note that the ability to monitor "true effectiveness of central teaching" and to "compare relative performance" through performance indicators is very limited and can tend to dampen enthusiasm for methods of improvement (Kells, 1992). The use of performance indicators can lead to a preoccupation with the measure and "how to improve the score" rather than concentrating on how best to improve. This can have further adverse effects if higher rewards go to those scoring the highest (Kells, 1992). Concern has also been expressed as to whether the variables that have been proposed as a basis for performance indicators are appropriate with respect to the purposes of higher education, which are, in any case, difficult to define. It is difficult to improve the quality of the data "to such a conceptual and technical level that a table of numbers which ranks UK universities…can validly be constructed" (Yorke, 1997, p. 71).

There are also difficulties in the introduction of performance indicators in terms of costs. These are both the direct costs of introducing the scheme of measurement and the indirect costs of the resultant changes in behaviour that the system induces. These changes may stifle innovation and lead to further "emotional costs" due to adverse effects on those being observed (Dill, 1998). Another criticism of the use of performance indicators is that "higher education is a developmental process of increasing intellectual maturity…given this view…it is difficult to see how PIs can be of any help" (Barnett, 1989, p. 38). However, the main problem with the use of performance indicators in quality assessment is that the development of valid performance indicators depends on agreement on the goals of higher education and that these have become increasingly diverse, contentious and political. Government has tried to move away from the academic definition of the goals to their own market and employer led definitions.

Performance indicators can be combined and presented in tabulated form in order to provide a way to compare one institution with another. A number of versions of these "league tables" regularly appear in the educational and national newspapers and this attempted use of performance indicators is regarded as even more controversial than their general usage (Kennedy & Clare, 2003). The main concerns over league tables include the validity of the formulation of individual indicators and their subsequent use with little or no qualification (Yorke, 1997).

A number of the indicators that are used in the preparation of league tables are also considered to be too coarse for this type of application and appear not to have been properly thought through. Examples of these include the staff-student ratio (SSR) and the number of first class honours degrees awarded. A low SSR could be considered a positive aspect in that, from the students' point of view it indicates

more face-to-face contact between students and staff. On the other hand, from the funding body point of view it could be considered to be negative because it suggests an inefficient use of resources. A university awarding a high number of first class honours degrees may be a highly effective institution providing very high quality teaching, or, alternatively, may be thought to have lower than average standards, because it is awarding firsts too cheaply.

One of the most difficult issues concerns the qualifications of students on entry to their course and the subsequent retention, by the university, of those students. Institutions with a mission to widen access to, and participation in, higher education necessarily take on students with non-standard entry qualifications. The majority of these students are successful. However, they could be considered as a high-risk group because a number of them may not be able to cope with a full programme of study at the level of higher education despite increasingly sophisticated attempts to assess their ability on entry to higher education. Such institutions are often penalised in league tables on both counts. They occupy a lowly position because the entry qualifications, when aggregated, are less than institutions taking students with high grade 'A' level passes. Furthermore, because more of their students leave before completing their programme, they will find themselves in the lower reaches of the retention tables. Such a situation would be difficult to support because, in the absence of genuine, widely agreed measures of added value in education, success in adherence to a mission of widening access and increased participation cannot be properly reflected (Kennedy & Clare, 2003).

One of the causes of these difficulties is that league tables are based on the notion of a single view of the mission of a university and they tend to assume that all universities and higher education institutions share identical aims and objectives. The choice of performance indicators and their weighting inevitably contains a judgement on what the mission of a university is. This is compounded when the data from different sources is aggregated into a single table, as the weighting used in the aggregation is a further source of potential bias.


CONCLUSION

Most of the discussion in the literature of performance indicators in higher education has been largely restricted to measuring the effectiveness or efficiency of institutional management. For example, staff-student ratios, liquidity ratios and so on, are all measures of various aspects of running the institution rather than directly of the quality of the student experience. The issue of the acceptability of performance indicators in higher education has long been controversial and there have been a number of occasions, indicated in the literature, where performance indicators have been proposed but not widely adopted.

Many authors express doubts as to whether performance indicators have a legitimate role in quality assessment of the learning and teaching experience of students. In a small number of instances, there have been attempts to forge links between performance indicators and their possible use in teaching quality

assessment, but other commentators suggest that performance indicators are simply not applicable. In many instances, the discussion of performance indicators concentrates on the assessment of the efficiency and effectiveness of the operation of the institution. If they are to be applied, there is an understanding of the need for all parties using performance indicators to understand fully their purpose and context and the need for consultation and ownership of any metrics system. The higher education environment appears to differ significantly from other industries and sectors on these issues because links between performance indicators and "product" or "service" quality are often a significant feature of those other industries and sectors, widely understood and embedded in the culture. It may be the case that higher education is so specialised that forging such links is more difficult or that the appropriate tools have not been available.

Implicit in all quality regimes, inside and outside higher education, is the desire to improve quality. Other industries are, perhaps, more overt in this aim with declared continuous improvement procedures (Hill, 1991) but continuous improvement has been acknowledged as a worthwhile result of the activities of QAA, HEQC and HEFCE in the educational literature. The majority of the discussions on performance indicators focus on being able to compare institutions along various dimensions, even if some moderation or normalisation is required. The main incentive for them to be used within an institution would be to identify any weaknesses with a view to implementing changes in order to improve the performance indicator. This has been addressed in the non-higher education areas and an important distinction is made. Managers do not have direct control over the performance indicators; they control processes that produce results that are measured by the indicators.

Managers can be thought of as having the ability to operate the "levers" of the institution in order to aim for a particular target. The performance indicator signifies how close to that target the manager is but it does not help them control the lever (Sherwood, 2002). There are difficulties in finding the message from within large amounts of data and managers continually rely on a process of intuition to solve complex problems when logical (that is number based) methods fail (Hayashi, 2001). Other commentators put forward the view that decision-making is not an event (where direct measures can be employed), but a process that takes place over time and is therefore subject to other forces beyond the control of the manager (Haspeslagh et al., 2001). These views point to the limitations of performance indicators as a management tool.

There are parallels to be drawn with higher education. A widely accepted interpretation is that teaching and learning are processes. The fact that they operate in socio-technical environments results in some similarities with management processes. Teachers, like managers, lead, plan, monitor, control and undertake many of the functions required of managers. Consequently, the performance indicators are likely to have the same limitations as those used in other environments. As a consequence, they would have to carry similar "health warnings".

As noted in the literature, performance indicators and other metrics are still alien to many in higher education. Previous attempts to introduce measures (including the QAA methodology based on "scores out of 24") have been met with criticism and resistance. Where they may be of the greatest use would be to provide feedback to the tutor (or the institution) on the result of a certain practice in terms of the quality of the student experience. This, together with the tutor's own intuition and experience may enable them to try different levers (using Sherwood's analogy) in order to improve that experience. Using this approach may make the notion of measures and performance indicators more palatable to the higher education community and hence make them more likely to be embraced.

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## AFFILIATION

*Christopher Clare*
**ifs** *School of Finance*

GEOFFREY ELLIOTT


# 3. HIGHER EDUCATION MANAGEMENT
# AND UNIVERSITY CULTURE


## INTRODUCTION

This chapter studies the role and meaning of higher education management and university culture within the context of the United Kingdom, but with relevance to the Anglophone world of mass university higher education (i.e. Australia, Canada, New Zealand and the USA). This chapter reviews the culture of university management and uses the examples of the role and position of Dean and Vice Chancellor, in the post-1992 group of universities in the United Kingdom, to highlight and interpret the tensions, challenges and conflicts arising from the boundary positions of Dean and Vice Chancellor within the academic and corporate spheres of the university world. The emphasis of this chapter is on understanding and interpreting the "dual-identity" of Dean and Vice Chancellor within three philosophical and interpretative categories: (a) university governance, organisation and management impacting on the role of Dean and Vice Chancellor; (b) the challenges to academic management and corporate management position and identity within the role of Dean and Vice Chancellor; and (c) the conflicts and dichotomies inherent within academic and corporate management language and discursive styles. This chapter further explores and analyses how Deans and Vice Chancellors manage, and conceptualise, the dichotomies of their cultural position within the university organisation; and manage the trade-offs implicit within academic management and corporate management culture within universities.


## MANAGEMENT AND CULTURE

### *Janus Like Dispositions*

The role of Dean and Vice Chancellor requires a politically skilled and experienced understanding of the perceived and actual cultural position, and meaning, of these roles within the university organisation. The boundary position of Deanship, sitting between academic faculty management and university institutional (corporate) management, and the role of Vice Chancellor residing on the border between the university (corporate) management and the board of governors, possesses a Janus-like disposition (i.e. the ability to look both ways – particularly at entrances, gates and bridges)[1] with regard to cultural positions (Elliott, 2008). In many respects the role of Dean and Vice Chancellor acts as a

shock absorber between conflicting cultures, positions and identities within the university. How Deans and Vice Chancellors cope with these border roles between conflicting cultures is the focus of this chapter.

## *Traditional versus Modern University Cultures*

Culture appears as a combination of values, structure and power that has implications for every aspect of a university's operation, management and external relationships with the outside university world (Dopson & McNay, 2000). Apart from the micro-cultures found within individual university organisations, there is also a macro-cultural divide found between sectors of the university world. The macro-cultural divide in higher education in the United Kingdom is often apparent between the "old" (or traditional) university sector and the "new" university sector; this divide is also similarly replicated in the university sectors of Australia and the USA. Micro-cultural divides are largely the result of the way in which a university has been structured within the governance framework of the institution.

The older universities in the United Kingdom, sometimes referred to as the Russell Group, were set up with bi-cameral governance structures (i.e. the governance practice of having two legislative bodies, such as, senate and court in the University of London) that ensures some level of balance between academic and corporate agendas and gives voice to the different cultural positions within an institution. The 1992-group of universities was established by Government legislation. The governance of these institutions is based on incorporated limited liability company governance and managerial reporting lines (Shattock, 2006). Interestingly, the newer and often smaller more specialised universities, awarded university status in the last ten years, have primarily opted to model their governance on the older university sector; and to some extent the 1992-group of universities in the United Kingdom have now become an experiment lost in time; operating within governance frameworks that magnify and emphasise the divide between academic management culture and corporate management culture within institutions.

## *Polarities and Dichotomies of Culture*

The different cultural positions within a university often cause real tension and conflict as cultures meet, and sometimes unknowingly collide, within the university organisation. The positions of Dean and Vice Chancellor are required to manage conflict and reconcile these different cultural positions; often maintaining one identity (e.g. academic management) whilst appeasing or reconciling another identity (e.g. corporate management). To do this successfully a Dean or Vice Chancellor will need to be reflective of their own position, sensitive to the collision of cultures, and able to interpret and conceptually model the dichotomies and conflicts of cultural positions found within the organisation. This enables them to better understand, mediate, and bridge, the differences and polarities that exist between academic management and institutional management within universities

(Elliott, 2008). The idea of a university, and its defining culture and meaning, in the industrial and post-industrial age has been debated for the past two centuries, from Cardinal Newman's "Discourses on the Scope and Nature of University Education" (1852), through to Alfred North Whitehead's "The Aims of Education and Other Essays" (1929) and Sir Sydney Caine's "British Universities: Purpose and Prospects" (1969) ending up more recently with Gordon Graham's "Universities: The Recovery of an Idea" (2002), that went full circle in promoting and espousing Cardinal Newman's ideas and theories of the culture and meaning of a university.

What is clear is that there is not a single shared idea or universal meaning of university organisation and culture. What is also evident from the literature is that university cultures mutate over time; and are largely influenced by trends and policies, and recovered and re-current ideas, that shape and define higher education management cultures (Barnett, 2003). In many respects the cultural debate in the 1990's over university managerialism versus collegiality within the organisational culture of universities has given way to arguments over corporate versus academic culture in the early part of the 21st Century. The debate appears now to be moving towards an exploration of the cultural divide that exists between publically (or government) funded universities and privately funded universities; and their different management objectives and cultural styles.

In terms of the transition and mutation of higher education management culture over time, this can be divided into defined cultural periods (Scott, 1995; Elliott, 2008). The "Donnish" period (1920s to mid-1960s) was characterised by academic self-management through academic hierarchies, where academics largely ran their own affairs with minimum external scrutiny and involvement by students or support departments. The "Democratic" period (approximately the mid-1960s to early-1980s) was characterised by the growing representation of students and support departments on main university committees, leading to the growth of decision-making by committee, often referred to as the "democratisation of academic governance". The "Managerial" period (mid-1980s to mid-1990s) was characterised by the growth and increasing positional importance of support departments (e.g. finance, estates, human resources, marketing and external relations etc.) and the movement towards audit accountability, greater financial independence, and a need for systematic management techniques to deal with commercially oriented activity, accountability and reporting. The "Entrepreneurial" period (mid-1990s to mid-2000s) was characterised by strong executive control with presidential style leadership; university missions, governance and strategies that were increasingly business-like in character; the replacement of traditional academic governance with focus groups and executive project development groups; the weakening of academic identity; the growth of internal markets within higher education institutions with resource allocation partly based on achieving benchmarks and targets; increasing employer engagement and partnership with business; growing scarcity of institutional funding from public sources such as the Higher Education Funding Council for England (HEFCE) block grant funding for teaching and HEFCE grant funding for research. The

"Global" period (mid 2000s to date) is characterised by institutional competition for global status and ranking; the establishment of international markets for students; increasing competition for international students; and the re-invention of the university in the context of the meaning and definition of internationalisation; and seeking national and international ranking or status.

Within these academic periods, the role, cultural position and meaning of Dean and Vice Chancellor has changed, evolved and mutated. External factors, such as government policy and prevailing societal attitudes, clearly influence and shape university management culture.

ACADEMIC VERSUS CORPORATE MANAGEMENT CULTURE

*Exogenous and Endogenous Factors*

University management culture is tied into issues of individual identity with a subject, group or ideology, and is influenced by both exogenous influences from the outside world (i.e. Government policy on education, and the prevailing societal attitudes and behaviours present at the time) and endogenous factors from the predominance of one culture over another within the fabric of the university organisation. In many respects the exogenous causes and affects on university culture can be seen as the macro-cultural influences; whilst the endogenous causes and affects are primarily how micro-cultures dominate (or fail to dominate) within individual university organisations and structures. Tensions and challenges exist within the university organisation between academic management and corporate management; particularly where university governance and management structure has separated the university "centre" from the faculty "academic units" in terms of culture and identity. In the business world the main and overriding role of management theory is to monitor and control the effective and efficient use of resources in order to meet a strategic plan or objective within the context of making a commercial profit.

The growth of university managerialism between the late 1990 and into the 21st Century has been significant in promoting the division between academic and corporate management in universities. In its wider definition, managerialism is a broad and changing ideology that regards the socio-technical practices and functions of managing, and management, as essential to the achievement of economic success, technological progress and defined objectives. In later research in the last decade of the 20th century this has mutated into New Managerialism which refers to an ideologically driven set of reforms in the management of publicly funded services that have permeated the management of universities in the United Kingdom (Deem & Brehony, 2005; Deem, Hillyard & Reed, 2007). Within the ideology and theoretical models of managerialism in universities managers are leaders and agents of change and progress in a predominately target driven economic environment. It is in managing within old and new managerialism that tensions and conflicts develop because of the strong academic cultural loyalty to values of academic freedom, professional autonomy, indeterminacy, and

collegiality over the cultural values of management control, target setting and accountability.

Mangerialism and New Managerialism (Deem 2001; 2003; 2004) have had a significant effect on university culture, involving the adoption and absorption of exogenous general management theory found within the business and commercial world; it has witnessed the adoption and absorption of generalist management tool kits and techniques found within business; and seen the adoption and absorption of the language, semantics and discursive styles of business and commerce which has been alien to the language and discursive styles of the academic environment; with phrases, such as, "win-win", "low hanging fruit" and "being ahead of the curve" dominating the language and culture of new universities. The post-1992 group of universities appears to be more receptive, and perhaps less concerned (or challenging), of corporate change management ideologies and management fads. In making non-academic appointments to the position of Dean or Vice Chancellor, universities are in some respects deliberately trying to dissolve the duality of identity and position inherent within the role and function of Dean and Vice Chancellor by aligning the roles and cultural positions more to the corporate agendas of the institution. However, cultural discussion, and often challenge, then follows with other groups in the university, often sapping the strength of the institution, regarding the rights of the predominant corporate agenda over the academic agenda in a university.

During this period of evolution in managerialist culture, the position and title of Vice Chancellor evolved (particularly in the post-1992 group universities) to encompass the title of Vice Chancellor and Chief Executive Officer (CEO) to better reflect the corporate and business agendas and culture of higher education management in universities. This, in the late 1990's, was a significant signal of the growing corporate identity of higher education institutions which in turn affected the internal management and governance structures of universities as they altered governance processes and re-shaped organisational structures to address the growing imperatives of financial control, external audit and corporate income generation (Salter & Tapper, 2002; Shattock, 2003). It was also noticeable during this cultural period that the role and position of the Director of Finance evolved to become more authoritative, and dominant, as financial regulation and accountability became more significant to higher education institutions in the first decade of the 21st century.

More recently higher education institutions have begun to classify their corporate and institutional identity with values and expected staff behaviours (e.g. customer focused, client aware, etc.). The budgetary and financial control tools and theoretical techniques, subsumed into the institution at both corporate and academic level, have been augmented in recent years with further corporate ideologies of risk-management, key performance indicators and financial target setting for both academic and non-academic areas of the institution. The emphasis has been on performance management, the management of risk and the assessment and monitoring of departmental and faculty contribution levels. This in turn creates internal markets within universities as departments and faculties

compete with each other, in quasi economic micro-markets, for finite resources and in turn establish internal practices, structures and organisational micro-cultures.

*The Downgrading of Academic Culture*

The growth of a management culture centred on commercial accountability and target setting, driven by quasi-market forces, "productisation" of academic programmes, and meeting external business and employer needs has to some extent undermined the authority and position of the academic manager (Bok, 2003). The traditional university culture of an academic manager viewed as possessing unique, sector-specific knowledge and skills, with the added advantage of possessing appropriate experience and positional authority within the university environment, has in a number of cases been replaced in the new university sector with a cultural view that academic managers can (and in some cases should) be replaced with generalist business managers from industry. It has been felt that the skills and competences of management in business are universal and transferable to the university world. This has led to business sector managers, without any relevant university experience, being appointed to senior management positions in universities.

The concept of a universal and common management practice that can be transferred without customisation from industry to academia has led, in some circumstances, to the view that all resources can be treated in the same business manner whether technical, financial or human; and irrespective of the uniqueness of the environment or market. The movement towards a more commercialised education system, based on students funding their own education in place of Government subsidy, rather than neo-liberal education as an end in itself, has had a major impact on altering academic management culture within universities. This has partly led to a perceptual down-grading of the value of an academic manager. It has also led to perceptions that the academic manager and business manager are culturally polarised positions. The academic manager being seen as a collegiate facilitator and mediator who encourages a sense of reflective learning and intellectual development among both staff and students; and the perception of a business manager as a resource monitor and distributor in the implementation of corporate university policy.

The role of Dean and Vice Chancellor in this academic and corporate management nexus is critical in aligning the academic aims and objectives of the faculties with the strategic and corporate aims and objectives of the institution. The role of Dean sits between the institutional management domain and the academic management domain and in a similar manner the role of Vice Chancellor sits on the border between the institution as an academic and commercial entity and the board of governors who in the new university sector act a commercial board of directors. Therefore, the role, position and identity of Dean and Vice Chancellor assumes a duality of meaning and function requiring unique skills and competencies to bridge the cultural and positional divide between the centre and its

academic units and the university and it external board of governors. This dual and split identity largely defines the culture these two management roles in the university today. How these management roles reconcile the cultural differences between academic and corporate management are outlined in the next section; facilitated by a conceptual model of management culture for these two roles and positions in the university.

RECONCILING ACADEMIC AND CORPORATE MANAGEMENT CULTURE

*Bridging Cultural Polarities*

A significant aspect of the role and function of Dean and Vice Chancellor is to understand and manage the different cultural positions that exist within the university and the outside world. The different cultures are embedded within the dualities of culture and position of Dean and Vice Chancellor. The objective for these two roles is to attempt to find new and appropriate management approaches and dialects to bridge the differences and polarities that exist between the academic and corporate cultures of the university. A core function of the role of Dean and Vice Chancellor is to mediate the tensions and challenges that exist between the academic and corporate cultures of the university.

The role of Dean and Vice Chancellor requires translation and interpretation skills that enable dual positions and cultural identities to be understood and new positions and identities negotiated and reconciled for the collective good of the university (Elliott, 2008). Therefore, an understanding of the cultural identity of the roles of Dean and Vice Chancellor is critical to understanding the dual nature and position and identity of these roles. A function of the Dean and Vice Chancellor is in negotiating and mediating conflicts and tensions that arise between academic management and corporate management. This requires Deans and Vice Chancellors to mediate and resolve these cultural conflicts to meet the needs and requirements of both the university and the faculties (Wolverton & Gmelch, 2002). However, this intermediary position of Dean and Vice Chancellor can sometimes leave the role holder isolated between the university centre and the faculty (in the case of Deans), and the university and the board of governors (in the case of Vice Chancellors).

In many universities, particularly post-1992 institutions, the role and position of Dean has been deliberately absorbed into the senior management team of the institution in order to better transmit university policies throughout the faculties and academic units of the university (Burgess, 2008). This function of translating and transmitting university policies and agendas, either between the university centre and its faculties, or between the university and the board of governors, becomes more difficult where ideas and policy agendas do not naturally resonate with the cultural identity of a particular management group in the university. The establishment of harmony between the cultural management groups within the university is essential for enabling the priorities of the institution to be met.

*Culture and Identity in University Management*

The literature on the changing nature of academic and corporate management culture, identity, position and meaning over the last decade is extensive (Becher & Trowler, 2001; Woodward, 2002; Barnett, 2003; Walker & Nixon, 2004; Beck & Young, 2005; Nixon, 2006; Barnett & Di Napoli, 2008; Nixon, 2010). Universities are complex organisations in terms of relationships, individual status, and professional and cultural identity. The dominant positions and identities within a university shape the cultural identity of the university and establish the predominant positions and cultural identities of individuals within the institution. The balance between the culture of academic management and the culture of corporate management is shaped by the institutional context and its underlying vision, mission and ambitions. A university is an example of an organic organisation that is best understood in terms of a dynamic process rather than a fixed structure, and one that is generative of an increasing variety of positions and cultural identities (Delanty, 2008). The identity of a university is a composite of the dominant positions and identities of individuals and roles within the institution.

Management culture and identity, like any other form of social identity, can be said to be based on four factors: (a) positionality, (b) performativity, (c) situation, and (d) discursive style (Delanty, 2008). In terms of positionality, a higher education manager (such as Dean or Vice Chancellor) will position themselves in relation to other cultural groups in the organisation and in doing so make a distinction between "self" and "otherness". In terms of performativity Deans and Vice Chancellors carry out a number of functions with concurrent actions and their identity is encapsulated in these actions and sets of practices within both the faculty and the wider university domain. The situation (or context) within which Deans and Vice Chancellors operate influences their management identity within the university organisation; and in terms of language and discourse, management culture and identity are embedded within the language styles and discursive narratives of the role of Dean and Vice Chancellor.

Balancing conflicting priorities and agendas within resource constrained university organisations becomes a critically important competency of the function and role of Dean and Vice Chancellor. When a senior academic becomes a manager they immediately assume a dual identity. The conflicts and challenges that come with the role and position result from the legacy of their former academic existence colliding with their new managerial role. The tensions and conflicts of Dean and Vice Chancellor appear in trying to balance these two different identities within the institution (Elliott, 2008). These tensions are exacerbated by the fact that academics usually tend to have strong loyalty to their academic subject area, academic unit, or academic department, whereas Deans and the role of Vice Chancellor have to manage across both academic and non-academic units in the university; and show neutral and objective loyalty to both areas of the university organisation. Some academic managers, particularly in the Russell group of universities, often try to retain, and maintain, their research and

pedagogic profile in their academic area of expertise whilst at the same time addressing their new management responsibilities.

However, over time, and as an academic manager progresses through the ranks of university management further expanding their management remit, academic managers will most likely gradually lose touch with their academic subject domain and in some cases expediently relinquish their academic identity due to the growing importance and position of their managerial identity over their academic identity. But again, in many other circumstances academic managers consciously try to retain, and nourish, their academic identity in parallel with their management identity, but this will depend on the context of the university in the sector and the overall view of the university's mission. In some circumstances the specific career path ambitions of an academic manager to aspire to the roles of Dean and Vice Chancellor may necessitate the academic manager deliberately discarding their academic identity to fully concentrate on gaining greater institutional acceptance of their management identity.

The strength and weakness of the academic management identity is normally dependent upon the nature of the institution (i.e. whether a post-1992 or pre-1992 university), managerial position within the university hierarchy, individual career aspirations, and reflections of self within the wider higher education world (Deem, Hillyard & Reed, 2007). Clearly, management as a core identity is stronger, and more prevalent, the further up the university hierarchy the management job is located. In the late 1990s, a major ESRC study into "New Managerialism and the Management of UK Universities" (1998–2000) was conducted with Rosemary Deem as lead investigator[2]. The study addressed four major themes: (a) the identity of manager-academics, (b) generic principles and values about the role of academics in the university, (c) practical characteristics of everyday life in universities, and (d) how academics are turned into manager-academics and their understandings of their careers.

This study provided valuable early insights into the value sets and identity conflicts of Deans, Pro Vice Chancellors and academic Heads of Department at the end of the 1990s. The study recognised that academics and academic managers have multiple identities with particular aspects of identity being highlighted more, or less, at particular moments in time over an academic or academic manager's career. The study recognised that identities can shift over time and will depend on both career location and position within the institution. The study also discovered that (a) the majority of academic managers recognised that the role required understanding significant elements of management theory and practice although few managers below Pro-Vice Chancellor saw management as an attractive or all-encompassing identity; (b) the importance of management identity was lessened the lower down the management hierarchy the academic manager was located (i.e. at head of academic department level); (c) at Dean level there was less ambivalence about being described and identified as a manager with only a minority eschewing the management label, although most deans wanted to hang on to their subject and academic identity in some manner; (d) there was recognition that holding onto an academic identity was limited by the time available to maintain academic credibility

through research or professional engagement; and (e) for those who progressed to a Pro-Vice Chancellor post or above the academic disciplinary context began to recede although the person's academic discipline may still be a significant element in personal identity (Deem, Hillyard & Reed, 2007).

The job description and function of Dean and Vice Chancellor does slightly vary between pre-1992 and post-1992 universities, although much of the role is similar; and there are many common fundamentals within the experiences of Deans and Vice Chancellors within both old (chartered) universities and new (statutory) universities. One underlying commonality is the challenging position Deans often find themselves in by representing both faculty and university values. Deans can only deal with this conflict in the context of their own view of themselves (i.e. self), their perceived and actual management role and function in the university (i.e. positionality), and the power and authority (i.e. agency) they exercise within each position and identity. In comparison however the role, position and identity of Vice Chancellor in the old and new university sectors is more similar, unitary and transparent. The role, position, and identity of Vice Chancellor is clearly, and predominantly, managerial, even if the vice chancellor has reached the position through reputation and standing within academia. However, it should be understood that the dual identity of Vice Chancellor is not between academic and managerial identity, but between corporate identity and ambassadorial identity, between the institution and its board of governors.

In order to mitigate and eliminate some of the conflicts and tensions inherent in the role of Dean, universities often set up institution-wide management group forums as a mechanism and instrument for changing perceptions of self and cultural identity within the institution. A number of post-1992 and pre-1992 universities have invested significant resources (money, time and effort) in both internal and external management development and training programmes. The aim of such managerial development activity is to bring middle-university management values, identities and positions (such as the Dean) into line with institutional management attitudes, values and identities. The role of management development and training helps to define, codify and legitimise corporate management values and positions over academic management values and positions. Such management development activity further helps create new communities of practice, centred on the role, function and identity of corporate management within universities. The university sector is also clear about the importance of developing corporate management identity and culture within institutions. There is clear evidence in the university sector of exogenous bodies re-defining and re-codifying university corporate management leadership within universities. The Leadership Foundation for Higher Education and the Higher Education Academy (HEA) leadership development programmes in the United Kingdom have emphasised the importance of corporate management development and training within universities. If university managers are not involved in these sector-wide management development programmes they will in many circumstances reduce their career opportunities to progress to senior levels of university management.

*Language and Discourse in University Management*

This section explores and interprets how the use of language and discursive styles may reveal, establish and polarise the cultural positions of academic managers and senior institutional managers within universities. Research has shown that dichotomies of language and discursive style not only exist between academic and non-academic areas of universities but are also found within the diverse tribes and territories of academia and the wider academic world (Becher & Trowler, 2001). In terms of language and discourse, management culture and identity are embedded within the discursive language styles and narratives of communication of Deans and Vice Chancellors. In order to reconcile the duality of position of Dean and Vice Chancellor, the role holders have to become "culturally bilingual" in order to survive, live and communicate in dual cultural positions and identities.

Deans, in particular, express both their academic identity and their corporate identity. The language and discursive styles used by a Dean or Vice Chancellor to express ideas and convey positions becomes very important; and language and discursive style can make or break the relationship of Dean and Vice Chancellor within a university. Language embodies and defines beliefs, values and cultural positions. Language can be used to accommodate, reconcile or mediate different cultural positions, and be used to reinforce cultural identities within the university.

University managers will often try to present cultural positions that are empathetic with institutional values, positions and identities. To achieve this outcome Deans and Vice Chancellors will often adopt a dual language and discursive style to translate, communicate, and establish identity and affinity with the different groups within a university. Deans and Vice Chancellors will often try to translate the identities and positions of corporate management into a language, and discursive style that resonates with academics. Within social practice theory, professionals within a particular community of practice, such as academia, work within recurrent practices and sets of meaning that are endogenous and localised to that community of professional practice. This social construction of reality involves the development of rules, conventions, connotative codes and taken-for-granted understanding. Underpinning these are values, attitudes and ideologies that are developed, communicated and given meaning within an endogenous and local context (Knight & Trowler, 2001).

The prevailing policy ideologies of the Government, with their associated language and rhetoric, impact on the language and discursive styles of university managers. These different discursive styles often possess different meanings, arising from their separate and localised contexts. The different rhetoric and discursive styles get embedded into the fabric of university language and debate; and get cemented by their use and interpreted meaning by both academic and corporate management. In order to survive and operate effectively a Dean and Vice Chancellor will often become culturally bilingual and in some cases trilingual, so that they may hold several different sets of values, beliefs and positions in sometimes contradictory discourses (Deem, Hillyard & Reed, 2007). Within the context of dual cultural identity, where it is necessary to be bilingual, a Dean or Vice Chancellor will often try to establish cultural identity and affinity with a

group by sending appropriate messages and signals in the language and discursive style understood by that group. If Deans are communicating within an academic forum they will often use a language and discursive style that will identify them as from academia. In many ways this dual identity, and change in the nature of language and discursive style used, can be seen as a chameleon identity expressed through bilingual and trilingual language and discursive styles.

Without common rhetoric and semantic meaning, universities have no basis for a common understanding of different cultural positions. Therefore, it is important to understand different discursive styles, as embedded in different groups within the university, in order to understand meaning and avoid misinterpretation of thoughts, concepts and ideas within the university environment. The extent to which differences in cultural position and language are near or far apart depends on the authority of the role, position and identity of the Dean and Vice Chancellor within the institution, mapped to three Cartesian coordinates as follows: (a) the specific authority, mass and position of the academic and professional community of practice within the institution, (b) the hierarchical position and location of individuals with particular identities within the authority and command structures of the institution, and (c) the predominant cultural identity of the institution at any moment in time (i.e. focus on corporate or academic values and positions). These three coordinates will determine the extent of an individual Dean or Vice Chancellor's closeness to, or distance from, an institutional identity and collective cultural position. In many ways the dichotomies of language, meaning and discursive style evident in universities leads to situations, and positions, where language and semantic meaning can often get lost in translation across the various and diverse communities of practice that exist in a university.

## ACADEMIC CULTURE AND MEDIATION OF DIFFERENCE

### *Defining Cultural Polarities*

This chapter has stated that the role and position of Dean and Vice Chancellor sits at the border between different cultural identities. Consequently, the role, position and identity of Dean and Vice Chancellor experiences tensions and challenges because of the inherent dual cultural identity, position and meaning of the roles particularly within post-1992 group of universities in the United Kingdom. This chapter has stated that the dual identity of Dean and Vice Chancellor is a result of the existence of positional polarities within the university organisation. These positional polarities, with all their embedded and inherent cultural identities, need to be reconciled in order for a university to operate in a harmonious manner.

In order to interpret and analyse the polarities that exist in the roles of Dean and Vice Chancellor, and the pressures that exist within these border (Janus-like) roles, conceptual models have been developed. For example, the Pyramid-Diamond Model of Reach, Influence and Tension within the role, position and identity of Deanship in the post-1992 group of universities in the United Kingdom (Elliott, 2008). This interpretative model of understanding defines the horizontal and vertical tensions and challenges that exist in institutions, and are inherent in the

role and position of Dean and Vice Chancellor. The Pyramid-Diamond Model may be used to visualise, explain, and interpret, the forces and tensions present within the role of Dean and Vice Chancellor. The model can also be used to gauge the cultural role and position of Dean and Vice Chancellor; and can be used by individual Deans and Vice Chancellors to interpret their own individual position within a particular university organisation.

*Artefacts of Mediation*

The mediation of different cultural positions, and the process of reconciling dichotomous visions, is important within the roles of Dean and Vice Chancellor. The use of language and discursive styles to achieve reconciliation and create a resonance between different cultural positions, and agendas, is also important to these university roles. Deans and Vice Chancellors need to be aware of trends in the university sector which cement and provide a critical cultural mass to the language and identities found within a university.

To mediate different positions Deans and Vice Chancellors may consciously or sub-consciously use the following artefacts of mediation (Elliott, 2008):

– Negotiation: the ability to negotiate positions within the university often through the use of language and discursive styles that resonate with the various stakeholders of the university;
– Mediation: the ability to understand stakeholder positions and identities and to mediate between different communities of practice, to converge different positions and identities within the university;
– Inspiration: the ability to deal with the dual positions and visions that exist in universities and to reconcile these visions;
– Leadership: the possession of an academic or institutional identity as a framework for leading, managing and controlling the various communities of practice within an institution;
– Inclusiveness: the ability to rationalise dual positions and identities in different ways, whilst avoiding wearing two hats;
– Recognition: the ability to recognise and understand the various positions and identities found within universities and use artefacts of common understanding to enthuse around a common vision and mission;
– Bridging positions: it is an important characteristic of Dean and Vice Chancellor that different positions in the university, and their inherent polarities, are bridged to avoid conflicting briefs and visions;
– Culturally bi-lingual: the ability to operate within different language sets, discursive styles and cultures, within universities; thus being able to hold several different cultural values and positions within contradictory discourses;
– Symbolic agency: the role and identity of Dean and Vice Chancellor to define and shape the cultural identity of the university and act as a symbolic agent of change (i.e. within the context of agency theory institutions are shaped through the dominant and interpretive activity of its social actors);

– Deliberative democracy: the use of deliberative decision making within forums of discursive democracy to mitigate, and legitimise, positions, and converge different cultural identities within the university;
– Language of reconciliation: using a discursive style and language that resonates a common vision among the different cultural positions and identities within the university;
– Distinctive authority: the ability to avoid conflicting remits and to provide a distinctive and authoritative position and language that provides leadership recognition among stakeholders of the legitimacy of the role of Dean and Vice Chancellor;
– Recognition of complexity: it is important to recognise and manage the complex, and often nebulous, nature of universities and to live with, and recognise, ambiguity and complexity within the university organisation.

In conclusion, being an effective Dean or Vice Chancellor within the modern University environment requires grounded experience and practice in higher education, at all levels of the university organisation. Effective academic management also lies in deliberative contextual reflection on the bivalent identities and dichotomous positions that comprise the complex world of a Dean and Vice Chancellor in both old and new universities.

NOTES

[1] Janus was a Roman deity of gates, doors, beginnings, and endings, depicted with two heads looking in opposite directions.
[2] ESRC award (00 23 7661): *New Managerialism and the management of UK Universities* (1998–2000).

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## AFFILIATION

*Professor Geoffrey Elliott*
*Faculty of Business*
*London South Bank University*
*United Kingdom*

STEPHEN R QUINTON

# 4. RETHINKING LEARNING IN THE 21ST CENTURY

INTRODUCTION

The predominant system of delivering education today is focussed almost exclusively on managing students and the transmission of prescribed knowledge as though they are indistinguishable factors. This traditional, highly inflexible organisational and delivery model is so entrenched that it is often difficult to initiate learner-centred approaches such as small group projects, problem-based tasks, simulation experiences, and tailored, interactive online learning activities.

Individuals and groups want a say in what and how they learn, and rather than conform to institutional constraints, students prefer to define their own learning agendas and independently engage in the learning process at times and in places of their own choosing. In essence, greater flexibility in accessing learning activities and how and when learning takes place have emerged as important factors in understanding students' preferences.

Even though many universities around the world have introduced online learning as a delivery option, the design of most web-based learning environments is structured around the traditional delivery model and despite the rhetoric by vendors and institutions alike, very few learning technology systems promote pedagogical diversity. Compared to the Internet, people are "meeting" in chat rooms, running Weblogs, engaging in "virtual" networked communities of interest, answering each others' questions on "support" websites (bulletin boards, forums, and Wikis), and sharing resources using peer-to-peer systems: features that typically are not readily available in leading online delivery platforms.

As an example of the assumed benefits of technology, consider the myth of the Learning Management System (LMS) that is employed by many universities around the world to deliver electronic online teaching solutions. Although a relatively recent development, the LMS is now commonplace in higher education.

Current LMS platforms offer comprehensive integrated tool sets designed primarily for ease of use. Although there are many researchers who agree that technology has the potential to expand and improve learning, most efforts to promote eLearning have resulted in little more than a faithful transference of earlier teaching and learning practices to the electronic environment. As a result, what needs to be recognised is that LMS platforms provide only a subset of the components required to meet the learning needs of current and future students.

Aside from their capacity to leverage media in a variety of engaging ways, there is little evidence to support the view that the use of proprietary eLearning software has, by itself, improved teaching and learning. From a technology perspective two

reasons provide insight into this viewpoint: first, once the software has been installed and fully supported, the escalating cost of proprietary software potentially reduces the institution's available IT budget for further research and experimentation; second, there is little or no flexibility to adapt the system to changing institutional culture, disciplinary uniqueness, teaching practices, and student preferences. Add to this the cost of customised in-house development and the risk is to exceed the annual license fees of proprietary solutions.

Despite such limitations, over time increasing numbers of staff around the world have become more sophisticated about the use of educational technology in their teaching as evidenced by the growing acknowledgement of the need to deliver online courses and learning materials that conform to accepted international educational technology standards, which in turn promote interoperability amongst delivery platforms and course content. This emerging awareness has lead to greater collaboration on devising pedagogical strategies for online learning in addition to establishing interoperability for educational delivery systems, technologies, and teaching content through a common standards framework. There is also a growing recognition that isolation from (or avoidance of) the main stream impetus on open standards and open specifications only serves to further drive up costs and restrict student choice.

Where learning in the future is concerned, it is argued that to manage the unimaginable quantities of information that is yet to be generated, as well as to interpret, understand, synthesise, and derive new knowledge requires new curriculum design approaches that interconnect all aspects of the learning process to form highly flexible and adaptable environments where the focus is on the learning needs of the individual.

However, without a thorough examination of the relationships between technology, communication, media, human interactions, and cognitive development, the full power of electronic learning environments will not be realised. For every successive level of understanding and learning aspired to, new and increasingly more complex strategies are required to ensure continued progression towards more higher, more abstract levels of understanding.

The level of flexibility referred to here extends to providing for diverse differences in the preferences, attitudes, learning styles, and technological skills of current, past, and future generations. Ultimately, it is conceivable that we are on the verge of entering into new realms of possibilities that may bring into question the long-accepted role and purpose not just of education as we know it, but also of learning.

While it is difficult to determine the full extent of change over the next five to ten years, there is little doubt that our current strategies for teaching higher order thinking and analysis skills will be insufficient for addressing the complexities of a knowledge-based society. In order to deal with the emerging issues and challenges, new ways of thinking are required that support an increasing need for innovative knowledge creation and advanced information management skills.

This chapter argues that instead of requiring students to follow the same course en masse in the same manner, technology can facilitate active collaboration on

demand whilst permitting learners to pursue their own individual approaches to learning. Technology can also assist teachers to work together to develop and share resources and teaching strategies; and instead of competing for student numbers, technology can permit institutions to cooperate to better serve the needs of students.

## PAST CHALLENGES

In the early 1970s, "Deschooling Society" (Illich, 1971, p. 9) was required reading on most education courses. His concern lay with how schools had become obsessed with curriculum content, and how the system forces students to accommodate this view:

> Many students, especially those who are poor, intuitively know what the schools do for them. They school them to confuse process and substance. Once these become blurred, a new logic is assumed: the more treatment there is, the better are the results; or, escalation leads to success. The pupil is thereby "schooled" to confuse teaching with learning, grade advancement with education, a diploma with competence, and fluency with the ability to say something new.

Even today, where institutionalised learning is concerned students are afforded little option except to acquiesce to the demands of an inflexible, subject delineated, curriculum-based system that grades and categorises them in a recurring cycle of promoting the perceived benefits that are used to justify the structure and goals of what is universally accepted as the "education system". Two seemingly immutable tenets of the current system stand out. First, the division of knowledge into subjects and subjects into curricula advantages the institutional structure in that it can plan how to manage the delivery of education. The problem is that by firmly embedding the notion of knowledge domains within the traditional educational delivery methodology, there is a tendency to design curricula in sequential pathways that constrain learners to a narrow range of options for traversing divergent knowledge domains and so limit the pursuit of interdisciplinary learning. The second tenet is the regimentation of time (timetabling), which is an effective (industrial) tool for coordinating and managing learners' and teachers' activities. Ultimately, timetables restrict the learning experience to arbitrary time segments and force learners to switch from subject to subject at set intervals, oftentimes not when learning can or has taken full effect.

The two tenets noted above are indicative of an entrenched educational mindset that is focussed on managing the complexities of transmitting knowledge and the teaching of learners as though no distinction is necessary. This organisational approach to the delivery of education has become so predominant that any exploration of what is possible within the known constraints is erroneously construed as a discussion on pedagogy. The issue here is that neither tenet is remotely connected with effective learning and teaching. The education system is designed for the transmission of prescribed content thereby making it difficult if

not impossible to organise and apply learner-centred approaches to teaching practice. The struggle between the advocates of content knowledge versus those who prefer to promote process skills continues to this day, and is particularly evident amongst learning technologists.

Now, at a time when process skills are increasingly favoured over factual knowledge, skills involving team working, problem solving, evaluation, interpretation, application, and community interaction have become increasingly more difficult to cultivate (Liber, 2004). A preference that has not been addressed is that a growing number of people now articulate a strong preference to define their own learning agendas and engage more actively in the learning process.

No longer should governments, politicians, and institutions set the agenda: individuals and groups want a say in what and how they learn. In essence, greater flexibility in accessing learning solutions and how learning takes place has become an important factor in the minds of learners. Aside from the issue of learning process skills versus factual knowledge, there is also the perennial issue of personal experience versus conceptual understanding observed as far back as Schopenhauer's time (Magee, 1997, p. 6):

> The chief drawback of formal education is that it reverses the proper order of experiences and concepts. Concepts have content and significance in so far as they derive from experience and can be cashed back into it. And the trouble with formal education is that it pre-empts experience in this regard by giving us our first knowledge of many of the most important aspects of life not through experience, from which we then abstract and generalise, but through concepts based on other people's abstractions and generalisations to which nothing in our own experience corresponds or can be opposed. So for all of us, reality is bound to be to some extent impeded by the observations and perceptions of others; and so, therefore, is truly original thinking and insight.

As noted earlier, Illich (1971) suggested (forty years ago) that the best solution for many of our education dilemmas is to have less of it. The notion of "de-schooling of society" was proposed as a way of overcoming the problems of "schooling students to confuse teaching with learning, grade advancement with education, a diploma with competence, and fluency with the ability to say something new". He further challenged society to embrace the notion of "institutional inversion" by seeking out ways to redesign institutions so that they once again serve the needs of all people in respectful ways (Liber, 2004, p. 128).

Even before technology became an influencing factor, Gardner and Hatch (1989, pp. 4–9) proposed that "we need to be able to formulate new questions, and not just rely on tasks or problems posed by others. We need the ability to learn in new ways, to evaluate our own progress and to be able to transfer knowledge from one context to another". For Gardner and Hatch, the most important skill of all is metacognition: a term manifestly described by Thackara (2005) as an understanding of guiding principles, of what really matters, and the ability to filter out the growing flood of information and trivia that matters least.

However, attempts made to date to deliver effective learning solutions are overshadowed by a predominance of seemingly intractable limitations and difficulties. Wardrop (2001) expressed a wide range of concerns derived through examining the design and delivery of online learning solutions over several years, which in this author's view still holds true today:

– most online provisions have not moved beyond the traditional structure of lectures, tutorials, seminars, workshops, units, modules, topics, lessons and represent little more than a digital adaptation of this design approach;
– with some notable exceptions, the only real change being that material is online and the quiz or essay is marked by email or online;
– most educational software (including LMS platforms) are designed using top-down instructional principles where the lecturer determines the learning pathways and controls the lesson structure;
– structured learning (which is highly suited to LMS configurations) is not always conducive to designing flexible learning environments that require an open-ended constructivist approach;
– the misfit between the need for flexible design solutions and the choice of LMS platform to deliver such solutions is especially difficult for discipline areas such as the social sciences, visual arts, film making, and creative writing where an open-ended, highly interactive mix of collaborative versus individual learning is essential. The end result is not always a pedagogically sound approach;
– it is time the "deliverers of education" (lecturers) had a say in software design (including the choice of LMS) that permits the use of effective teaching strategies and assist in achieving the desired learning outcomes for all teaching staff in all disciplines.

Thus, care must be taken not to apply what Thackara (2005, p. 135) refers to as a "pipe and bucket" approach to the delivery of web-based learning. As he contends:

Pipe-and-bucket thinking pervades policy that has to do with learning and education. The British government is even building a "National Grid of Learning" that will connect all schools to the internet. It is a great political metaphor – knowledge for all, just like water or electricity. But it's an outdated model of learning. Learning is a complex, social, and multidimensional process that does not lend itself to being sent down a pipe – for example, from a website. Knowledge, understanding wisdom – or "content", if you must, are qualities one develops through time. They are not a thing one is sent.

Moreover, as Illich (1971, p. 9) warned decades before Thackara, we need to develop institutions and technologies that allow people to engage with each other creatively and autonomously, and for values to emerge from these interactions, since in his words:

…the institutionalization of values leads inevitably to physical pollution, social polarization, and psychological impotence: three dimensions in a process of global degradation and modernised misery… most of the research now going on about the future tends to advocate further increases in the institutionalization of values.

THE CHALLENGE BEFORE US

The task of bridging the transition from traditional learning to individualised (or personalised) human or electronically facilitated learning is fraught with difficulties. As implied, success in meeting the future needs of learners requires radically new teaching methods and strategies. Any attempt for example, to accommodate the skills and preferences of current generation computer literate students will inevitably compel education designers to think entirely outside the box and consider design strategies that are more in line with students' expectations and demands. Such strategies may include the provision of: content interactive features that offer intelligent search tools capable of meaningfully interpreting student input; the capacity for learners to annotate and record ideas online at will and to interactively receive responses normally provided by a human tutor; user defined (manual) and automatically (dynamic) generated alternative teaching material that is relevant to the current context; and "on-demand" or "just-in-time" display of customised content such as interactive assessments and constructive feedback tailored to students' immediate learning needs.

Already there are signs that the fundamental nature of the learning environment is undergoing dramatic transformation, in particular as a result of the rapidly expanding interest in distributed, cloud-based information and communications systems, a growing awareness of the need to teach advanced metacognitive thinking strategies, and an emerging universal access to high quality learning resources irrespective of device, location, and time.

A major challenge facing educationalists is to design and deliver learning solutions aimed not just at representing and navigating complex knowledge structures, but also to devise learning design methodologies that employ software technologies to support the refinement of knowledge creation skills such as decision analysis, problem-solving, conceptual thinking, and metacognition (which is dependent on and thus further complicated by tacit, experiential knowledge). All these skills are valued by individuals, organisations, and society. With these outcomes in mind, the ideal learning environment should assist learners to derive answers to the broad level "meta-questions" of: how do I know what I need to learn?; how do I get there?; how am I progressing?; are my goals still relevant?; what are the best learning models for me?; and, what are the effects of social change, culture, and market needs on my personal learning goals? (Quinton, 2009).

Proficiency in the application of higher order cognitive competencies to the creative construction of knowledge extends well beyond the transmission of prescribed knowledge and the use of traditional problem-solving skills. An acknowledgement of this fact in turn raises the many latent and complex problems of how to accurately and efficiently model and structure knowledge and how to automatically identify the relationships that connect predefined knowledge structures to selected teaching content while taking into account contextual relevance and innate cultural and individual biases. Resolving such complex issues requires an unreserved commitment to: identifying the properties and relationships that can serve to model the structure of targeted knowledge domains to thereby provide access to tailored navigational strategies; devising "intelligent" methods

for assisting learners to manage and transfer their knowledge construction skills; and, the capacity to strategically exploit digitised teaching resources on-demand through the dynamic selection and contextualisation of content.

The social element of active engagement in communities also poses significant challenges, in particular environments in which the relationship between collaboration and consensus-based learning is crucial. There are many occasions where learning is a collaborative activity, involving continual interchange of ideas and views between individuals within a community and between communities, or among individuals and other communities. Some communities may confine their focus to the knowledge and skills of a specific profession or others may span several disciplines or interests united by a common purpose (operating for example, as a multi-disciplinary networked partnership). Alternatively, a networked community may be structured as a single organisation or span many organisations. In light of these added complexities, delivery systems designed for individualised online learning must also address the need to:

– enable productive social interactions in a virtual world;
– identify and provide for the needs of communities of purpose established within broader networks of learners;
– define learners' roles and accommodate both individual and group preferences and behaviours;
– manage the creation and transfer of knowledge to all participants engaged in virtual learning communities; and,
– establish ownership of the knowledge generated by individual learners and groups participating within and across networked communities.

Given the tenor of the preceding claims, learning in the immediate future must demonstrate a clear pedagogical and technological capacity to interweave all aspects of the communal learning process within a loosely structured (flexible) environment whilst not losing sight of the needs and preferences of the individual. In other words, enhancing the quality and effectiveness of learning for individuals and communities are not the only factors to consider. Future learning environments, regardless of delivery mode, should facilitate support for the divergent needs of current and past generations, from pre-school through to senior citizens. These needs apply to the distinctive attributes of: technology use and skills; personal influences, needs, and aspirations; values, perceptions and attitudes; and, current and future concerns. Emphasis must also be given to identifying and allowing for variations in learner behaviours, inter-personal communication skills, preferred learning styles, and intelligence types relative to all generations, interests, and modes of learning. In essence, the personalisation of learning requires an evolving programme of design, experimentation and development augmented by quantitatively and qualitatively distinct modes of support and resources.

Ultimately, the aim is to support the lifelong learning needs and personal development of all individuals through the provision of dynamically facilitated and/or self-directed environments, characterised by flexible, ubiquitous, and/or

mobile delivery at any time and to any place. A systemic focus on learning design (for curriculum and environments) redirects the goal of research towards the creation of new learning strategies while recognising the need for learners to develop knowledge creation skills that demand entirely new perspectives on the purpose of learning. For example, "just-in-time", "incremental", and "on-the-fly" learning provide three models that are well suited to these approaches and offer the advantage of being readily transferable to many contexts (thus raising for example, the possibility of providing professional development to companies, governments, and organisations).

Taken as a whole, it is conceivable that education as we have known it over the past century is poised on the verge of entering into new realms of possibilities that will revolutionise accepted views on the role and purpose of learning. The emergent power of the web and related technologies (Web 2.0 tools for example) makes it both desirable and viable to not only access and manage far more information than previously thought possible, but also to make available learning environments at anytime and anywhere convenient to the learner.

Regardless of the promised potential, we must not neglect the fact that ready access to information does not always equate to being educated, in particular when asynchronous and computer-mediated distance communication modes are employed. It is not enough to simply deliver information and assume learning will result. In practice, the issues and strategies for designing effective learning environments are highly complex and diverse in that it requires an openness to applying a more systemic approach to planning, design, and development. In essence, quality learning is assured through curriculum design wherein knowledge building is the primary focus, not the transmission of content (Liber, 2004).

Already it is evident that the learning technologies and the content design and teaching strategies that have evolved as a result, have pushed the limits of the dialectical learning process and the assumed need to construct knowledge into a hierarchical structure. As knowledge becomes increasingly more complex and the demands of society for deeper and more comprehensive understanding become more prevalent, there will soon come a time when no amount of testing and examination will teach learners the cognitive skills that are required for success in the twenty-first century.

## THE EFFECT OF THE 21ST-CENTURY MINDSET ON LEARNING

In his examination of the current generational uses of information and communication technologies, Candy (2004) concludes (consistent with the arguments presented to this point) that an unexpected yet fundamental reconceptualisation of the purpose of learning has emerged over recent years. The extent of this shift is such that it represents a marked transformation in their expectations of learning and is partly attributable to the fact that young people are amongst the most innovative exploiters of the new mediums, and partly because they will become the next generation of self-directed adult learners. The Millennials (circa 1980 to 2000) for example, have grown up in a world in which

computers, cell phones, and cable television are a normal part of everyday life. They are inundated with information from a multitude of media sources, and are capable of using a wide variety of sources to communicate and locate information. The most favoured of these sources are those that permit relatively instantaneous, concurrent, communication with multiple people, regardless of geographic boundaries.

The Millennials are also a genuinely interactive generation (Mask, 2002). Virtual chat is used to communicate directly with their peers. Chat archives attest to the frequent and topical use of virtual spaces in late-night, peer-to-peer conversations held within their own cultural frameworks (Carmean & Haefner, 2002). Not only are they constantly engaged in interactive communications, they expect it. As a result, they are exposed to an unparalleled flow of customs and ideas that may in fact represent a significant step in the development of human cognitive processing. Kaimal (2003) identifies a number of distinctive factors and characteristics of the current generations that are worthy of further note:

– with 70 million members, Generation Y is almost as large a demographic group in the United States as the Baby Boomers, a group that comprises upwards of 76 million individuals (p. 36);
– many researchers support the position that the Generation X and Generation Y groups came out of a different history and with a different set of coping skills and expectations than earlier generations (p. 37);
– the current 18–24 year old group belong to the best educated generation in American history (p. 38);
– Generation Y youth have been characterised as less cynical, more optimistic, more idealistic, more inclined to value tradition, and more similar to the Baby Boomers than the Generation X group (p. 41);
– young people are one-third less likely than their parents to read newspapers, believing there are quicker, more efficient ways to stay informed (p. 42);
– rather than rely exclusively on traditional tools and teaching strategies, perhaps it is their innovative use of media and technology that may prove useful for assisting young people to learn (p. 47).

Frand (2000) points out that the majority of first year undergraduates have never known life without a computer; are more accustomed to using a keyboard than writing with a pen; and experience little difficulty reading from a computer screen rather than from the printed page. Their priority is to be constantly connected to friends and family, at any time and from any place.

The increasing presence of ubiquitous, highly flexible technologies (hardware and software) has led to a complex interaction between the technology-based classroom activities of today's youth and their out of school and post school experiences. Where young people are concerned, the new technologies constitute a natural part of the environment. As they grow into adulthood, they are going to extend the boundaries of an increasing availability of digital innovations and activities, which may for example include self-directed learning. In the process, new innovations in information and communication technologies need to be

adapted and refined to support the complex learning activities of expanding numbers of diverse and widely distributed networks of online users (Candy, 2004). Designers of learning environments must distinguish between the information-age mindset that is becoming more common among students accustomed to growing up in a globally connected, digitally defined information culture, and the broader, more prevalent industrial age way of thinking.

Candy (2004) further notes that a great deal of attention (both anecdotal and scholarly), has been given to the impact of ICT on the transference effects of young people's leisure time activities to their school-based pursuits. Most serious researchers tend to be more circumspect about the differential effects of digital technologies preferring instead to rely on variables such as class, gender, and cultural background. They point to the fact that the number of highly adept young people with access to the best and most sophisticated technology is not perhaps as great as we have been led to believe. Nonetheless, it is possible to catch glimpses of the self-directed learner of the future. As Young (2002, p. 4, cited in Candy, 2004, pp. 312–13) astutely observes:

> As we shift from a culture of need to know to want to learn, on-line brings new options for learners. But here we speak of the technology, as we understand it and ourselves today. All the limitations of technology are being worked on. Think of the coming generations of young people who have grown up with technology, and see it as second nature. We have to see computers not as something people escape into, but as a way to reach people. It's about seeing the possible in what seems impossible. That's what will make on-line learning work.

While technically it could be argued that students may be ready to engage in the digital world, how can we be sure they are adequately prepared for learning in an electronic environment? Using the Internet (or any other technology) as a medium for delivering teaching does not automatically translate to quality learning outcomes (let alone improve learning outcomes). Taylor (2002, p. 11) reminds us, there are many complex factors to consider:

> In efforts to determine an appropriate approach to online teaching and learning, there is a need to acknowledge the importance of the complex interplay of different epistemologies, modes of thinking and associated types of subject matter in different academic disciplines, different educational objectives for course of study, and not least the extant levels of expertise of the student target audience.

Taylor is not alone in these views. Oliver, Omari and Herrington (1998, p. 121) for example write:

> With any form of information or knowledge, providing students with access to meaningful content, does not guarantee learning, a factor frequently overlooked by developers of WWW based learning materials. What is also important to learning is the level of learner engagement.

As alluded to a number of times, it is not safe to assume that all learners are equipped with the skills and tools to organise themselves, that group learning is always readily available, that group and problem-based learning are easily supported, and that integration with the wider Internet is always possible. Most crucial of all is not to assume that ready access to information translates into effective learning and productive knowledge. Although the Internet is continually providing new tools to support these activities, many contemporary learning delivery platforms are not exploiting them. A mismatch is now evident between what people are doing on the Internet and what online learning platforms provide (Liber, 2004).

CONCLUSION

By using the new technologies in learning and teaching wherever and whenever possible, the opportunity exists to de-institutionalise education (in effect), and rather than separate the values and goals of education from the learning needs and aspirations of the individual, the opportunity now exists to hand control back to learners so that they are empowered to learn, understand, and grow in response to their unique needs, interests, and circumstances.

Moreover, it is conceivable that web-based learning and the search engines that drive the web will be given the capacity to assist humans to form new associations between concepts, to synthesise information to create new knowledge, and to solve problems on demand. In effect, web-based solutions will evolve into intelligent thinking systems that learn and respond to human input. Thus, instead of being a convenient tool for accessing information, the learning solutions delivered through the Internet can assist to enhance conceptual thinking and understanding.

Ultimately, what is needed is for educational researchers to develop new learning technologies attuned to the needs of current and future generations of learners. It is not enough just to deliver information online, new methods for the design and delivery of challenging, highly interactive learning environments are crucial to the success of learning in the coming decades. Already today's youth show signs of a readiness to be much more creative with computers than many educators can imagine. What they now require are the hardware and software that enable the new generations to become fully immersed in seeking out and constructing new knowledge.

The responsibility for implementing change lies not simply with educators and researchers. University administrators and decision-makers also need to consider how the ongoing global pressure for organisational and product innovation to gain international markets as well as to preserve domestic share has placed considerable emphasis on the value of intellectual development. This emphasis is not only directed towards the traditional preparatory education and training system as we have known it, but through an ongoing process of lifelong learning that for many could extend across multiple career paths.

Adding further pressure to the emerging changes in learning patterns are the ecological and cultural imperatives of the global economy that in turn are critical to

the overall quality and success of a lifelong learning programme. Observance of these additional factors not only provides the basis for a sound economic outcome, but ensures sustainable practices in cultural, educational, governmental, and environmental management.

The fundamental factors that strengthen competitive advantage no longer apply to the provision of goods and services, but to the emergence of information processing as the core activity affecting all stages of production, distribution, consumption and management. Therefore, it is important that educational institutions recognise the need for new forms of literacy based upon technological competence, information research skills, and the creative application of higher order thinking skills to solving complex problems. These skills and competencies form part of a concept generally referred to as information literacy. Moreover, these conceptual understandings underpin the new knowledge-based paradigm.

As the knowledge economy expands, so too will the demand for information literacy skills dominate. The era in which it was sufficient for people to possess a minimal standard of literacy and numeracy is drawing to an end. These skills alone will no longer guarantee sustained employment. The significance of this observation is made more apparent when it is considered that as the information sector expands, the need for highly skilled information workers will also increase.

The continued growth in available information will create a demand for new skills and new literacies, which in turn will place new pressures to question the purpose of education and methods employed to deliver quality learning experiences.

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AFFILIATION

*Stephen R Quinton*
*University of New South Wales*
*Australia*

STEPHEN HICKS


# 5. THE FUNDING OF HIGHER EDUCATION
# IN ENGLAND


## INTRODUCTION

This chapter will explore the funding of Higher Education in English universities. This deliberately excludes activities and universities in Scotland, Wales and Northern Ireland, because the devolution of political powers to these countries over the past decade has led to significant differences of approaches to higher education funding. Aggregating at the UK level is therefore not particularly helpful. There is also a limited amount of higher education provided and funded outside of the universities, in further education colleges, but again this in not included in this analysis.

The chapter considers the funding arrangements in place during the first decade of this century. It will examine total income and its major constituent elements, showing the trend over the past ten years, and will then consider each of these income sources in more detail. University sustainability will be considered in the light of cash flow and capital investment and financing. Finally, the challenges presented by the new fees regime (to be introduced in September 2012) in England will be considered.

The data in figure 1 are sourced from the Higher Education Statistics Authority (HESA) finance record, and include all English universities. The actual figures are those reported for the year concerned; income has doubled over the ten year period from £B11 to £B22. As a comparison, the 2000/01 income has been used as a base and uplifted by sector inflation as measured by the Higher Education Pay and Prices Index (HEPPI) published by Universities UK (2010). The resultant figure for 2009/10 is just under £B16. Compared to the actual figure of £B22 we can clearly see that the sector has enjoyed a period of substantial real terms growth in income. To understand how this growth has been achieved, we need to analyse the above total income figures in more detail, as shown in figure 1 and figure 2.

The broad categories shown in figure 2 are those specified by HESA in compiling the finance return but in any event are broadly consistent with the manner in which most universities view their operations – teaching, research and third stream, this latter category being picked up by the imaginatively titled "other income" category shown in the chart.

It can be readily seen that all categories save investment income have increased over the ten year period. We shall now examine each category in a little more detail to understand the broad principles behind each category and the policy issues that may have led to the increases shown.
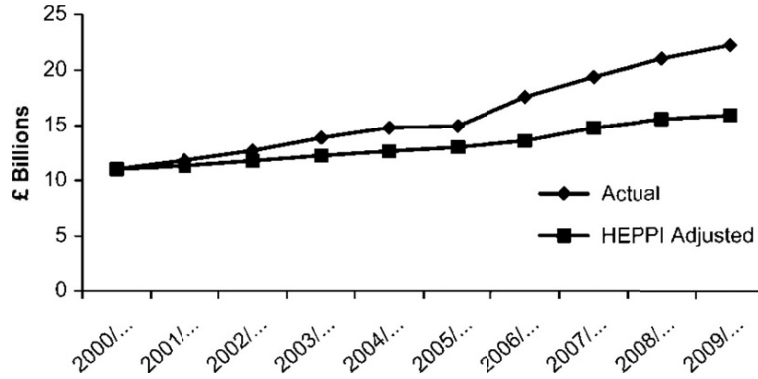
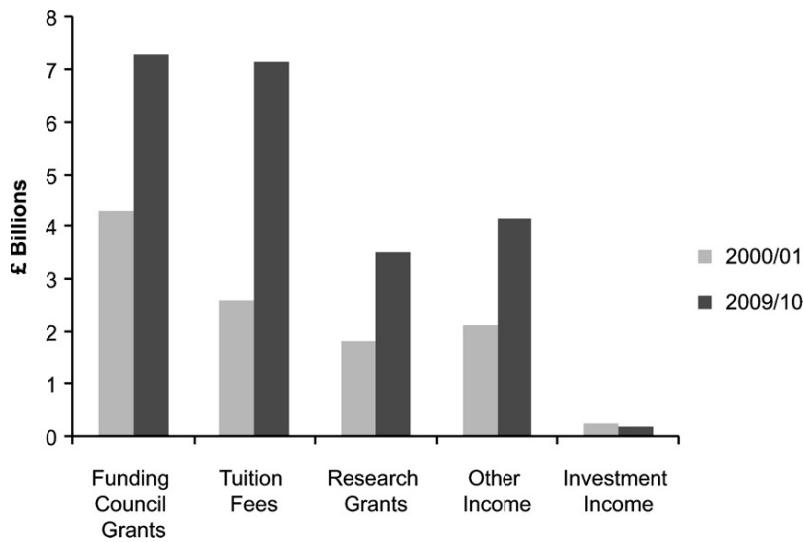*Figure 1. Total income of English universities.*



*Figure 2. Analysis of income of English universities.*

Funding council grants are predominantly grants for teaching and research provided by the Higher Education Funding Council in England (Hefce). Hefce is a quango which operates on behalf of whichever government department has responsibility for higher education – currently the Department for Business, Innovation and Skills. A lesser funding council in financial terms is the Training and Development Agency (TDA), another quango that funds the training of school teachers. Figure 3 compares funding council grants for the two financial years 2001/02 and 2009/10. The categories are those which Hefce use to allocate its grants.

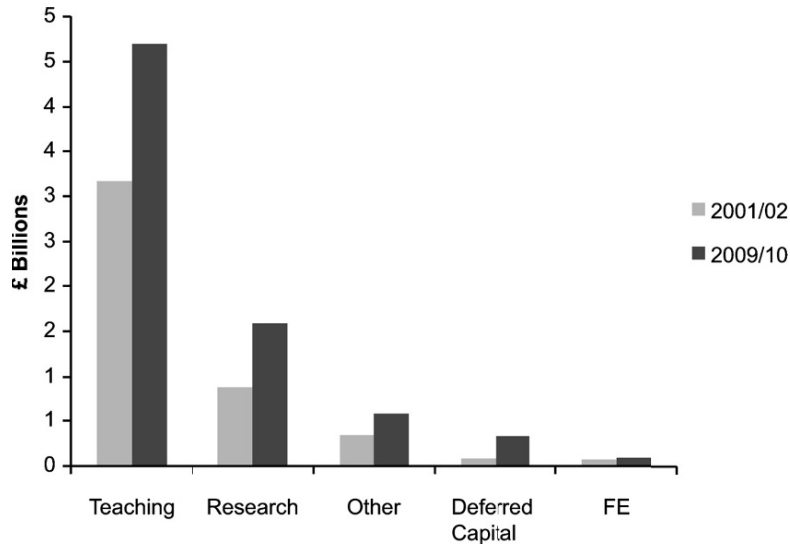*Figure 3. Analysis of income from funding councils.*

An immediate message we can take from figure 3 (in conjunction with the preceding figures) is that teaching and research activities are funded from two different sources, broadly speaking a block grant from the government via funding councils and then income linked to each student or research grant. It can be argued that this approach has provided a measure of stability to the sector, but as the chapter develops we can perhaps see that this stability is about to be disturbed. We shall continue by exploring the income universities earn from teaching.

## TEACHING ACTIVITIES

An initial broad distinction to make is between funding for European Union (EU) students and funding for students from outside the EU. Funding for EU students is managed by Hefce, and reflects government decisions on public sector expenditure and the level of tuition fees to be paid by students. Hefce's approach to funding has been consistent over the years, although altered in detail at the behest of government. The underlying principle that Hefce have used is to calculate how much grant for teaching a university should receive and compare this to the amount of grant a university is actually in receipt of. If the difference between these two figures is 5% or less, no changes are made to a university's grant (save for sector wide adjustments for inflation and other global factors). If the difference is more than 5%, then Hefce will agree a "migration plan" with the university, whereby grant is reduced or fewer students taught to bring the university back within the 5% tolerance band. This approach builds a certain amount of stability into this element of funding; the level of grant is not subject to immediate changes due to relatively small changes in a university's student numbers, and where changes are needed these are often effected over a period of years.

This of course is a very broad description of what is a very detailed process. The underlying calculations take into account student numbers, level and mode of study and subject area, in the latter case recognising that some subjects cost more to teach than others. Hefce deal with this by allocating students into four broad subject groups, weighting each subject group to reflect relative cost. The current groups and weightings are as follows.

*Table 1. Subject groupings*

| Price group | Description | Cost weight |
|---|---|---|
| A | The clinical stages of medicine and dentistry courses and veterinary science | 4 |
| B | Laboratory-based subjects (science, pre-clinical stages of medicine and dentistry, engineering and technology) | 1.7 |
| C | Subjects with a studio, laboratory or fieldwork element | 1.3 |
| D | All other subjects | 1 |

These weightings are informed by cost data collected from the sector. The first decade of the new century has seen grants for teaching increase from £B3.2 to £B4.7 and reflects a government commitment to increase student numbers in higher education and to provide additional funds to a sector that was seen as having been financially squeezed in the previous decade. The government white paper (The Future of Higher Education) provides background information to the funding position in the 1990's and government intentions moving forward (DfES, 2003).

In addition to grant received from Hefce (and in much smaller part from the TDA) universities also receive fee income from EU students. Note that although students themselves may receive grants and/or loans to finance their fees, this does not impact directly on the sector. Undergraduate fees are regulated by the government; by contrast, fees for postgraduate students are not regulated and universities can set these at the level which they believe optimises income, but for the sector as a whole fees from postgraduate students represents a relatively small proportion of overall fee income. Going back to undergraduate fees, for the period up to and including 2005/06 these were based on a fee of £1,000, introduced in 1997, uplifted for inflation. In 2006/07, universities were allowed to charge a fee of up to £3,000 (the so called top up fee) and nearly all universities opted to charge this level of fee. As part of these arrangements, Universities were required to offer a range of bursaries, scholarships and other financial support, and have this package agreed by the Office For Fair Access. The impact of this change can be seen in figure 4.

The new level of fee income was introduced progressively; so by 2008/09 most students would be paying fees at the revised level. The introduction of a fee nearly three times the level of the previous fee might have been expected to have caused some reduction in demand for student places, but as evidenced in figure 5 demand has increased. Note in addition the increasing numbers of students from non UK EU countries.
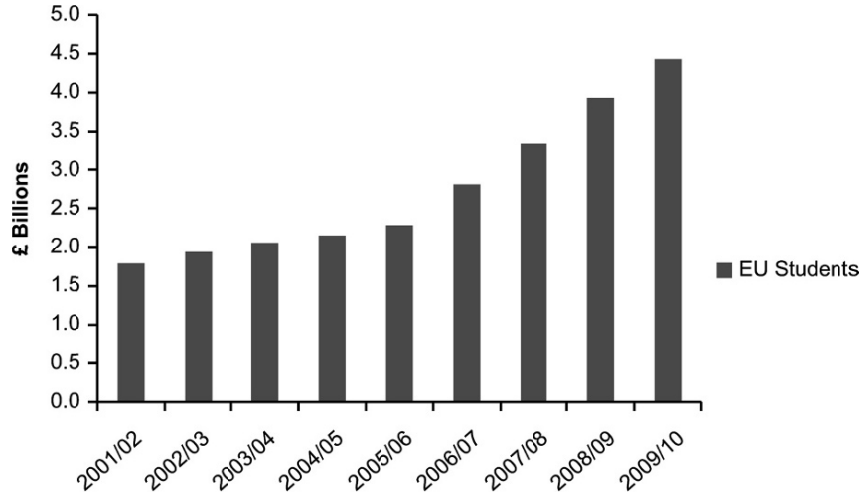
*Figure 4. Fee income.*

A key feature of the revised fee arrangements is that Hefce grants remained unchanged, in essence assuming that fees were at the previous levels. This meant of course that the sector benefitted from the increased fee income with no loss of funding council grant. Taken with the favourable situation on funding council grants, the sector has enjoyed a decade of growth in income from teaching EU students.
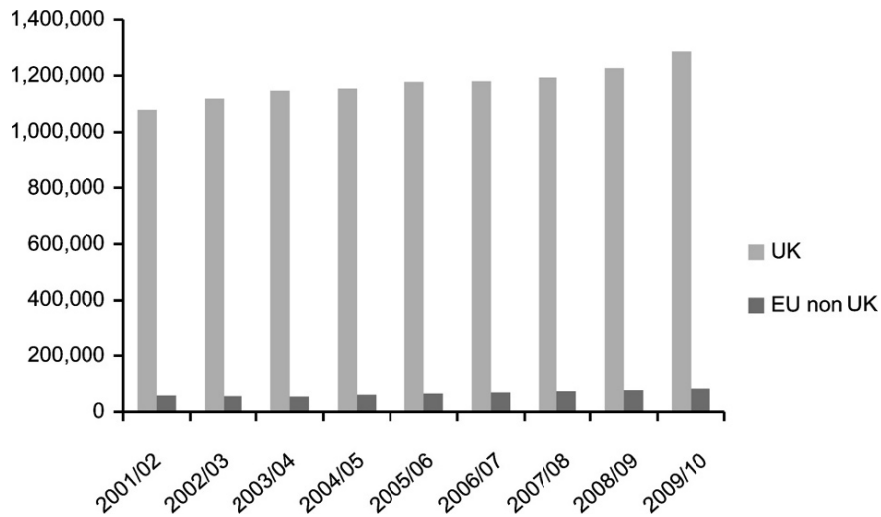


*Figure 5. Full time equivalent student numbers.*

Students from outside the EU do not attract funding council grant; universities receive only fee income for these students, but the level of fee income is set by each university, reflecting their view of what the market will bear and the numbers of students they feel fit in with the university's mission. The growth in income from these students is quite striking, and is shown in figure 6.

In 2001/02, income from these students represented about 7% of sector income; by 2009/10 this has risen to 10% of sector income. A key feature of this income is that it follows the student; with EU students, the current Hefce system for funding teaching provides a measure of insulation from changes in EU student numbers. To exemplify this, an additional 100 non EU students typically yields about £900,000 and a reduction in numbers would mean a loss of income of the same amount. For EU students, the gain or loss of fee income would be about £300,000. Depending on a university's position within the plus/minus 5% tolerance band, it may not lose any funding council grant or might have a number of years to adjust. We shall later see how the new fee and funding arrangements for 2012 onward will change this position quite radically.

A final significant source of fee income for many universities is derived from the National Health Service (NHS), for the training of nurses, midwives, physiotherapist and other staff groups. These are largely based on a national contract negotiated between the sector and the Department of Health, which includes provisions on quality, drop out and prices.
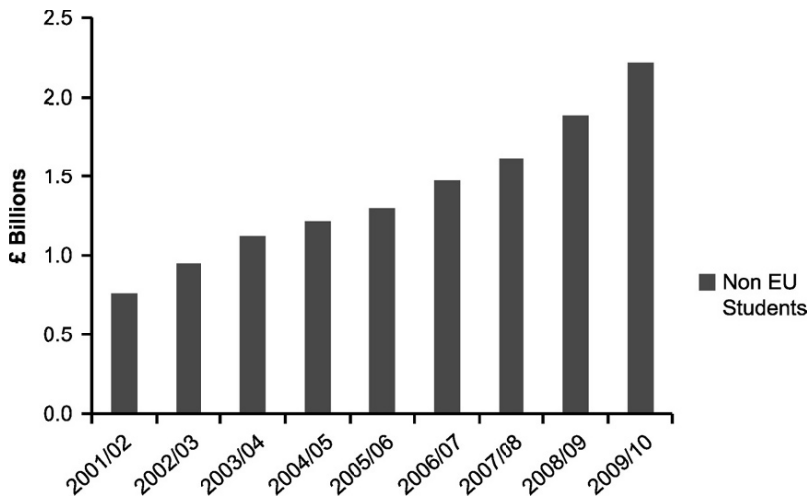


*Figure 6. Fee income non EU students.*

A key feature to understand about the income streams described so far is that Universities by and large have freedom to decide how they spend the income; the fact, for example, that income is derived from a formula based on a number of price

group B students does not constrain the University to utilise the income received for such a group of students. Of course, there may be many interesting debates within a university as to how these funds should be used but there is no external imperative.

RESEARCH ACTIVITIES

Income for Research derives from two main sources, under the "dual support" system. If we refer back to figure 3 we can see that Hefce provide a grant towards research, but in addition to this there is income derived from individual grant sponsors. Both income streams are competitive in that they rely upon some assessment of the quality and price of the underlying research. We shall continue by examining the funding Hefce provide for research.

In 2009/10 Hefce distributed about £B1.6 in research grant to universities. Of this sum, £B1.1 was allocated on the basis of an assessment of quality and volume in research and is termed mainstream QR. The mechanism for this assessment is the Research Assessment Exercise (RAE) which is conducted roughly every five years. The underlying principle is that universities submit research published by their staff which is then assessed for quality by panels of subject experts. The last RAE was conducted in 2008 and table 2 describes the measures of quality that were used.

The funding weightings are prescribed by Hefce and may alter from year to year, so that although the assessed quality of research will not change between RAE's, the amount of funding might. The volume of research is based on the numbers of staff whose work was submitted for assessment – it does not change between RAE's. Hefce have in the past included in the volume measure research fellows and research assistants, but this practice has now ceased. As with teaching, Hefce recognise that different subjects have different costs of research (consider a particle physicist using a linear accelerator compared to a musicologist pouring over an original manuscript of Mozart) and so apply cost weightings as shown in table 3.

*Table 2. RAE quality measures*

| Quality rating (with abbreviated description) | Funding weighting |
|---|---|
| 4* (Quality that is world-leading) | 7 |
| 3* (Quality that is internationally excellent) | 3 |
| 2* (Quality that is recognised internationally) | 1 |
| 1* (Quality that is recognised nationally) | 0 |
| Unclassified (Quality that falls below the standard of nationally recognised work) | 0 |

*Table 3. HEFCE cost weightings*

| | Weighting |
|---|---|
| High cost laboratory and clinical subjects | 1.6 |
| Intermediate cost subjects | 1.3 |
| Others | 1.0 |

There are 67 units of assessments i.e. discrete subject groups, but these are allocated into one of the above cost weightings. The funding for each university will be based on its share of the total Hefce wish to distribute for each unit of assessment taking into account quality, volume and cost weighting. Hefce only provide funding for research with a quality rating of 2* and above; this threshold can change from year to year, as can the funding weighting and the cost weightings. Therefore, although the underlying metrics of quality and volume are stable between RAE's, Hefce are able, by manipulating these factors and the total funding allocated to research in total and to each unit of assessment, to effect significant changes in the grant received by each university and to respond to government direction. For example in 2009/10 Hefce were directed to continue to recognise and respond to the high cost and national importance of STEM subjects (science, technology, engineering and mathematics).

In addition to the mainstream QR described, Hefce also provide funds for the supervision of research students (in departments which receive mainstream funding) and support for universities that receive research income from charities (because charities do not as yet meet the full cost of research carried out for them by universities). A feature of Hefce research funding is that it is concentrated in relatively few universities. In 2001/02, 50% of this funding was received by just 10 universities; in 2009/10 the figure had declined slightly to 49%. In addition, the top six recipients of funding in 2001/02 were the same universities in the same ranking in 2009/10. So although it is true to say that as with funding grants for teaching, this period has been favourable to the sector, it is also true to say that this benefit has been mostly enjoyed by a small group of universities.

In addition to Hefce grants for research, Universities also obtain substantial income by competing for grant income from various sponsors. Figure 7 shows the research grant income analysed over broad funding groups.

It can be seen that the predominant source of research grant income is Research Councils, which are government funded bodies who have a mandate to fund research in a particular area (e.g. Arts and Humanities; Science and Technology; Medicine). For much of this period, it was government policy to increase the amount of research activity; hence the substantial increase shown in the income between the years. The next biggest source is charities, which includes charities such as the Wellcome Trust or the Joseph Rowntree Foundation, followed by UK government bodies which includes research sponsored by both local and central government.

The process for obtaining income from these sources is essentially one of submitting research proposals and hoping that the body applied to recognises the intrinsic value of the research and is prepared to fund it. Sometimes bodies will make calls for proposals in an area they are keen to explore, but applications may be more speculative. A change that has occurred to the costing and hence pricing of these grants is that universities have over the decade developed a process called Full Economic Costing (FEC) that provides a framework for costing grant applications. Before this initiative the costs of the "principal investigator", typically a full time academic employed by a university, were not allowed as part of the costs (on the basis that these costs were already funded by Hefce via QR
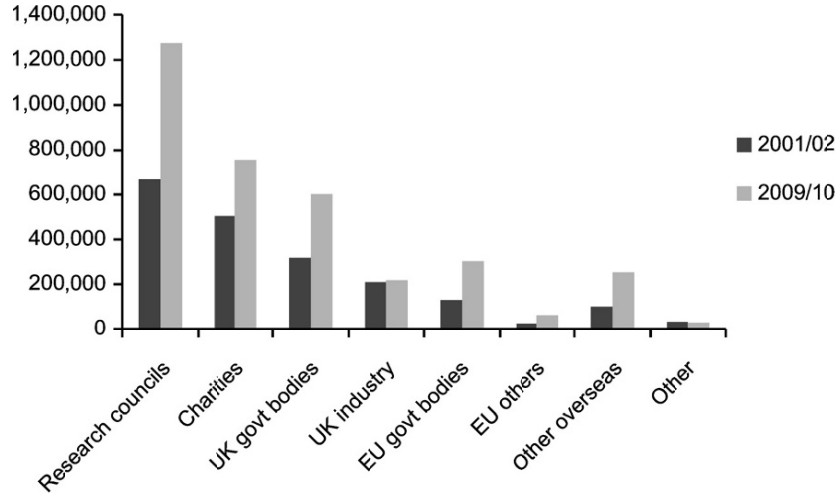
*Figure 7. Research grant income.*

grant under the dual support system). In addition, allowances for overhead costs (e.g. premises; technical and administrative support) were either poorly costed or limited to an arbitrary percentage. In effect this meant that many grants were funded only on the basis of direct marginal costs, not the full cost of the project. The advent of FEC means that Universities now have a recognised audited methodology for costing research proposals. The research councils and other government bodies recognise this approach and hence pay the full cost of any research they commission. Charities are moving towards this approach, but of course other sponsors (for example private commerce and industry) are at liberty to negotiate over the price of research notwithstanding the FEC process.

Just as Hefce QR grant was concentrated in relatively few universities, a similar pattern applies to research grant income as shown in figure 8.
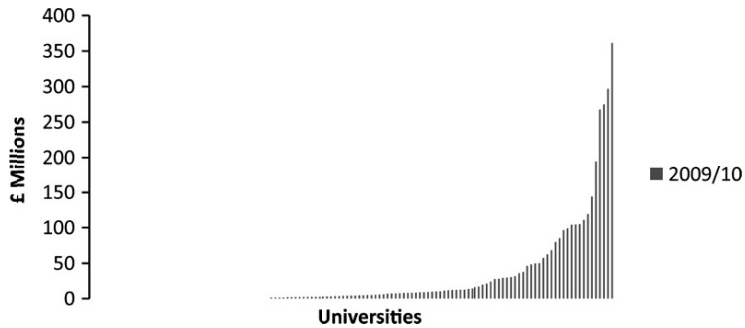


*Figure 8. Total research grant income.*

As with QR grant, nearly half of research grant income is earned by 10 universities. The composition of this top ten has changed little over the decade. In the case of income for teaching, it was observed that universities are free to apply the income earned as they see fit; expenditure does not have to match income. The same provision applies for Hefce QR income, but not for income earned from research grants. Most sponsors, including the Research Councils and major charities require universities to account for the grant income by providing statements of related expenditure, and as a general rule income will not be paid to a university if it cannot demonstrate it has incurred expenditure against the grant.

## OTHER SOURCES OF INCOME

If we refer back to figure 2 we can see that we have dealt with the largest income streams, which as described above relate to teaching and research. This leaves the "other income" category. The two main activities included in here are income from residences and catering and then third stream activities (see figure 9).
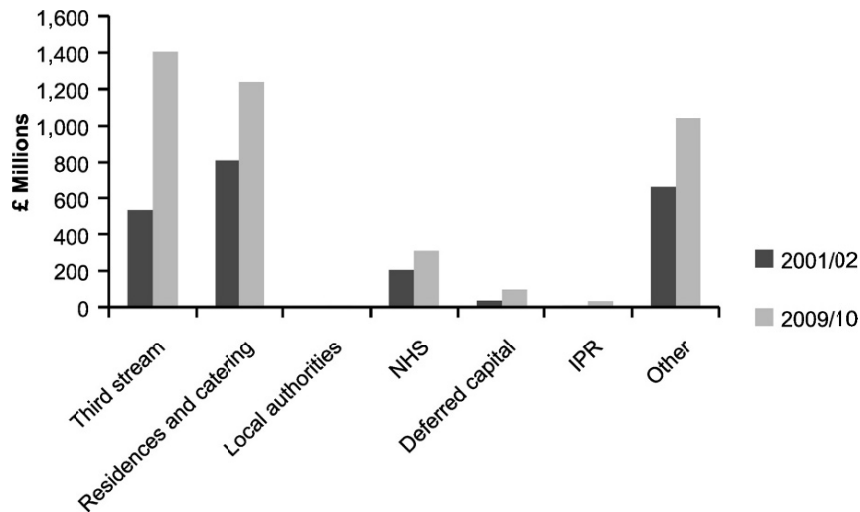


*Figure 9. Third stream and other income.*

Most universities provide some provision for student accommodation and catering; we can see that at the start of the decade this was the largest source of income in this category. Income here has grown but has been subject to increased competition from private sector providers of student accommodation, availability of capital to increase the stock of accommodation (Hefce capital grants are not available for this purpose) and the difficulty and/or desirability of increasing levels of rent. Many universities let student accommodation for conferences during vacation times, also of course selling conference facilities and catering.

The area of real growth has been in the third stream category, which essentially comprises those activities that provide a service to third parties but are not teaching and research. Examples might be testing and assay services; technical and management consultancies; social programmes on behalf of the EU and its various initiatives. The growth in income here has far outstripped inflation as measured by HEPPI and represents substantial real terms growth. Such growth has been encouraged by government, by providing Hefce grants (HEROBAC and then HEIF) with the Lambert Report of 2003 (HM Treasury, 2003) proposing an agenda in particular for the interaction between the private sector and universities in the field of knowledge transfer and collaboration. Some of the activities here are priced competitively and universities are at liberty to make profits and to apply the income as they see fit. However, other activities, especially when sponsored by the EU will be funded on a grant basis, and income can only be drawn down when allowable expenditure has been incurred. A further feature to note here is that many of these EU projects are based on "matched funding" whereby universities have to provide a proportion of the total cost of the project.

Given the impetus given to knowledge transfer by the Lambert review, one might have expected to have seen substantial sums accruing; however, figure 9 shows the relatively small amount of income being generated through the exploitation of intellectual property. Of the total income for 2009/10 of about £M32, 80% was earned by 10 universities; well over half of all universities recorded no income under this category.

## INVESTMENT INCOME

As at the end of the 2009/10 financial year, universities held over £B5 as cash, in either short term or longer term accounts, and over £B3 in endowment assets. This latter category represents donations to universities, which may be applied for general or specific purposes. Universities will naturally invest these funds to obtain an income from them; they do of course have to observe the law around trusteeship and investments.

However, despite the above balances having grown substantially compared to 2001/02 (when the comparative figures were cash and investments of £B1.8 and endowments of £B1.9) investment income has decreased, primarily due to the changes in interest rates in the UK economy. Over the period, the bank base rate peaked at 5.75%, in 2006/07, and was at 0.5% throughout 2009/10. Although universities will invest in a variety of funds, for example equities and bonds, it does appear that the credit crunch of 2008 origin has had an adverse impact on income from this source.

Many universities do not have large endowment balances; indeed over half of the £B3 total is enjoyed by just two universities. In 2003, the DFES white paper suggested that endowments were the way forward in terms of providing additional sources of income for a variety of purposes; endowing academic chairs, investing in new facilities and providing scholarship funds. Hefce sought to incentivise endowment giving with a matched funding scheme announced in 2008. It is

perhaps too early to comment on the long term success of this sentiment and this initiative, but it is true to say that the sector has a long way to go to match the example the USA in this respect. The Sutton Trust (2006) noted that endowments received by universities in the USA totalled over £B14 in 2004/05. Clearly England has a long way to go to match this performance.

At this point we need to move away from current income and expenditure and examine the position on funding non-current, or capital expenditure.

## CAPITAL EXPENDITURE

Although in strict accounting terms each university may have its own different definition of what constitutes capital as opposed to current, or revenue, income and expenditure, the essential point is that capital comprises assets that are expected to have a useful life of more than one year. In practical terms this will include land and buildings, major items of furniture, fittings and equipment and major items of software. Universities have various options when it comes to funding the acquisition of these items. They can generate cash by achieving a surplus on the income and expenditure account; they can borrow; they can use grants of different sorts; they can sell existing assets. If we look at the situation from 2001/02 we can see that universities have used all of these methods.

During the 1990's there were various surveys of the capital estate of universities (for example the KDK and Hunter surveys), which pointed to an estate in need of substantial investment to repair, improve and make fit for purpose. The DFES white paper of 2003 alluded to an £B8 backlog in estate maintenance and Hefce reports in 2002 and 2007 suggested that over £B2 per annum investment in the estate was required. Actual investment has amounted to nearly £B20, as detailed in the figure 10.
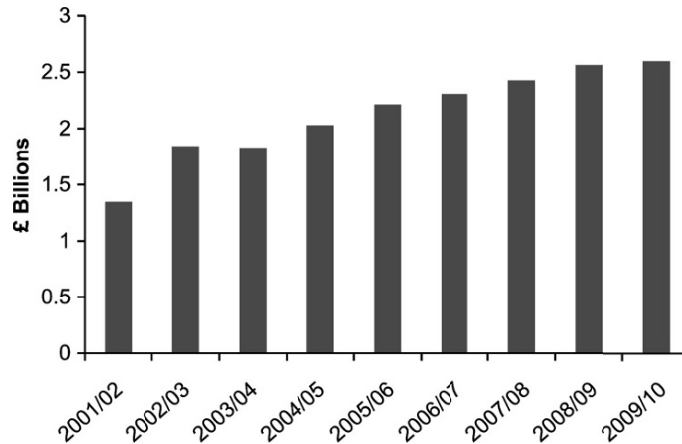


*Figure 10. Capital expenditure.*

During the period, capital grants totalling nearly £B9 have been received. A significant proportion of this will have been provided by Hefce in the form of grants for both teaching and research infrastructure. Over the decade, Hefce provided capital grants over four funding rounds, each covering a period of three years, with total funds allocated increasing with each round, as set out in table 4.

*Table 4. Hefce capital grants*

|  | Teaching £ M | Research £ M |
| --- | --- | --- |
| 2002 | 209 | 600 |
| 2004 | 494 | 900 |
| 2006 | 550 | 903 |
| 2008 | 1,100 | 1,300 |

It can be seen that there has been substantial funding provided by the government through Hefce over this period, in the order of £B6, with the remaining capital grants over the period of about £B3 being from a variety of sources, including central and local government, the lottery commission and charities/philanthropic organisations. However, these grants, substantial as they are, have clearly been supplemented by additional funds to meet the actual investment of £B20 previously alluded to.

The second major source of finance for capital investment appears to be borrowings. In the main these are in the form of secured mortgages but some universities have gone down the route of issuing bonds or securitising income streams. Gross additional borrowings have amounted to nearly £B6, as shown in figure 11.

There is a clear peak in the chart; possibly the financial problems facing UK banks from 2008 onwards have curtailed the availability of funds. We have to be a little circumspect here because it is possible that some of these borrowings have in effect been the re-financing of existing loans (perhaps to gain better terms or an extension on the loan period) and so not all of these funds would have been available to finance capital expenditure. In addition to grants and borrowings, asset sales have yielded about £B2 over the period. If we put all these factors together, then at a minimum the sector has invested about £B2 of cash generated from surpluses on the income and expenditure account; this assumes that all borrowings are fresh injections of funds which, as already discussed, is probably not the case.

This leads us to a conclusion for this part of the chapter. The overall thrust so far has been of a sector that has enjoyed a period of financial growth within a favourable overall funding environment. Cash flow and liquidity are of course important measures of financial health and if we examine cash flow over the period 2001/02 to 2009/10 we obtain the following key statistics.

– Cash generated from operating activities                £B9.1
– Cash invested in Capital                                £B19.2
– Cash and Investments at July 2010 (July 2001)          £B5.4 (£B1.6)
– Endowment assets at July 2010 (July 2001)              £B3.0 (£B2.2)

Of course, some universities have fared better than others, but as a whole the sector has enjoyed nine years of growth and investment and also achieved a substantial increase in cash balances.
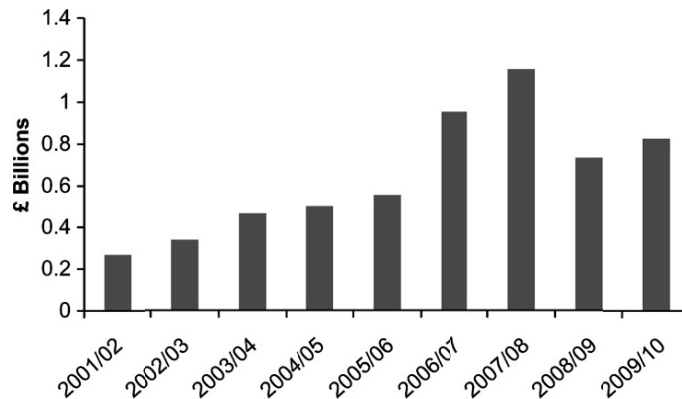


*Figure 11. Gross borrowing.*

THE FUTURE

Two factors have become intertwined in the shaping of funding post 2009/10. When top up fees were introduced in 2006/07, a commitment was given for the (index linked) cap of £3,000 to be reviewed. This review was conducted on behalf of the government under the chairmanship of Lord Browne (Browne, 2010) and began its work in 2009. Of course, the economic backdrop to this review was the "credit crunch" or financial crisis in the banking system that commenced in 2007, one consequence of which has been downward pressure on government spending, culminating in the budget published in March 2011 that contained significant real terms reductions in public expenditure for the next five years. Obviously it is not possible to say the degree to which the findings and implementation of the Browne review were influenced by the financial crisis; what can be said though is that the funding of universities does not exist in a vacuum; it will be impacted by national and international economic and political events.

Browne recommended that the cap be taken off tuition fees, so that universities could set fees at what they believed made economic sense for them. However, if fees were set above £6,000 then a levy was proposed on the balance above this figure at an increasing percentage for each £1,000 slice above the threshold of £6,000. Browne also proposed changing the student loan system, by amongst other things increasing the salary threshold at which loan repayments were due. A key part of Browne's thinking was that funding should follow the student much more dynamically than under the existing Hefce system and also that whatever government funding there was should be directed towards subjects in price groups A and B – essentially medicine, dentistry and physical science subjects. The government's proposals (which were accepted by parliament in December 2010)

broadly accepted the proposals as regards student support and brought part-time students into the system, but set a cap on fees of £9,000, with provisions for Universities charging more than £6,000 to contribute to a national scholarship scheme. At the time of writing, many but not all Universities have opted to charge a fee of £9,000 but with most above £8,000.

These proposals will come into effect with the 2012/13 academic year. Before we consider what impact they might have on implementation, we should also recognise that funding to universities has already been impacted by reductions in public expenditure. We will not detail all of these, but commencing from 2009/10 funding from Hefce driven by government decisions on public expenditure, has resulted in in-year reduction of teaching and research grants, the introduction of student number controls (which financially penalises over-recruitment) and reductions in capital grants. The grants announced by Hefce in March 2011 for the 2011/2012 academic year (the last before the revised fees are introduced) represents reductions in cash terms over the previous year of 8% for teaching and 3% for research, or about £M450 in total. Controls on public sector pay may mean that inflationary pressures are curtailed, but the real terms impact will be somewhat greater than the cash decrease. Clearly this is a different regime compared to the growth previously experienced.

At the time of writing, the detailed method for implementing the revised fee proposals and its impact on Hefce funding is not yet agreed. However, if we follow Browne's proposal that government funding should be restricted to price groups A and B, then the sector would lose about £B3 in teaching grant. This figure is also implied by modelling the impact of revised fees of £6,000; on the basis that the teaching grant would be withdrawn to match the fee income increase, a similar level of grant reduction is arrived at. If of course, student numbers remained at present levels then at worst we would have a simple substitution of one income source (grant) for another (fees). At best, charging a fee above £6,000 up to the maximum of £9,000 might mean a net financial gain, even allowing for the potential costs of the national scholarship scheme and other bursaries etc. agreed with OFFA.

Of course, the brave assumption here is that student numbers will remain unchanged. If they don't, then a university may lose all the funding associated with that student, depending on the process Hefce adopt, although for band D students it is hard to see that there will be any income other than fees from the students. Previously a measure of teaching grant might have been retained, at least for a number of years. Sector wide, about one eighth of total income has been transformed from being relatively fixed to being very volatile, from Hefce grant to fees from students.

Meanwhile of course, expenditures retain the same characteristic of being largely fixed costs that cannot be readily avoided (for example staff salaries; building heating and maintenance; library provision). We should also bear in mind that these changes may have a differential impact across the sector, depending on the mix of subjects in the different price groups and the ratio of income from

teaching to total income. Research on behalf of the University and College Union (2010) highlights potential problems related to this latter point.

A final point to make here is that students will be able to get financial support for part-time study, which may give an advantage to those universities who offer this type of provision. Of course, Universities may seek to grow other income streams, but such growth if it is to replace income lost from teaching has to be not just gross income but profit from income.

As we have seen some of these income streams are student related (residences and so on) and others may only be used towards the purpose for which they were given (research grants) although the implementation of FEC approach to pricing such grants may give some prospect of increasing the contribution to existing costs. It should also be borne in mind that major grant sponsors, the Research Councils, are themselves subject to public expenditure constraints.

These factors would place the emphasis on income growth in third-stream activities, and profit and/or recovery of existing fixed costs from such income growth at that. Operationally this would mean staff and facilities being redeployed from teaching to these new activities, which of course represents a challenge in terms of the ability and willingness of staff, and the suitability of facilities. An alternative would be to seek cost reductions, which would invariably have to include saving on staffing costs.

It seems there are interesting times ahead!

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## AFFILIATION

*Stephen Hicks*
*Senior Lecturer*
*University of Worcester*

PART 3


**MANAGING STUDENT LEARNING AND SUPPORT**

JO SMEDLEY

# 6. MANAGING E-XPECTATIONS

*Developing Knowledge Management Through Market Communication*

INTRODUCTION

The quality of the relationship between a business and its stakeholders has a profound effect on attracting, maintaining and retaining its contacts (Neville et al., 2005). This provides a substantive and productive information base with the aim of improved satisfaction, loyalty maintenance and determination of current and future needs. It also informs enhanced strategic positioning within the market.

Customer knowledge can be a valuable competitive tool. It can be gathered from transactions or gained through customer interaction (Garcia-Murillo & Annabi, 2002). Previous knowledge management work in this area has focussed on the acquisition of knowledge within organisations with the emphasis on helping employees to create and share their knowledge. Customer knowledge here relates to two different aspects. First, the knowledge possessed by the customer about the services being purchased. Secondly, the knowledge that the organisation has about the customer to assist the purchase decision.

This chapter develops the application of an established knowledge management model to customer relationship management. This demonstrates the link between the existing customer knowledge and the onset of the new purchase experience providing a progressive organisational knowledge management process. A case study is then described focusing on the development of pre-university customer relationships at undergraduate level.

LITERATURE REVIEW

Different people learn the same things in different ways dependent on their existing personal knowledge. The effect of existing personal knowledge on knowledge increase is the "Learning Capability" (Dörfler, 2010). However, existing knowledge is only one factor affecting knowledge increase in a more general model. Other elements may include talent, learning, willingness, and attention. As an individual develops their own personal knowledge management techniques, the role of the "mentor" and peer group is influential (Smedley, 2009). Increasingly, the impact of the use of technology on personal and organizational knowledge management development informs continuing professional development (Smedley, 2010). Group-based activities play an important role in knowledge sharing to develop and inform organisational learning. They enable

structured communication and create conditions for sharing knowledge among organisational members (Michailova & Sidorova, 2011).

## The Learning Organisation

Senge (1990) established knowledge as an important element of the learning organisation. Nonaka and Konno (1998) acknowledged the importance of building effective spaces for knowledge interactions to take place, resulting in rich sources of data from normally unconventional approaches to be realised. Supporting informal links is increasingly important for organisations competing on a knowledge basis (Cross et al., 2002).

Customers invariably know more about a business than a business knows about its customers (Butler, 2000). "Customer intimacy" is one of several business strategies that an organisation can adopt for competitive advantage. This can involve capitalising on the information of the customer's previous knowledge to improve customer satisfaction and purchasing performance. Organisations realise that they need to know more about their customers to remain competitive (Davenport et al., 2001). Their effective management of data is a key part of this.

Successful learning organisations possess a learning culture and an organisational climate that nurtures learning and innovation. Organisations that achieve innovative and creative learning provide opportunities for reinvention in their organisation and also in their industry (Hamel & Prahaled, 1994). While training helps to develop certain types of skill, a learning organisation involves the development of higher levels of knowledge. Success lies in investing time in building relations between disparate parts of an organisation (Hamilton-Jones[1] & Svane, 2003). Tangible benefits must be apparent for all involved parties for sustainability.

## Customer Knowledge Management

Offering products or services alone is no longer sufficient. Organisations need to provide their customers with satisfactory experiences (Berry et al., 2002). Reading and addressing "clues" that speak to emotions is particularly important. Emotional bonds between companies and customers often sustain brand loyalty and are difficult for competitors to sever. Creating an internalised meaning and value sustains a deep-seated preference for a particular experience and for one company's product or service over another. Businesses depend on their customers. Placing the customer at the heart of the business builds and maintains an ever closer link with them. This encourages brand loyalty and offers new opportunities for communication and dialogue. Increased knowledge about customers' skills and needs enables businesses to anticipate opportunities to enhance their experience and enhance the service provided to them. With the customer needs as the focus of the business, the introduction of blends of technologies provides a forum to "soften" or even remove the traditional physical boundaries. This has the potential to enhance customer relationships, yielding competitive advantage in the market (Whelan, 2007).

Most organisations aim to maintain an edge in the way that they interact with their customers. They recognise that customers value the interaction process as much as the product that they purchase. Strategies built around offering effective and efficient customer interaction offer new sources of customer value as an alternative to following the usual path of competing on product innovation. Traditional marketing with complementary e-marketing elements highlights the possible transformational effects using digital approaches (Umit Kucuk, 2011). Social customer relationship management (SCRM) provides increased insight, contributing to driving and informing customer centric innovation. The knowledge gained on customer behaviour, attitudes and mood provides benefits throughout the value chain (Woodcock et al., 2011). Such approaches are often difficult to devise or implement, as they require creativity, imagination, hard work and willingness to take risks. However, the rewards are more than worth the effort devoted to them.

*Modelling Knowledge Management*

The SECI (Socialisation, Externalisation, Combination, Internalisation) model (Nonaka & Konno, 1998) provides a theoretical framework for analysis of the development of customer knowledge management. It illustrates a spiraling process of interactions between explicit and tacit knowledge, leading to the acquisition of new knowledge. The importance of relating information to users is highlighted (figure 1), demonstrating their engagement at appropriate stages throughout the process.
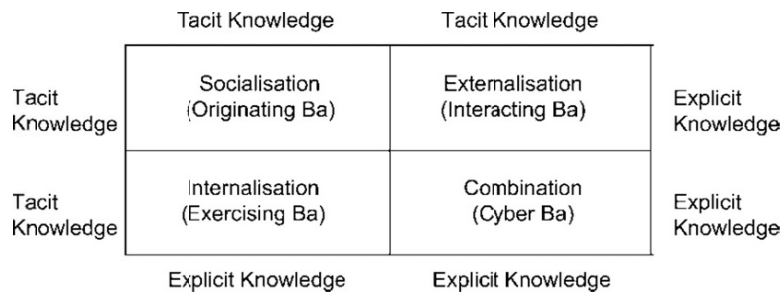


|  | Tacit Knowledge | Tacit Knowledge |  |
|---|---|---|---|
| Tacit Knowledge | Socialisation (Originating Ba) | Externalisation (Interacting Ba) | Explicit Knowledge |
| Tacit Knowledge | Internalisation (Exercising Ba) | Combination (Cyber Ba) | Explicit Knowledge |
|  | Explicit Knowledge | Explicit Knowledge |  |

*Figure 1. SECI model (Nonaka & Konno, 1998).*

The Socialisation stage or "originating ba[2]" is the world where individuals share feelings, emotions, experiences and mental models. It enables sympathising and/or empathising with others and the removal of barriers between self and others. This has often been described as being "thrown into the world", producing "entrainment" and improvisation (Condon, 1976). It yields feelings of care, trust and commitment in the customer. The issues are primarily of relating existing theoretical tacit knowledge to the new everyday practice using established approaches.

The externalization process or "interacting ba" is where tacit knowledge becomes explicit. Here, it is important that all ideas are positively encouraged

irrespective of the initial method of communication. This encourages individuals to engage jointly in the creation of meaning and value. During this phase, the individual becomes "one of the group", accepting standard practices and adopting normal procedures. This challenges individual personalities and their willingness and ability to be reflective in accepted practices and adjust accordingly.

The combination phase or "cyber ba" is where new explicit knowledge is combined with existing information and knowledge to generate explicit knowledge through the organisation. Individuals put their theoretical knowledge into use to reform existing real-life practices and generate new methods of operation. These experiences often demonstrate that existing practices are in place based on experience rather than ideals. This can cause frustration and requires careful management to ensure that positive experiences encourage the customer to continue their development.

The internalization phase or "exercising ba" allows the conversion of explicit knowledge to tacit knowledge, based on experience. Often the most exciting development phase, it provides customers with insights of how their previous knowledge can be used in new situations. Applying theoretical knowledge to real-life practice enables greater individual understanding of concepts leading to enhanced organisational performance.

## APPLICATION TO CUSTOMER KNOWLEDGE MANAGEMENT

This section applies the SECI model (Nonaka & Konno, 1998) to develop the customer knowledge management pyramid (figure 2). This provides a visual representation of three-dimensional customer knowledge management development, linking the organisational knowledge framework with the knowledge development of new customers through various phases of the purchasing and decision process.
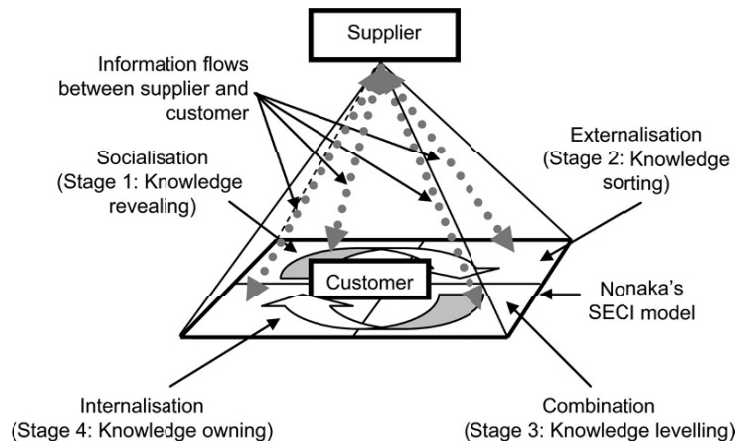


*Figure 2. The customer knowledge management pyramid.*

The provider of the knowledge to be purchased is denoted by the Supplier. Knowledge is manageable when it is embraced and understood. The role of the supplier and their style and empathy of delivery is crucial. This encourages the customer to accept and adopt expected practices, and also that he/she feels able to acquire the necessary skills and is encouraged to display and develop their own creativity. The Supplier focus is on supporting the changing process with vision while also committing time and influence. The customer is placed at the heart of the knowledge development process with the Supplier at the top of the pyramid, without any intentional hierarchy. This emphasises the many roles of the supplier, e.g. salesman/guide/mentor/facilitator, as the prospective customer moves through the knowledge acquisition process.

For each of the four stages of the SECI model (the base rectangle of figure 2), information flows between the supplier and customer (dotted arrowed lines), indicate four three-dimensional interaction "zones". Each zone highlights different aspects of information management as the skill, experience, confidence and needs of both parties change during their developing relationship. This could be due to enhanced links between customers, between customers and suppliers or between customers and external links associated with the purchasing decision. This step-by-step consideration of information transfer during informal customer interactions is useful. It enables the recognition of knowledge surety, identification of areas for enhancement and also acts as an interaction tool. Opportunities for greater exploration are also highlighted to develop closer and more informal relationships, develop loyalty and enhance satisfaction. The emphasis is on nurturing, supporting, enhancing and caring for knowledge to maximise the impact from sharing, ownership and transfer. Each of the zones expects the use of various interaction styles with the crossover points providing opportunities to evaluate progress across the developing partnership. These may be categorised appropriately, e.g. time, the relationship between the parties or collective outcomes achieved.

### Stage 1: Knowledge Revealing (One Way Flow)

When the customer and organisation "meet", they bring knowledge, experience and expectations to the dialogue. The customer is seeking more information, to gain confidence and to enhance their understanding of the product or service. The organisation is seeking more information about the customer to clarify current understanding. It is also offering an appropriate product and level of service, now and for the future. Customer knowledge management changes the nature of the role of the "salesman". From merely providing information about the product, the role broadens into listening attentively to the customer to understand their specific needs. This would also involve gathering knowledge from them about preferences, product appeal and choice and competitor products and services (Garcia-Murillo & Annabi, 2002). This information can be extremely valuable to the organisation, revealing opportunities and insights for new products and informing trends and opinions in the existing market. The knowledge sharing process is continuous

throughout the whole learning experience enabling the collection of some of the most important data on customer aspirations, expectations and experience.

### Stage 2: Knowledge Sorting (Two Way Flow)

As the customer reveals the depth and possible limitations of their knowledge, areas of misunderstanding are identified and greater clarification sought. This may require a range of discussion approaches through a blend of technological and more traditional methods – dependent on the experience of the customer. Additional sources of guidance are provided to assist the customer with their information gathering and interim decision-making. The rationale is not to force a "sale" but rather to assist with the retention process and learning experience of the customer. This approach contributes to the building of an informal and informed relationship. It aims to increase the likelihood of success and provides opportunities to question if further information is required.

### Stage 3: Knowledge Levelling (Two Way Flow)

Both customers and suppliers have a richer understanding of each others' needs and expectations. Examples of this could be an understanding of the type of product available, the ability to engage with the concept and the type of product or service that would be received. Customers adapt expectations to accommodate the available information, supported through the development of an intimacy "bond" associated with the product, service and/or organisation. The organisation has considerable value invested in the customer and can use the information already gained, irrespective of the outcome of each transaction at this stage. This assists in the update of information of current and potential issues and the continued aspiration to enhance customer care, now and in the future.

### Stage 4: Knowledge Owning (One Way Flow)

At this final stage, the customer has gained a considerable amount of information, has ownership and understanding of the product or service and feels secure with their knowledge. They are able to make a decision on whether to proceed to the next level of commitment. Alternatively, they may revisit the existing information to gain greater reinforcement and security. If the customer decides to move ahead to commit to the next level and purchase the product or service, then the knowledge management cycle is repeated during the next transaction phase. The organisation continues to work hard to maintain the satisfaction level of the customer and increase loyalty. Simultaneously, the customer continues to develop their knowledge of the product to a deeper level to reflect the developing "bond". However, if the customer decides not to commit to the next level, it is important that the organisation reacts positively to this. Reviewing the information gathered in the interim communication progress will inform and support development of its customer relationship management practices.

CASE STUDY: DEVELOPING PRE-UNIVERSITY CUSTOMER RELATIONSHIPS
AT UNDERGRADUATE LEVEL

*Background*

The increasing focus on student satisfaction is a natural development of the emerging consumer market in higher education. The challenge is to develop and maintain positive relationships with students recognising that this has the potential to affect future satisfaction for the duration of their studies (Gaffney-Rhys & Jones, 2008). With increased costs associated with higher education studies, students are more discerning of where to invest their money to get the best returns on their spend. Universities have become increasingly sensitive to perceptions of their "product" among prospective students from a range of information sources.

Applying the customer knowledge management pyramid model was undertaken through the use of a blended learning information system by a Higher Education institution. This enabled students to link with tutors and other students during their preparatory process, through Open Days and post-acceptance/pre-entry. This increased the opportunities for contact and enhancing customer relationship management approaches (Smedley, 2005). The overall aim of the initiative was to encourage the "bond" and "intimacy" between incoming learners and the university prior to physical arrival on campus.

*The Blended Learning Information System[3]*

Prospective students were provided with examples of learning approaches and curriculum content likely to be experienced during their initial university studies. This enhanced the communication "bridge" and encouraged greater learning ownership while also providing the organisation with increased knowledge and awareness of its new learners.

Some of the materials were at an equivalent level to those encountered in learning at school or college with the remainder at initial university level. The information system enabled access to learning through a variety of approaches, e.g. paper, webpages, synchronous discussion forums, asynchronous bulletin boards, telephone and email. Learning components focused on twelve separate study areas, providing a "library" of information. Subsequent feedback informed developments of the existing information and/or new areas. This deliberate step-by-step process encouraged participants to "feel at home" and "settle in", offering reassurance of the level of their learning skills prior to arrival. It also offered opportunities to increase their knowledge and skills in specific learning areas to prepare for future studies.

The system approach was to guide the user through the preparatory learning using the idea of "hold the user by the hand and guide him/her through". The locus of control remained with the student through his/her ability to select the quantity and pace of their work.

Each short learning component consisted of content, a quiz, feedback and a reflective diary. The reflective elements were particularly important to encourage

greater ownership and reflection by students as a contribution to their continuing professional development process. All responses during the course were stored and contributed to an overall individual diagnostic study skills profile.

On completion, the system provided an overview of each learner's study skills capabilities, giving tutors an enhanced understanding of their learners' abilities and developmental needs prior to their physical arrival for study. This enabled more focused help in directing study for the future, for example through appropriate tutorial groupings reflecting students' stronger and weaker areas.

### Stage 1: Knowledge Revealing (One Way Flow)

At entry to university, learners are often apprehensive about the new social and learning experiences that await them. Feedback (Smedley, 2005) indicated that students were keen to experience the next stage of their studies. This was a self-confirming process that they could manage the transition to study at a higher level prior to arrival on campus and commencement of the course. This also enabled them to identify any specific areas of development or support which they may require to enhance the transition process. Participant feedback indicated that they valued their engagement with the learning system and the related interactions with fellow students. Knowledge and skills acquired were perceived to be relevant to university study and provided useful support prior to the commencement of formal learning. Few made use of the opportunity to seek backup support by email or telephone preferring to link with tutors and peers through an online forum to clarify their understanding. Interactions focused on the clarification of their learning and organisational arrangements for their future studies.

### Stage 2: Knowledge Sorting (Two Way Flow)

This phase reinforced the expectations of the learners, providing an important step in setting appropriate boundaries for the future learning experience. Feedback illustrated that value of the system. It also highlighted that the links with the peer group and staff provided opportunities to check that expectations were realistic and appropriate. This was perhaps the most important stage of development of the model providing a timely clarification opportunity. At this stage, participation demonstrated that participants were at their most retentive and enthusiastic, being very "hungry" for information to build foundations for their future learning experience. High quality was imperative, providing a powerful "scene setting" for the first stages of the formal engaging process.

The students were becoming more conversant with the blended learning experience and felt more comfortable with participation. The style of engagement enabled students dispersed across the UK and internationally to interact with others. Participation often took place during late evening. The volume of engagement was unexpected, particularly as the study skills content and materials could have been perceived to be unrelated or additional to the direction of their future curriculum. Students indicated that they valued engagement for the learning

support development as well as the opportunities to link with the fellow students at the university. Comments also reflected that the learning system provided a guide for their future studies and gave insight into the type of learning approaches to be experienced. Email contact with staff increased, relating to system content and also with regard to additional organisational queries about their future course. This was a notable positive change in established communication practice.

### *Stage 3: Knowledge Levelling (Two Way Flow)*

In this phase, where students had increased substantially in confidence and feel ownership of their new approach, they had effectively completed their pre-arrival preparation. Students demonstrated that they had become more confident with their newly acquired content knowledge and technological skills and applied both in developing their peer group links. The continued (and increased) flow of interaction with tutors at the university and also among the peer group illustrated the value that the course had provided in customer relationship management. It had also provide greater awareness among students of areas that they needed to work on in preparation for their forthcoming university studies as well as providing a profile of information and technological literacy.

### *Stage 4: Knowledge Sorting (One Way Flow)*

On entering the final phase of the model by arriving at university, feedback from students was universally positive towards their use of the information system. They felt better prepared and informed from learning and study preparation perspectives. The interactions had also enabled them to link with their peer group and feel more confident in asking questions on organisational arrangements. Overall, they welcomed the experience of the approach, which had enabled them to develop a gradual and informal familiarization with the university and its learning expectations.

### OUTCOMES

Overall, feedback at each stage of the customer knowledge management process was useful in guiding subsequent refinements of the system. Reflecting continuing technological development, the focus ensured that information is appropriate in style and content with appropriate technologies for interaction. This is an important aspect of managing expectations effectively and supports the customer knowledge management process.

More extensive knowledge of customers and their needs means that organisations gain an improved understanding of the support needed during the "purchase" process. Developing a positive, productive dialogue with customers is crucial to achieve a successful and continuing dialogue and outcomes. This can also inform the identification of trends relating to current customer behaviours and insight into future market trends. Subsequent re-positioning in the market can result, enabling the organisation to fulfil and maintain competitive advantage.

Knowledge management between a customer and supplier is at a much more informal and personal level than that across and within an organisation. Relationships built through experience and trust over time provide a platform for mishaps and mistakes to occur without retaliation. The knowledge management skills of the supplier are often overlooked and underrated in terms of guiding and achieving the necessary outcomes. The techniques and skills of the supplier in developing a productive relationship is crucial in order to develop a good working relationship with customers. This instills trust and promotes approachability to achieve a "sale" while also maximizing opportunities for an ongoing relationship with future purchase opportunities. Resisting temptation to bombard customers with information, glitz and latest deals is an important part of maintaining a productive and long-lasting relationship. The person-to-person experience is often the one that produces a responsive, flexible and longer lasting outcome with heightened customer satisfaction.

The developed model suggests a process where the organisation takes advantage of the knowledge that each customer brings to knowledge purchase situations. Building in appropriate staged review positions enables progress to be reflected on with appropriate strategies to be devised to ensure an overall positive outcome. Consequently, effective and efficient systems can be introduced from the outset rather than once customers have experienced a settling in phase as part of a seamless progression of knowledge acquisition.

## CONCLUSION

Customer relationship management tools provide opportunities for organisations to provide valuable information and support to attract, maintain and retain new and existing customers. Ensuring that a customer researches and purchases a product is a complex process. This chapter has provided a model for customer knowledge management, using a four-stage approach to guide the support and interaction associated with the purchasing process. The model was applied to post-acceptance/pre-arrival interactions of Higher Education students as they become more familiar with the learning product that they had purchased. These informal interactions are often regarded as being a non-essential part of the process. The outcomes suggest that the informal nature of dialogue, whether face-to-face or through technology, complementing the customers purchase could be the key to developing successful enduring partnerships.

## NOTES

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# AFFILIATION

*Jo Smedley*
*Centre for Excellence in Learning and Teaching,*
*University of Wales, Newport,*
*Newport,*
*NP18 3QT.*

SUSANNAH QUINSEE


# 7. WHERE WORLDS COLLIDE: CHANGING SPACES TO FACILITATE LEARNING


INTRODUCTION

Learning environments, whether physical and virtual, have attracted greater attention over the past 10 or so years (Oblinger, 2006; Strange & Banning, 2001; Weller, 2007). Creating formal and informal learning spaces to engender collaboration between students and to encourage more interactive teaching has become important for most higher education institutions globally because there is a realisation that:

> spaces are themselves agents for change. Changed spaces will change practice (JISC, 2006, p. 30).

Why has this trend become so important in the early stages of the 21st century? The rise in virtual learning environments (VLEs), which contain easy, one-stop access to course materials, is one reason why there has been a changing emphasis on the environment in which students learn. VLEs, by their very existence, enable students to engage with each other, and their tutors, beyond the classroom. This in turn, changes, or has the potential to change the physical or face-to-face classroom experience (Weller, 2007). Other educational technologies too have impacted on the design and requirements of physical space. Personal response systems enable greater interaction between students and tutors; wireless computing and access to the Internet also have the ability to destabilise classroom interaction. Social networking too has the potential to blend the physical and virtual together, for example, the use of social networking to alert the tutor to questions or comments brings real-time interaction facilitated by the Internet into the classroom. Therefore, technology provides us with an opportunity to rethink and reconceptualise the types of interactions we have with students and where we have them.

A further reason for this trend has been the shift to a more student-focused approach to the design of university campuses and delivery of services, which has often been driven by changing student demographics with more part-time, mature and international students (Lea et al., 2003). This has led to an increased demand, particularly in the UK for more student designed spaces. Libraries, in particular, are the most obvious manifestation of this shift, where traditional shelf space and quiet study areas have been replaced with social spaces, cafes, group learning spaces and informal interaction areas or "information commons" (Lippincott, 2006).

But when we talk about "learning spaces" or "learning environments" what do we mean? At its simplest it denotes places where learning can take place. Traditionally such institutionally supported spaces have been campus based and within the lecture or seminar room, with some additional learning or research activity taking place within the library but now

> if you get wireless reception under a tree, there really isn't any need to be in a classroom (Mitchell cited in Chism, 2006, p. 26).

Kolb and Kolb (2005) give a much more complex consideration of learning space as consisting of a number of different dimensions where learners, depending upon their preferences, are both attracted and repelled by the space around them depending upon what activities they are in engaged in.

In this chapter, learning spaces and learning environments are used interchangeably to refer to those places where interactions between learners and staff take place and which are designed to encourage and facilitate such learning and interaction. This may take place virtually or physically. Although learning environments are often more frequently applied to the virtual space here it refers to any space that can be utilised for students or staff to engage in educational activities. However, as noted above, over the last ten to fifteen years changes to technology have had a massive impact on the availability and potential access to educational resources, and this has changed the notions of what spaces constitute learning spaces, where learning takes place and how. This has also broken down barriers between formal spaces, such as lecture theatres, and informal spaces, such as libraries, coffee shops and so on.

However, whilst the opportunities exist to remodel and remould both physical and virtual spaces this poses complex problems in relation to the pedagogic models required to make the most of these opportunities. In the connected classroom is it still appropriate to use didactic methods? Through access to the internet and mobile technologies, the intimacy of the closed classroom and relationship between tutor and student is immediately undermined as the classroom is "without walls". Much of our design of learning environments is based on a set of assumptions around the rigidity of the classroom and the privacy of the experience which limits learning to defined times and places (Chism & Bickford, 2002). How are academic staff responding to the changes within their environments and are they developing new pedagogic models to meet the requirements of their learners? Even more importantly, how are institutions exploring the nexus between the physical and virtual learning spaces that students and staff now occupy on and off campus? Are the technological affordances offered by technology being realised within the classroom to create a different mode of learning and the co-creation of knowledge? Have educators moved from the "sage on the stage" model to the "guide on the side" or is the rhetoric surrounding the potential impact of technology on education much more pervasive than the reality?

This chapter will consider the organisational challenges and opportunities around evolving learning environments and new pedagogies in three areas: firstly, it will consider how learning environments are evolving and looking at the advent

of virtual learning environments and learning spaces; secondly, it will consider some of the new pedagogic approaches that have been developed to meet these challenges and opportunities, whether through changes to face-to-face teaching or within the online world; and lastly the chapter will pose some questions around the management challenges this affords with some examples from institutions that have responded to these challenges, what approaches they have used and pose some suggestions for future developments in this area. The chapter provides an overview of some of the issues and some ideas on how HE management can respond.

## EVOLVING LEARNING ENVIRONMENTS

As noted above interest and development in learning spaces and environments has risen over the past ten to fifteen years. Oblinger (2006) notes three trends that have influenced this; changes to students, changes to technology and understanding of learning. Whilst learning may have always taken place beyond the formal classroom settings, the ubiquitous nature of technology and the internet enables a different kind of learning to occur beyond the classroom and also offers the potential for new learning spaces to be facilitated within university environments (Levy, 2005). Technology has had the ability to destabilise traditional classroom interactions in two significant ways; firstly by making "public" the previously more clandestine and closed environment of the lecture theatre or teaching experience and secondly by shifting the locus of control from the lecturer to the student (Holley & Oliver, 2000). Whilst both of these issues may be beneficial in creating a more student centred learning experience they can be challenging and complex trends for lecturers and institutions to manage.

### *Development of Online Environments*

The rise of VLEs is, arguably, one of the most significant technological factors that has impacted on the view and design of learning environments (Weller, 2007). VLEs enable learners to access course content, communicate with peers and tutors and submit assessments amongst other things all in one place. By providing access to a "one stop shop" for course content, lecturers have the ability to supplement their face-to-face interactions with students as well as encouraging more peer learning and formative assessments. This kind of access to materials and co-creation of knowledge has the potential to then change the nature of classroom interactions as students can access materials outside of the lecture theatre (Clay, 2011). They also have the ability to learn anywhere as VLEs are accessible remotely. However, the grand ambitions for VLEs have not always been realised with them frequently becoming "glorified filing cabinets" and merely a place where lecturers post their PowerPoint slides after the lecture (Ellis, 2008; Stiles, 2007). This sadly does not realise the potential of VLEs and has led to a backlash against VLEs and a search for new technologies to take their place. From a management perspective, VLEs have significant potential in the control and

management of information to students. There are various administrative benefits of VLEs in terms of communicating with students, but there are also advantages in terms of potential monitoring of staff time and assessing the quality of lecture materials which hitherto may have been hidden. Whilst this may sound rather negative and controlling, VLEs were the start of the hitherto private interactions between staff and students becoming available to more public scrutiny.

The advent of social networking has the potential to exacerbate this destabilisation further. Social networking sites, as defined by Boyd and Ellison (2007)

> Allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others (p. 210).

Lecturers can be recorded and the lectures posted immediately on YouTube; students can be in class yet communicating via twitter or Facebook with "classmates" from around the world. The notion of the lecturer as the controller of knowledge crumbles when students can immediately critique the lecture via access to resources online. And why should a student attend a particular lecture at a university if they could access the world expert in the field via iTunesU? These are challenging questions and require a fundamental rethink of how we are not only engaging our students but creating an environment where students wish to learn, learn collaboratively and still respect the knowledge and expertise of the lecturer.

Whilst technology has destabilised the formal learning environment, access to resources and changes in the student demographic have had a profound influence on the creation of social learning spaces.

## *Learning Socially*

One of the most significant changes on campuses over the past ten years or so has been the development of traditional library facilities into social and interactive learning environments, referred to as social learning spaces or information commons (Christie, 2009; Lippincott, 2006; MacWhinnie, 2003). With the increasing amounts of information available to students online and movement from print based resources, libraries have been exploring the development of new kinds of spaces. What is interesting is that the library as a metaphor or signifier of a particular type of learning and/or study is a powerful one for students (Littlejohn, 2005). Despite the availability of material online, student use of library facilities is showing an increasing trend across higher education (Lippincott, 2006; ALA, 2011). Students still regard libraries as the locus for information retrieval and individual study, but they are increasingly looking to engage in other types of study whilst in the library. They want to use technology, so wireless connectivity is vital as well as allowing them to use their own equipment. Changes to the student demographic are partly responsible for this increase in demand. Data from the National Union of Students in the UK, for example, shows that students are now

more inclined to be working part-time and studying full-time. They are used to using the internet in their studies and see it as a vital information resource (NUS/HSBC, 2008; 2009; NUS, 2010).

The development of social learning spaces raises interesting questions for the use of traditional lecture theatres and has the potential to break down the barriers between areas such as the library and lecture theatres. If students prefer to work in groups, then what learning is happening when they are in formal settings, such as lectures, which are less conducive to groupwork? Furthermore, whereas one could argue that VLEs perpetuate the didactic teaching model, the use of technology within social learning spaces actually predicts a new kind of pedagogy, one which encourages collaboration, peer support and sharing.

### *Challenges for Institutions*

What the advent of technology, coupled with changes to student demographics and demands, has demonstrated is that the configuration of much of the current campus is outdated and not fit for purpose. Not only does it facilitate a particular style of teaching but it fails to take into account the opportunities of new technologies and how these could be harnessed to improve student learning.

The introduction of institutionally supported educational technologies, such as VLEs, has been an attempt to address some of these needs, as has the creation of student centred informal learning spaces. But what has not really been considered is the nexus between the physical and virtual worlds. How can we harness technology to create a new kind of learning experience for staff and students?

Traditional learning spaces are relatively easy to manage. Although there are problems with timetabling, creating large scale lecture theatres and delivering to mass audiences is an easier model logistically to support, as is the development of static computer banks to fulfil requirements to offer so much IT access on campus. Traditional quiet library spaces are also potentially "easier" to manage than informal spaces with cafes and wifi. However, if lecturers start to change the way that they teach, they will start to demand more small-scale breakout rooms. They may wish to divide their teaching space into lecture room and then break-out/seminar rooms. This places a huge demand on resources in terms of space as well sophisticated timetabling requirements. Creating break-out rooms with flexible seating is expensive and the space cannot be utilised to such a capacity as a 150 seat lecture theatre. Turning raked lecture theatres into smaller, interactive breakout spaces can cost thousands of pounds. Do the benefits to students justify the cost?

UK Higher Education in particular is facing a big challenge with the rise of undergraduate fees from 2012 which will actually not bring in an increase in investment. Can universities continue to offer programmes taught in the same way and with the same outdated space when students are paying so much more and will therefore expect so much?

Space costs are one of the highest expenditures for universities in the UK and yet utilisation is very low (SMG, 2006). Social spaces may be required by students but how are these spaces managed? Who controls and owns the space? There is a

tension then here between the opportunities offered by technology and the demands from students, with the institutional management of learning space and the ability of institutions to respond rapidly to these changing trends. There has been a tendency in some institutions to create new learning spaces that are crammed with technology, yet this is quickly out of date and the university is left with a large bill and a space that is soon as outdated as a lecture theatre.

Before considering how some institutions have attempted to reconceptualise their use of space, let us consider how the development of some new pedagogical models has occurred hand-in-hand with technology changes which can pose a response to the challenges that technology developments have brought.

## NEW PEDAGOGIC MODELS

The introduction of technology into learning spaces, whether formal or informal, and the increased application of technology to the delivery of learning has led to the development of various theories and pedagogic models to support this. One common theme of these approaches is the exploration of how to increase student interaction and engagement in learning which technology affords (Levy, 2005). Although still prevalent in many institutions, the notion of didactic teaching becomes less tenable when technology can be used to enhance interactions and destabilise the relationship between teacher and student. However, increase in student numbers, particularly in the UK, and changes to that demographic globally, as Oblinger (2006) notes, means that large lectures are still the mainstream way of delivering material to large numbers of students.

Diana Laurillard's work creating her conversational framework (2002) although not directly designed in response to the introduction of technology, does demonstrate a model for improving interaction between teachers and learners.

> This Conversational Framework for describing the learning process is intended to be applicable to any academic learning situation (p. 87).

The framework is characterised by a focus on "the teaching and learning process as an iterative 'conversation'" where learners learn through dialogue. Her model takes account of the potentials for technology to assist with that dialogue as they enable multiple opportunities for engagement and interaction via different media. Technology provides opportunities for new forms of interaction, reflection and participation as it enables learners to express their ideas in a variety of forms and not only converse with teachers but also other learners creating networks of peer support. Laurillard's conversational framework is defined by a socio-constructivist view of learning and heavily influenced by Vygostky and others. Socio-constructivism is often linked to e-learning as it sees this as a natural articulation of this approach (Laurillard, 2002).

Laurillard's work attempts to make a clear case for how technology can support learning. Although not specifically concerned with the learning environment per se she demonstrates how technology plays a key role within the learning process and can shape, beneficially, the interactions between learners and teachers. What this

model does is attempt to redraw or redefine traditional classroom interactions and demonstrate to teachers how they can interact with the space differently to create new forms of interaction.

With the rise in the use of online environments and VLEs to support learning, there has also been an increase in pedagogic models to facilitate and support online interaction. One of the key issues with online delivery is parity or otherwise with face-to-face interactions, which is difficult to replicate online and, indeed, is not necessarily desirable (Collis & Moonen, 2001; Jochems et al., 2004). However, there is a recognised need that supporting students within an online environment takes a specific skill set which is different to that of traditional lecture or classroom based face-to-face interaction.

One of the most well known proponents of a different form of pedagogy is Gilly Salmon who developed a five step model for facilitating online interaction based on her experiences of working with fully distance learners at the Open University in the UK (2000). Her model attempts to overcome the divide between learning online and learning face-to-face by scaffolding a set of activities that facilitates engagement and collaboration. Salmon coined the term "e-moderating" to describe the skills required for tutors working within online environments to engage and enable participation with learners. This was particularly focused around interaction with discussion fora. What Salmon, in a similar way to Laurillard, posits in this pedagogic model is a shift in the role of the lecturer or teacher. Rather than the lecturer taking complete control and being seen as the locus of all knowledge and arbitrator of knowledge, they take a more collaborative role with the student and work alongside them. So both are undertaking a learning journey with the e-moderator assuming the role of a guide or helper, rather than a "sage". What is particularly interesting and potentially destabilising for the traditional academic is Salmon's contention that e-moderators could become the prime supporters of online learners and do not need to be subject specialists. Instead they need to be experts in demonstrating to students how to seek out and synthesise information (Salmon, 2000).

Both Laurillard's and Salmon's models pose questions about the role of the academic within a new learning environment. However, Salmon's design of the e-moderator role creates a particular challenge to traditional academic roles. Although perhaps less in vogue now as the promised dawn of ubiquitous online learning has not been achieved, (Conole, 2004) there are significant management challenges and organisational development issues in relation to the changes in learning environments. An attempt to consider learning environments and design in a more connected manner is given in the work of Beetham and Sharpe (eds) (2007).

In their edited collection of articles on pedagogy and learning design, Beetham and Sharpe (2007) argue that technology demands new pedagogies and together these offer the potential to transform education:

> Technology cannot but influence the ways in which people learn, and therefore what makes for effective learning and effective pedagogy (p. 6).

How we design learning is at the heart of this. Beetham and Sharpe argue that the application of technology to the curriculum can provide new opportunities to

engage learners and create personalised learning contexts. However, they heed Laurillard's introductory advice to focus more on those "human and organisational aspects of teaching and learning than [...] the use of technology" (Laurillard, 2008, p. xvi). We need to be sensitive to the appropriate use of technology, hence their focus on pedagogy rather than technology for technology's sake.

Whilst not specifically focused on physical design, Beetham and Sharpe's work explores a number of different pedagogic contexts and issues that need to be considered when looking at learning design in its broadest sense, including how space, whether physical or virtual, impacts on learning. They see

> design as a holistic process based around the learning activity, in which "already designed" elements such as materials and environments are only one aspect (p. 8).

Instances of where technology has been given prominence over the pedagogical application can be seen in the use of VLEs where research

> consistently find[s] that they promote design approaches that are either based on the content of materials or on non-pedagogical aspects of course administration (Beetham, 2007, p. 27).

It is not enough, therefore, to consider the technology in isolation or merely attempt to replicate existing pedagogies with technology, because the use of technology then changes the learning activity and its meaning (Beetham, 2007). It is essential that the design of learning is at the forefront which will enable appropriate use of the learning environment – both physical and virtual. As Sharpe and Oliver (2008) note in the same volume, application of technology to learning has often been a pragmatic response by academics to constraints of physical space (for example large group teaching) rather than a well thought out approach to redesigning learning to take into account technology affordances. Yet, as Kukulska-Hulme and Traxler (2007) argue, buildings and other physical spaces should be designed for learning so that they are fit for purpose, just as virtual environments should. They go on to argue that there needs to be more emphasis on

> the location and layout of learning and the nature of success of learning and to integrate virtual learning spaces with design and practice (p. 189).

Mobile learning offers great opportunities to rethink the physical learning space and bring the virtual and actual environments together.

Beetham and Sharpe's work creates a compelling argument for thinking about learning in a holistic manner and going back to the basics of learning design when incorporating technology into the curriculum. Their work illustrates how technology is impinging on the physical and virtual to create new pedagogies, but it also demonstrates a disconnect between these environments. Whilst focussing on design is vital, there is little in the work about how certain pedagogic models operate within the classroom setting and how different environments complement each other. Often, it seems that the pedagogy of the online world becomes divorced from the design of physical space which creates a disconnect for learning.

Conole et al. (2004) argue that whilst e-learning literature often purports to be expounding a particular pedagogic theory, that in reality, often the theoretical basis is tenuous. Instead they provide a useful overview of the application of theoretical models to e-learning and propose a new model of learning which

> articulates the key components of existing learning theories, displays their inter-relationships and offers a means of mapping them against each other (p. 21).

By adopting their toolkit approach, different parts of each learning theory can be mapped against learning activities to enable appropriate learning design. Assuming a new approach to learning design is vital

> in the context of e-learning where practitioners seek a clear understanding of the inherent affordances of technology and guidance on how to use and integrate different learning technologies into their teaching most effectively (p. 32).

Conole et al's approach is again indicative, as we have seen above, of a drive for the development of new pedagogic approaches that realise the opportunities for improving learner engagement offered by technology within a diversity of learning environments, and a desire to reconsider notions of blended "learning" and student-teacher interaction.

Changes to learning environments and the introduction of technology into the classroom, whether formally or informally, is prompting a reassessment of associated pedagogical methods. However, most of these approaches do not deal with the nexus between physical and virtual space. What do these pedagogic models mean in practice? And what challenges are there in terms of staff engagement, institutional support and the learner experience? How can academics and institutions keep up-to-date when technology changes so rapidly? These questions will be addressed in the final section.

## MANAGEMENT RESPONSES

As we have seen, there is a rise in new forms of learning environment prompted by advances in technology, and these demand different forms of pedagogy, which indeed have been proposed by a variety of authors. Much of this focuses on making the learner the centre of the educational experience as technology can have the effect of creating more personalised environments and an increased ability for learners to interact beyond the walls of the classroom. However, both the introduction of new learning environments and the resulting changes to pedagogic models are not without their own challenges. Challenges fall into the following three areas:

– strategic attitude;
– staff capability;
– student relationships.

To meet these challenges, information and resources need to be pulled from a variety of sources to understand the complexity of the challenge.

*Strategic Attitude*

Technology is not often understood as an enabler but rather as a means to an end. For example, the introduction of a particular piece of software is often regarded as the "solution" to a particular problem, whereas in reality it is rarely the software that solves the problem. An understanding of the potential of the technology to enact change is vital in successful implementations of technology across organisations (Laurillard, 2002). Nowhere is this truer than within Higher Education. The introduction of virtual learning environments to universities was often seen as a "Trojan horse" for introducing larger scale change. This promise was not always realised however as more attention was paid to implementing the technology than focusing on the resulting change management process in relation to staff and student learning. For example, a VLE will have limited impact if most students learn face-to-face and classrooms are not networked so that the VLE can be demonstrated in class. Many institutions have learnt from this experience, but it needs strong senior management support and an understanding of what is required and the possibilities that technology could provide when it is introduced with a focus on the "softer" aspects of change – staff skills, process change, addressing fears and anxieties and so on. Senior management need to understand that technology is an enabler, not an end in itself. This not only requires an understanding of the benefits but also associated investment.

Changes offered by technology do not come cheap. New learning environments require considerable investment, whether virtual or physical. As the HEFCE Online Learning Taskforce recommended in 2011, institutions need to invest heavily in infrastructure to meet student expectations for face-to-face learning, and then seriously consider the investment required to deliver courses online. Whereas ten years ago, developing online learning was seen as a "cheap" alternative to classroom based delivery, the high profile failure of such ventures as the UK e-University (Garrett, 2004) has led to a rethinking of this approach. High quality online delivery demands considerable resources. Some institutions have outsourced their provision to mitigate the risk, for example the University of Liverpool partnering with the international provider Laureate to deliver its high profile Masters courses, while others have considerable investment behind their development of online courses, such as at the University of Phoenix.

What is required for such investment is a clear statement of the strategic intent of an institution in relation to its use of both the physical and online learning environments available to it. Universities need to seriously consider why students should come to campus at all when so much information can be gained virtually. Clearly articulating a strategic approach to both the estate and infrastructure required to support learning within the institution is vital. Some institutions have chosen to adopt a particular pedagogic model and used this to position themselves within the sector as different. For example, the University of Maastrict has adopted a problem-based-learning approach to the delivery of its curricula and the University of Melbourne has radically restructured its undergraduate provision in a controversial move whereby it only offers six degree programmes at undergraduate level. In an increasingly competitive international market, universities need to

think seriously about what kind of education they are offering and how their commitment to the learning environment reflects this. Development of these approaches was taken after considerable analysis within the institutions about their strengths, market position and knowledge of their student body. The kind of transformations that have been seen at Maastrict and Melbourne could be indicative of the kind of "deep change" that universities need to undergo into order to survive (Quinn, 1996).

However, it is not just at senior management level that an understanding of the strategic importance of learning environments is vital. At the individual academic staff level, the requisite skills are required to deliver the desired curriculum.

## *Staff Capability*

The HEFCE Online Learning Taskforce (2011) also points to staff skills as vital for working within new learning environments. Over the past ten years in the UK in particular there has been a greater focus on staff skills for teaching, mainly through the introduction of ring-fenced government funding to support this. However, ensuring that staff keep up-to-date with new educational technologies whilst at the same time juggling teaching and research careers is a challenge. Technology changes rapidly so is it feasible for staff to keep up with all technological changes? Many lauded and popular technologies are great for personal interactions but can take a while before the pedagogic or learning benefits are realised. The rise in social networking is a good example of this. Not only does exploring the use of Twitter, Facebook etc. within the curriculum require the acquisition of new skills, it also raises more serious issues about the divides between personal and public lives and privacy issues. Should tutors be "friends" with students? Do students want lecturers to be their "friends" on Facebook? (JISC, 2007). Whilst there are arguments for and against each approach, the larger question is how much do universities, as providers of formal learning opportunities, need to enter students' "space" – whether this be via Facebook, mobile phone or other forms of learning?

These raise significant management and academic challenges. With students able to access information from a variety of sources the role of the academic is inevitably changing. Without perhaps going as far as the "e-moderator" as posited by Salmon (2000), the notion of the academic as a facilitator is a persuasive one, guiding students through the digital world. However, much of the "training" for academics is based on them being the expert in their subject, via their Ph.D., so how does this fit with them becoming a guide and facilitator or co-creator of knowledge with their students? For some staff this is not a problem but for others this is highly contentious.

Some institutions have decided to embrace new technologies as part of a demonstration that they are committed to student learning. The Abilene Christian University in the US, for example, has taken an approach to being an early adopter of iPads to demonstrate its commitment to innovation and learning how these can be used in the curriculum in partnership with the students (Perkins & Saltsman,

2010). However, as noted above the introduction of such technologies requires investment in staff development to ensure staff are up to speed with curriculum innovations and can support learners appropriately.

### *Student Relationships*

As we have seen, changing the design of learning environments, changes the interactions with students, whether this be through the informality of interactions via different media or through changing the dynamic within the classroom setting. Whilst this can be positive in terms of fostering student learning and increasing engagement, and, indeed there is much evidence to suggest that changing the physical layout has a beneficial effect upon student learning (Chism, 2006), this can also be potentially destabilising for the roles of both the academic and the learner. From an academic perspective the locus of "control" has shifted and this requires not only new pedagogical approaches but also new skills and aptitudes. Moving to a more learner centred curricula which makes a better use of learning spaces also takes different preparation, design and delivery. Academics may wish to embrace these changes but need institutional support to take the time to rethink and redevelop their learning materials.

For students too the changes can be destabilising, particularly for mature students who have studied previously under a different style of educational delivery. Some students expect lectures to be just that and are disappointed when the lecturer may use the lecture "slot" to do something different because the student can access the material online. Engaging with students to understand their expectations for learning at university level is key to ensuring that they make the most of the learning opportunities offered to them. School-leavers who come to university may not be used to the freedom and independent learning that is required. This in turn requires curriculum change and support for students in navigating new learning environments and inducting them into the university environment (Salmon, 2000).

On the opposite side, students welcome and wish to learn using technology but may be much more technically adept than their lecturing staff (NUS, 2010). This can lead to tensions and frustrations when learning materials are not up to scratch or do not make the most of the potentials offered by technology. Furthermore, there is often a mismatch between the students' technical skill and the ability to apply this to learning situations. The notion of students as "digital natives" as coined by Prensky (2001) has been problematised over the past few years as whilst undoubtedly students are confident with technological devices they are not confident about how to use these to support and engender learning. Rheingold (2010) creates a compelling case for the teaching of "social media literarcies". This is where academic staff play a vital role and the university can also act as a vital preparation for students professional lives, yet universities and academic staff need to be providing the appropriate professional environments and skills in their staff to offer these opportunities.

As we have seen, the introduction of more social spaces is also giving students greater opportunities to engage with social learning, which can be beneficial in the classroom. Some institutions have attempted to integrate this with their formal learning spaces. The key here seems to be to offer students a flexible experience (Dittoe, 2006).

## CONCLUSION

In this chapter we have considered how technology is changing learning environments, both physical and virtual, and in turn, resulting in changes to pedagogic models and delivery. This in turn has led to some considerable questions that need to be addressed at senior management level and across the institution in terms of strategy, infrastructure, roles and relationships with learners. Many of these questions go to the heart of what a university is about – what is the academic offer and how is this communicated to students. Examples of how some institutions have responded have been given to demonstrate approaches and models of how to overcome some of these challenges. Consideration of some of the theories has shown that frequently these focus on one method of delivery or another and illustrative examples of learning spaces often see a disconnect between social or informal space and formal learning environments.

Learning environments will continue to change apace with technology and institutions cannot be expected to respond to every change. However, what institutions need to be doing is creating flexible environments – whether on campus or online – that engender deeper engagement with students and facilitate meaningful interaction with academics. Institutions need to challenge and break down the traditional divides between formal and informal, classroom and online learning and consider pedagogic methods that straddle divides and provide personal engagement of students with academic expertise. By offering opportunities for collaboration and co-creation of knowledge, in whatever environment that may take place, institutions can adapt and grow to the benefit of both staff and learners.

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AFFILIATION

*Professor Susannah Quinsee*
*Learning Development Centre,*
*City University London*

JOHN VOYER, SUSAN BASSI BROWN, NATHAN GAGE
DMITRY KOVALENKO AND TRAVIS WILLIAMS

# 8. A SYSTEM DYNAMICS APPROACH
# TO IMPROVING AN ADVISING SYSTEM FOR
# BUSINESS SCHOOL UNDERGRADUATES

## INTRODUCTION

A School of Business located in the northeast United States annually administered the AACSB/EBI Undergraduate Business Exit Survey to all its graduating seniors. Students evaluated various aspects of their educational experience, and the School of Business took the results very seriously in its efforts to improve its programs. One area that consistently received low marks was advising. The Associate Dean of the Business School wanted to address the situation and see how to improve the system. Through interviews with the Associate Dean and the advising staff, a consulting team compiled information about the School's advising program, and analyzed it using systems thinking and system dynamics. Between the survey results shared and the staff interviews done with the team, the information painted a very clear picture of the systemic nature of the problem.

## STATEMENT OF THE PROBLEM

There were two advisors for eight hundred undergraduate business students, with each advisor responsible for advising four hundred students. The School of Business required some students to seek advising services to register for classes each semester, based on meeting any one of three criteria:

– the student has fewer than 53 credit hours;
– the student has not met the computer proficiency requirement;
– the student has a GPA of less than 2.33.

The students using advising services fell into three categories: those who were required to get advice based on the above requirements, those students who voluntarily sought advice about what courses would best meet their needs, and those transferring in from other departments or universities. According to the advisors, very few students sought them out during the school year, to talk about graduation requirements or to receive other advising support. While the advisors did have other duties, such as generating a newsletter, planning events and other outreach efforts, during most of the semester the advisors had ample time to spend with students. The busiest times for advising services were in the first few

days of the semester (for incoming first year students, add/drop, and transfer students) and at the end of the semester. This later period was dramatically busier because this was when all the students had to register for the next semester.

During the middle of the semester, when few students thought about using advising services, the advisors felt they were able to give good quality advice to the students by spending plenty of time with them and thereby developing personal relationships. They felt that a half hour was the most effective amount of time to spend with a student. In addition to half an hour spent talking with students, they also needed some time before the meeting to prepare by gathering the student's grades and records. The preparation process included manually checking a student's file for records of past visits and checking the information system for what limited information was available there. At the end of the semester, students flocked to the advisors' offices, resulting in long lines that forced many students to come back to the office repeatedly until an opening was available. When the line was too long, the students were unhappy and the advisors experienced high stress. When the end of semester deadline neared, the advisors often had no choice but to spend only about seven minutes with each student. Part of the reason so many students waited until the last four weeks to meet with an advisor were the established procedures in place within the School of Business. The window for the registration period was four weeks because the Registrar issued Personal Identification Numbers (PINs) only four weeks in advance of the deadline for registration. Students were not able to register for classes without a PIN, and the system forced those students who failed to meet the criteria listed earlier to meet with an advisor to receive a PIN.

Many other departments at the university used automated advising tools that were available on the university's "Campus Solutions Enterprise Portal" (CSEP) (Lieberman, 1996). Some examples of these were Prerequisite Check and Degree Audit. In many other departments, students were able to self-advise by using these tools and other materials, such as catalogues and simplified graduation plans. The School of Business advisors considered the curriculum requirements for their school to be relatively complex. It had been their mindset for many years that students were not capable of self-advising, so the School of Business had a policy that ensured most students had to see an advisor to register. Furthermore, in all other departments at the university, faculty members were responsible for advising, and they relied only to a limited extent on staff advisors. The non-faculty staff advisors had a long history with the School of Business, and it was not clear why faculty members were not involved in advising.

Based on the information the consulting team gathered, it determined the problem to be the way the advising system was structured. Although the use of staff advisors and lack of faculty involvement had a long history in the School of Business, the team thought that a solution was possible. It confined its analysis to just one semester, which allowed it to look at the entire advising cycle and see the impact of the system on all parties.

## KEY VARIABLES

Based on the team's interviews, its members identified the key variables in the system.

Advisors:
– total workload;
– advising workload;
– time spent with students;
– quality of advising;
– communications process;
– number of advisors.

Students:
– wait time;
– queue length;
– student expectations;
– students satisfaction;
– number of students seeking advising;
– non-traditional students;
– transfer students.

Faculty:
– faculty involvement;
– complexity of curriculum;
– guidance requirements.

Other:
– time frame;
– automated advising;
– budget.

## REFERENCE MODES

Working with the advisors, the consulting team clarified the relationships among the variables by drawing some of the most important as "reference modes", or graphs of "behavior over time". Its members determined that the five variables shown in figure 1 would act consistently from semester to semester. The team sketched these graphs with its expectations of their behavior against the x-axis of time (18 weeks of a semester). The reference modes highlight the last four weeks of the semester because that is when the largest volume of students entered the system.

Figure 1 shows the graphs that represent the research team's expectations for the dynamics of the most important variables in its model during the 18-week semester.
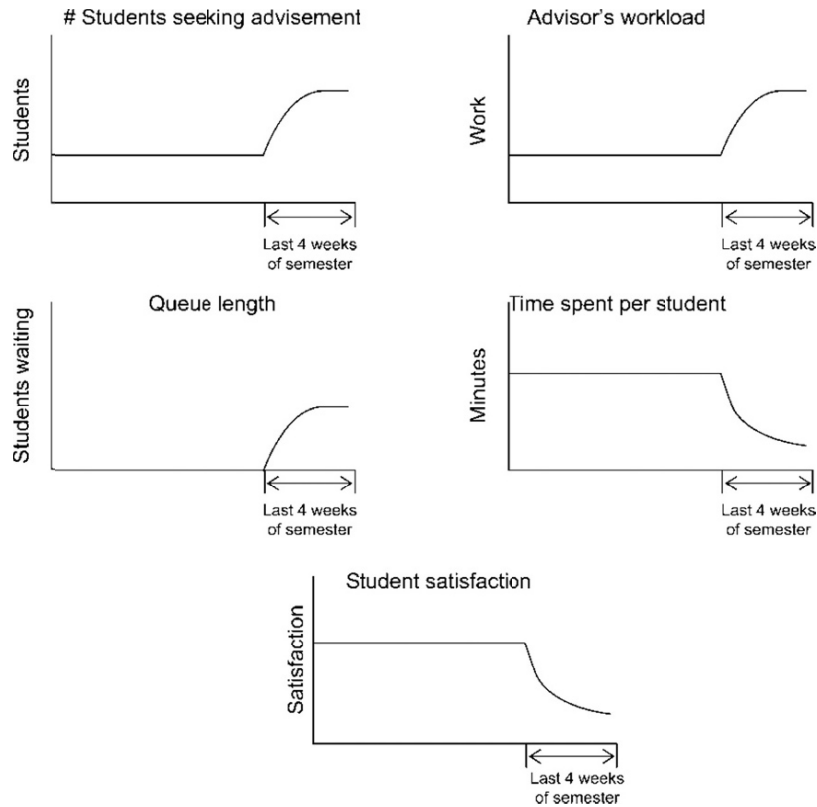
*Figure 1. Reference modes.*

DYNAMIC HYPOTHESIS

Before forming a dynamic hypothesis, the team listed all the potential issues to be resolved. A portion of this list follows:

– understaffing (advisors had too many students to advise);
– not enough time;
– students could not get a PIN early enough;
– faculty members were not knowledgeable about the advising system (and out of that ignorance established curricular policies and practices that made the situation worse);
– students waited until the last minute;
– students were purportedly immature;
– students were looking for parenting, not advising;
– student expectations were wrong (based on high school or prior experience);
– the term "Advising" did not have the same meaning for each constituency— students, advisors, and faculty;

– there was not a good method for communicating the message of advising to students (who, what, where, how, when);
– advising was not spread out enough; advisors could not do it in four weeks.

Most of these theories seemed to blame outside forces (exogenous variables), other people, or factors that were outside the control of the School of Business. The theories arose from mental models that each staff person held. Mental models can sometimes help to find answers, but, more often, they create barriers to learning and to new ways of thinking. In this case, the relatively long history of the system and the staff's traditional roles in the system seemed to limit everyone's ability to examine it in an objective way. Furthermore, the structure of the School of Business did not appear to encourage a lot of interaction among the faculty, the Dean's Office and the advisors in terms of sharing information and solving problems. These structural characteristics would certainly be factors when implementing policy changes and they would cause resistance to change. After considering this list of theories, which were products of team meetings with the advising and administrative staff, the team formed a dynamic hypothesis.

This hypothesis holds that "Student Satisfaction" is dependent on the amount of time students spend with their advisor, a hypothesis supported in the literature (Abernathy & Engelland, 2001). The students should be there because they want to talk to their advisor, not because someone forces them to. In general, if the amount of time spent with the advisor is a half hour or more, the student is satisfied; if it is less, the student is not satisfied. Therefore, "Queue Length" should be the primary indicator to see how much time advisors would spend with a student. If the "Queue Lengths" are short, the students will have plenty of time, at least a half hour with the advisor, and will be satisfied. If the "Queue Length" is too long, they will have less than a half hour, and will be dissatisfied with their advising experience. The most effective way to reduce "Queue Length" would be through a significant change in the requirements that dictate how many students would be in the queue.

## CAUSAL LOOP DESCRIPTION

The Advising Causal Loop diagram (shown in figure 2) has three exogenous inputs and eight loops. The diagram attempts to show how the relationships in the problematic School of Business advising system interconnected and how they interacted. Following are descriptions of the three exogenous inputs and the eight causal loops.

### Exogenous Inputs

Under the School of Business advising policies in effect at the time of this project, a significant portion of the student body was required to pass through the advising system to register for classes. The causal loop diagram represents this with the variable "Students Requiring PINs". This variable is the sum of the four groups of

students who make up this pool, which we represent with the following variable names: "# Students with <53 Credits", "# Students with GPA < 2.33", "# Students Lacking Computer Proficiency", and "# of Transfer Students". This input, which had a positive relationship with the variable "# of Students Requiring Advising", appeared to the advising staff to be exogenous, but in reality it was a policy choice that they, and their faculty colleagues, had made. No one imposed this policy on them.

A second exogenous input showed the effect of time passing during the semester, to measure the effect on the causal relationships. This input started with two variables, "Calendar Time" and "Start of Next Semester Date". Both of these variables fed into "Time Remaining", which was calculated as the difference between "Start of Next Semester Date" and "Calendar Time". This variable started out high at the beginning of the semester and decreased as time approached the start of the next semester. The variable "Time Remaining" had a negative relationship with "Schedule Pressure", showing that as the semester progressed "Time Remaining" decreased while "Schedule Pressure" increased. "Schedule Pressure" had a direct positive relationship with "Queue Length".
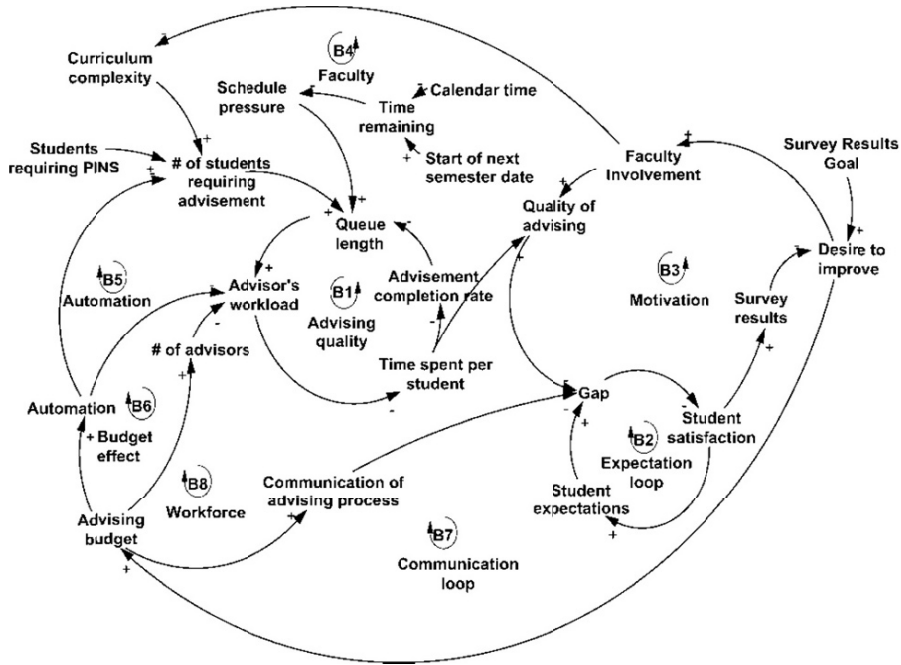


*Figure 2. Causal loop diagram.*

The final exogenous input came in the form of "Survey Results Goal", which was a benchmark target set by the School of Business for results on future exit surveys.

### Advising Quality Loop (B1)

This balancing loop illustrated that as workload increased, advisors sacrificed the quality of advising to increase throughput and reduce the length of the queue. "Queue Length" increased with increases in "Schedule Pressure" and with increases in the "# of Students Requiring Advising". As "Queue Length" increased, it caused an increase in "Advisors' Workload", which represented the total workload per advisor. Increases in "Advisors' Workload" resulted in decreases in the variable "Time Spent per Student". This variable represents the average time spent per student, at any given point in time during the semester. As "Time Spent per Student" went down, the "Advising Completion Rate" went up. This shows that as advisors spent less time per student, their student throughput increased. Finally, to complete the loop, as "Advising Completion Rate" increased, "Queue Length" decreased. This is a result of an increase in the outflow from the queue. Completing this loop shows that it was a balancing loop—an initial increase in "Queue Length" led to an ultimate decrease in "Queue Length".

### Expectations Loop (B2)

This loop represented the dynamics of student expectations relative to student satisfaction in the advising experience at the School of Business during the time of the study. The variable "Student Expectations" represents the student expectation coming into the semester. This variable was the cumulative result of experiences with advising, including any high school experiences as well as any advising experiences from previous years at the university. "Student Expectations" feeds into a variable labelled "Expectations Gap" with a positive relationship. As "Student Expectations" increased, so too did the "Expectations Gap"—the difference between students' expectations and their advising experiences. "Expectations Gap" took into account two different types of inputs. One was the gap between expectations from students regarding communication of the advising process; the other was the gap between the quality of advising expected and the quality received. "Expectations Gap" linked negatively into "Student Satisfaction", showing that as the gap between expectations and experience widened, satisfaction decreased. Finally, to complete the loop, "Student Satisfaction" fed positively into "Student Expectations", showing that as satisfaction increased (or decreased), so too did expectations regarding future advising. This was a classic balancing loop of expectations versus satisfaction.

### *Motivation Loop (B3)*

This loop captured how the results of the student exit survey motivated the School of Business to improve the advising process. As "Desire to Improve" increased, so too did "Faculty Involvement" (albeit slowly). In the course of interviewing the advisors about this project, the consulting team learned that historically there had been very little faculty involvement in the advising process, but after the "Desire to Improve" increased, there had been some initial involvement by the School of Business administration to seek a solution. The School hoped that this increased "Faculty Involvement" would result in an increase in "Quality of Advising", a hope borne out by previous studies (Swanson, 2006). This variable reflects the overall quality of the advising students received. Continuing around the loop, as "Quality of Advising" increased the "Expectations Gap" already discussed decreased, resulting in greater "Student Satisfaction" and ultimately in better "Survey Results". The variable "Survey Results" fed back into "Desire to Improve", closing this balancing loop.

### *Faculty Loop (B4)*

This balancing loop includes parts of the Advising Quality, Expectations, and the Motivation Loops. It represents the effect that "Faculty Involvement" had on "Student Satisfaction" and ultimately on the success in reaching the desired survey results goal. Starting with "Faculty Involvement", the loop shows that increases in this variable resulted in decreases in "Curriculum Complexity". As the team examined this topic, it found that one of the explanations given for the need to require many students to receive advising was the complexity of the curriculum. The rationale was that if faculty had greater involvement in the whole advising process they would see more clearly the complexity of the curriculum and would work to simplify it, thus reducing the need for students to be required to meet with an advisor. A decrease in curriculum complexity would decrease the "# of Students Requiring Advising". With fewer students needing advising, "Queue Length" would decrease. On the same path as described in the Advising Quality Loop (B1), "Advisors' Workload" would decrease, followed by an increase in "Time Spent per Student". With an increase in "Time Spent per Student" there would be an increase in the "Quality of Advising" and we could follow the Motivation Loop around to an increase in "Student Satisfaction" and ultimately to a decrease in "Faculty Involvement". Since an initial increase in "Faculty Involvement" resulted in an eventual decrease in "Faculty Involvement", this was a balancing loop.

### *Automation (B5) and Budget Effect (B6) Loops*

These loops were closely related and captured the effects of "Automation and Budget" on the advising process. The consulting team learned that very little of the advising process had been updated to take advantage of the computing power

available to the School of Business. Advisors still used a manual paper system to track student progress. Other departments at the university used automated advising tools, such as Prerequisite Check and Degree Audit, both of which enabled significant levels of student self-advising. The lack of an automated system for School of Business students to verify their path toward graduation forced them to seek advising, as shown in the Automation Loop. With decreases in "Automation" it followed that there would be an increase in "# of Students Requiring Advising" for the reasons just discussed. Increases in the "# of Students Requiring Advising" resulted in greater "Advisor Workload", which led to a reduction in "Time Spent Per Student". With a reduction in "Time Spent per Student", the "Quality of Advising" decreased, and the students' "Expectations Gap" increased. As "Expectations Gap" increased, "Student Satisfaction" decreased, followed by poorer "Survey Results". As "Survey Results" decreased, "Desire to Improve" increased; this led to more financial resources being allocated toward advising or to an increase in "Advising Budget". Because "Automation" of the advising process would require budget spending, a positive link existed between the "Advising Budget" and "Automation" variables in the model. Finally, increases in "Advising Budget" resulted in more "Automation", closing the balancing loop.

Although the Budget Effect Loop and the previously described Automation Loop have much in common, the consulting team decided to split them because the "Automation" of the advising process had another aspect directly related to the "Advisor's Workload" other than to the "# of Students Requiring Advising". The key distinction between the two is that increased "Automation" not only reduces "# of Students Requiring Advising" but also directly reduces "Advisors Workload". A significant part of the advisor's work consisted of the manual search for individual student records and information about curriculum requirements for the School of Business. During the busy final four weeks of the semester, the advisors often spend several minutes of the seven-minute advising meeting pulling and reviewing paper records. This decreased the "Time Spent Per Student" and ultimately the "Quality of Advising". The remainder of this loop overlaps with the Automation Loop, described in detail in the previous paragraph. This loop was also a balancing loop, since an initial increase in "Advising Budget" ultimately resulted in a decrease in this variable after completing the loop.

*Communication Loop (B7)*

The balancing Communication Loop reflected the ability of advisors to communicate important aspects of the university requirements to students effectively. Effective "Communication of Advising Process" reduced the gap between "Students Expectations" and "Quality of Advising", thereby increasing "Student Satisfaction". An increase in student satisfaction positively affected "Survey Results" which, in turn, had a negative effect on "Desire to Improve", a variable that also reflected the advisor's willingness or motivation to improve

her/his work if the goal for such an improvement was perceived and taken seriously. We show "Desire to Improve" with a positive link to "Advising Budget", since most of the improvements required budget spending. An increase in "Advising Budget" increased the capability of advisors to communicate the advising process to students more efficiently. The interview process revealed that many schools used direct mailing or even phone campaigns to remind students of important deadlines and to prompt them to seek advising. At the very least, administrators can use these tools to inform students of the advising options available to them, and to help set their expectations about what advising resources are available. All of these communication methods required money and this loop showed the positive effect that investment in communication can have on "Student Satisfaction".

*Workforce Loop (B8)*

A final loop was the Workforce Loop, another loop very closely related to the Automation Loop. However, it differed because it showed the effect that increases in the number of full or even part time advisors would have on the system. This balancing loop captured the link between "Advising Budget" and "# of Advisors". An increase in the "Advising Budget" allowed recruiting of more advisors which, in turn, reduced the "Advisor's Workload". As "Advisor's Workload" went down, "Time Spent per Student" increased. An increase of the latter resulted in improved "Quality of Advising", which caused "Student Satisfaction" to rise. Student satisfaction was the main factor driving "Survey Results". These, through "Desire to Improve", fed into "Advising Spending" as described in the previous section. Although included in the causal loop for completeness, the likelihood of hiring a new advisor was slim, and therefore this loop did not play a significant role in the analysis and policy recommendations to follow.

SYSTEM DYNAMICS MODEL

After creating the complete causal loop diagram, the consulting team chose to create a system dynamics model from a section of the diagram that was significant in showing the behavior of the system relative to the dynamic hypothesis. Because the dynamic hypothesis revolves around the idea that the most significant change that administrators could make to improve the system would be a reduction in "# of Students Requiring Advising", the team chose to build a simulation model (figure 3) around this variable and to show the effect on "Student Satisfaction". Most of the data about the dynamics of the system were qualitative, so it was necessary to use lookup tables to model the nonlinear behavior of the system. The model includes two stocks and their respective flows, with each controlled by the various input variables and lookup table functions. The Technical Appendix at the end of this paper discusses the issues related to the use of the table functions.
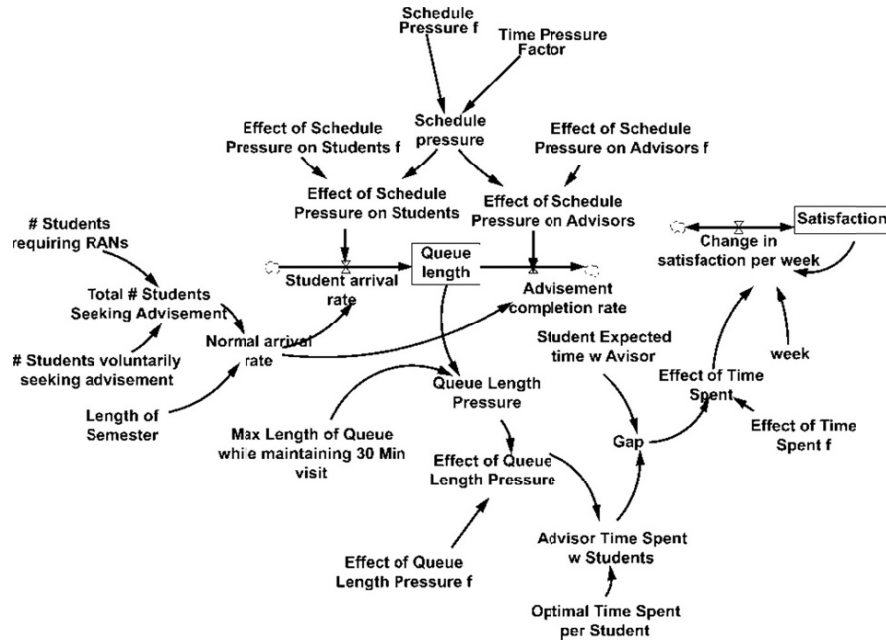
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*Figure 3. Simulation model queue length and satisfaction stocks.*

## POLICY DESIGN AND EVALUATION

The environment in which this system operated was static. The causal loop diagram contains several balancing loops, but no reinforcing loops. The system had been in equilibrium for a long time, resting in a state of dissatisfaction among students towards the advising process. Given the nature of the system, the only way to bring the system out of its rut was to make changes to some of the variables that are exogenous to the model, but certainly within the control of the School of Business. This was a fixable problem, but the first step had to be to expand the recognition of the problem beyond a few administrators and the advising staff. The problem needed to be clarified for all administrators and certainly for all faculty members.

The recommendations were designed to have the greatest amount of leverage throughout the system, and many involved altering the main exogenous variable affecting satisfaction, the number of students requiring advising. That this system was well entrenched in the School of Business was the largest obstacle to making these changes. The advisors were closest to the problem and felt the most pressure. Their area of work received low scores, but they worked hard and got little recognition for the work that they did. Most of the suggested policy changes were changes that someone needed to make, at either the administrative or the faculty level.

This presented a problem because the faculty was not dissatisfied with the system as it was currently structured—in fact, they were not involved in the system at all. As mentioned earlier, the School of Business was the only school in the

university that did not utilize its faculty as advisors. As articulated quite clearly by the advising team, there had been strong resistance in the past to suggestions that faculty become more involved in the process. This created a difficult situation for the advisors. They clearly wanted the system to be changed, yet they were not the ones who needed to act and were not in positions of power over the faculty to compel them to act. Faculty would obviously resist becoming more involved because it would mean more work for them. Although in the end the proposed changes would benefit everyone involved (faculty, advisors and most importantly the students), in the short term it is likely that faculty would continue to resist what they would see as the administration piling more tasks on their already full plates. It would be a tough package to sell to the faculty, but the benefits would probably warrant the sacrifices required of them.

The problem with the old system was obvious: a clogged pipeline created student dissatisfaction. Either there needed to be fewer students in the pipeline, or the School had to modify the system to accommodate more students. There were several areas of opportunity for change; one was to decrease the number of students in the system or to increase the number of advisor-hours by adding staff. Another was to change the structure of the advising process to spread the bulk of the advising over the semester rather than all occurring in the last several weeks.

The consultants thought that several approaches might ease system congestion. The following list of policy recommendations outlined only those that the team thought were most significant in their potential effects. Within the scope of this project, the consulting team chose to model the portion of the causal loop diagram that related most closely to the dynamic hypothesis and that offered the best potential for solving the problem. We list the recommendations in order of strength of recommendation from highest to lowest.

## POLICY RECOMMENDATIONS

The most obvious and easiest way to increase student satisfaction with advising would be to remove some of the students from the system, by loosening or eliminating the requirements for students who need advising prior to registration. This puts more responsibility on the shoulders of the students. The School could do this by decreasing the requirements gradually, or by eliminating a requirement. It could lower the GPA requirement to 2.0, or eliminate it. It could reduce the number of credits to fewer than 25, instead of 53. It could eliminate the computer proficiency requirement. These changes would reduce the number of students in the queue, which would eventually increase student satisfaction with advising. The idea here is to change the work of the advisors from a compulsory and inconveniently timed meeting with the student to a meeting where advisors have more time to work on serious problems or issues and get to know the students better. This way they would be better able to provide real advising rather than a hurried review of a course list and adding a signature at the bottom of a slip of paper. The consulting team felt that many students would prefer to self-advise if given the choice.

If a student's only experience with his or her advisor was rushing through a crowded system at the end of the semester to receive a PIN, then it should come as no surprise that the survey results were as low as they were. This was not a reflection of the quality of the advisors—it was a reflection of a poorly designed system. The system forced students into their advisor's office under the guise of helping them to plan their academic careers properly. Yet when they arrived, they received hurried and unsatisfactory service that amounted to little more than a rubber stamp in the form of a quick look at their schedule, the handing out of a PIN and a final push out the door so the next student could enter. For this reason, we felt that one sure way to raise satisfaction levels among the students was to remove the compulsory aspect of advising and make it instead a resource that students could use when they felt the need. The consulting team ran several policies in its model, to compare the implications of changes in the number of students requiring advising. The team tried to model the change in one advisor's workload. Each advisor had 400 students assigned to her. Of those 400 students, the assumption was that half required advising, based on the four criteria listed in the Statement of the Problem. That would be a modelled policy of two hundred students in the system. Figure 4 shows that the resulting the queue length headed up at about Week 13, and rose to a high of around seventeen at Week 18, the end of the semester. The team ran alternate policies—with one hundred students needing advising, fifty students requiring advising, and finally zero students requiring advising. In the last policy run there were still a few remaining students who voluntarily wish to be advised which accounts for the short queue length. As shown in figure 4, the fewer students in the system, the shorter the queue length becomes. Even with one hundred students still requiring advising, the queue length is only eight or nine at the most, and the increase is much more gradual than at two hundred students.
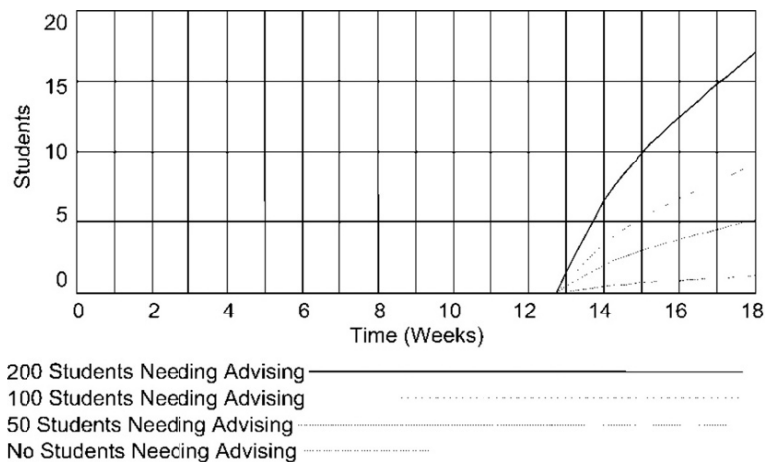


Figure 4. Simulation results of queue length by policy scenario.

The consulting team then ran the same policies, this time measuring Student Satisfaction. The result: as queue length increases, student satisfaction drops markedly. Testing the hypothesis that Queue Length has a direct effect on Student Satisfaction gives the results shown in figure 5—the fewer students requiring advising, the more likely students are to be satisfied with advising, because a short queue length means they will have at least a half hour with the advisor, which we have defined as being satisfactory. Complete satisfaction equals 1, i.e. students are 100% satisfied. Anything less than 1 indicates a level of dissatisfaction; the lower the number, the more dissatisfied the students are. When two hundred students are in the system, satisfaction levels drop more quickly and more dramatically. Far more students are dissatisfied at current assumed levels than at the reduced levels of students in the system.

A second policy recommendation was to simplify the curriculum for the School of Business. One of the problems that prevented increased automation and made the use of temporary help during peak times more difficult was that the curriculum was so complex. As shared by advisors, not only were the requirements for a given year sometimes difficult to follow, there were also several versions of the curriculum in play at any given time, depending on when the students started the program. The causal loop diagram shows a negative relationship shown between "Faculty Involvement" and "Curriculum Complexity". This indicates that as the faculty becomes more involved in the advising process, the curriculum becomes less complex.
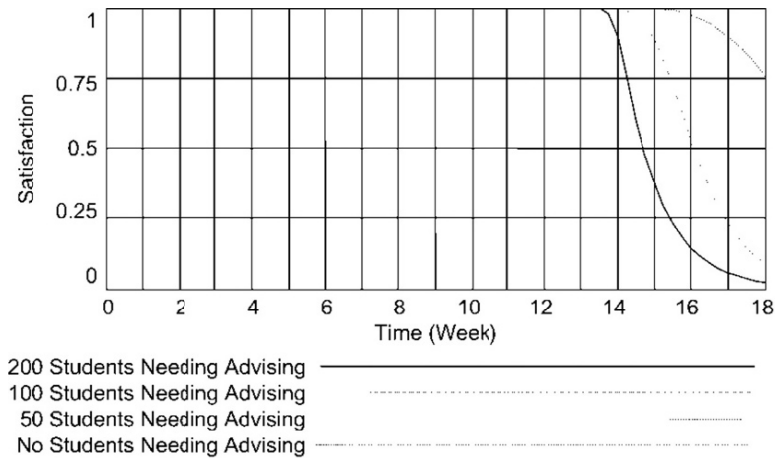


*Figure 5. Simulation Results of Satisfaction by Policy Scenario.*

This relationship is a valid and important one. A large part of the problem with advising at the School of Business was that the faculty were simply not aware of the implications of their curriculum decisions on the advising process. This is because they were not involved in the process at all, so advising was likely not a consideration when new course offerings were being considered. A good first step

to improving the system would simply be to make faculty aware of the advising process and show them the complexities involved in figuring out a schedule that will successfully meet all of the requirements. Exposing the faculty to these complexities would also help in another area that exacerbates the problem—the lack of long-term course scheduling that the administration does in its undergraduate program. One of the frustrations that the advisors expressed is that it was difficult to recommend schedule choices to students when it was unclear when faculty would offer certain courses again, and in which order.

Ultimately, the team felt that simply exposing the faculty to the current situation would not solve the problems. Ideally, the faculty will become involved in the advising process themselves. This could involve everything from opening up class time for the advisors to come in and talk to students, to taking on a caseload of advisees to help guide them through their academic program. Not only would it be easier for the students to understand the rationale behind the curriculum design from the designers themselves, this would also open the faculty up to seeing more clearly some of the logistical effects that their curricular and scheduling decisions have on students. The faculty saw portions of the student body every day in their classes, but seeing this other side of the student experience would help to broaden their horizons and in the end will make the curriculum less complex.

One fear of letting more students self-advise expressed by the advisors was that the students could misinterpret the curriculum and not graduate on time as a result. This would certainly not raise the satisfaction level of students. They would likely feel that the advisors really let them down in permitting them to miss needed classes and would rank them even lower on the senior exit surveys. Although the consulting team understood this fear and saw that the advisors were genuinely concerned about this, it did not feel that this would play out in reality. As the system was structured, most juniors and seniors were able to follow their respective curricula and graduate on time without being forced to seek the assistance of an advisor. The team felt that the same was true for the first and second year students. The advisors would still be available for the students to seek out, but the ball would be in their court. The reduced complexity of the curriculum, along with improved communication about the advisors and their availability, would also help to alleviate these problems.

The result of this policy recommendation would be to reduce the number of students seeking advising. Figure 4 already showed the effect of this (see policy suggestion 1). This policy change would not directly affect the number of students requiring advising, but would be an important step to take if the faculty loosened or eliminated those requirements. The School of Business wanted students to have success without forcing them into a frustrating advising process. Therefore, reducing the complexity of the program should go hand in hand with dropping the advising requirements so that students do not run into problems as they try to navigate the curriculum waters.

One of the jobs of the advisors was to communicate to students what advising was and how to get access to it. The advisors had an opportunity at first year student orientation to address this message with the students, and then follow it up

with the advisors' newsletter and other communications. The advisors felt that their message got lost at orientation because the students were being overwhelmed with so much information at that point that they were not able to retain important facts about the advising process. The consulting team asked the advisors if they could identify one required course that might present an opportunity to institute a regular half hour mini-seminar on advising, during class time. They said that most students took Accounting 110, but that there would be resistance among faculty to permit them to take class time for such a project. Were the faculty to allow such a change, it would get the students to understand and use the advising resources better, with the goal of spreading out the time for demand on advising services.

The consulting team felt that this change should occur regardless of whether or not staff made any other changes. There is no cost to this suggestion and would help to adjust student expectations, a leading contributor to their level of satisfaction. The causal loop diagram shows that "Communication of the Advising Process" led directly to reducing the "Expectations Gap" between "Student Expectations" and the "Quality of Advising". One of the problems that the advisors experienced during the rush of scheduling time was that the students had expectations that do not match what the advisors are able to provide, especially during this busy time of the semester. Students are looking for advice and help in a wide range of areas at a time when advisors are not able to give it. Expectations not being met leads to lower satisfaction with the advising process. Taking time to explain when, and for what, they are available would help to alleviate this source of dissatisfaction.

Increasing the amount of automation would reduce "Advisors' Workload" even if the rest of the system remained unchanged. One of the problems with the old system is that neither advisors nor students had the advantage of using all of the available tools to assist them in examining or creating schedules or tracking progress through the program. While others schools at the university use the degree audit and student records features available on the Campus Solutions Enterprise Portal (CSEP), the School of Business was not making full use of this resource. The consulting team was shocked to learn from the advisors how manual and paper-based the advising process was. Advisors spent much of their time pulling paper files and charting student progress on paper copies of the curriculum that was in effect at the time a particular student began the program. Automation would help to reduce the number of manual tasks performed by the advisors and would help to ease the pressure on the system by increasing the "Advising Completion Rate".

Additionally, increased automation could go hand in hand with the first policy recommendation of reducing the number of students requiring advising. As the university opens up more resources to students through the incorporation of automated records systems, students would be better able to track their own progress (Murray et al., 2000). This will help to ease the fear, discussed earlier, that students will make mistakes that will wind up affecting their scheduled graduation dates. As the university makes available tools such as the degree audit, the complexity of the curriculum will decrease even further.

Also on the student side, if students were able to communicate with the advisors, either by e-mail, phone, or fax rather than a face-to-face meeting, it might be more convenient (especially for non-traditional students) or more time-effective. Student services staff would have to address security issues with regard to giving out PINs, but others have done this, and it certainly could help to increase satisfaction rates at the university. Advisors could respond to e-mails when the queue length was short or non-existent (early, late, during class time), which would give the system much more flexibility. Students could contact advisors at any time that is convenient for them, as long as they understood the delay in response. E-mail blasts to students of reminders to come in for advisement might be helpful in improving the communication process, but now the budget and technology needed to do this are not in place.

Exploring the idea of expanding the length of the advising period yielded several ideas. If the university issued PINs earlier than four weeks before the registration deadline, it could extend the process over a longer period. Staff would have to test this because it is possible that many students would continue to wait until the last minute to register, even if they had an extra six weeks at the beginning of the period, making this intervention not as helpful as hoped.

One solution to the "wait until the last minute" problem would be to establish rolling registration periods, spread throughout the semester. For example, allow seniors to register between ten and nine weeks remaining in the semester, juniors between eight and seven weeks left in the semester and so forth. This would prevent students from waiting until the last minute because of the fear that their desired classes would fill if they waited too long.

As depicted in the causal loop diagram, this policy change would reduce "Schedule Pressure". Because this would increase the window for registration, the schedule pressure would be less intense and spread over a longer period, so there would be a reduction of the queue length at the end of the semester. Additionally, the queue would never reach the unmanageably high levels that it currently does. We are uncertain as to how difficult it would be to get the PINs earlier.

One of the largest limitations to this system was the number of hours that advisors had in their workday. The School could alleviate this by either adding another advisor or involving the faculty directly in advising. Examining the Budget Effect Loop shows that an increase in the "Advising Budget" could create an increase in "Number of Advisors", reducing the "Advisors' Workload", increasing the "Time Spent with Students" and ultimately increasing "Student Satisfaction". Although this would improve the situation, it is not without a significant cost to the School of Business and consequently does not yield the best cost/benefit ratio.

## CONCLUSIONS

The above suggestions for policy change came directly from discussions with the advising team. Although there was a lot of ambiguity about how to solve the problem at the time of these discussions, a couple of points nevertheless clearly came to the surface. The first is that there definitely was a problem with the

undergraduate advising in the School of Business. The advisors clearly described the chaotic situation that they experienced at the end of the semester. They were frustrated that no matter how fast they rushed through appointments with students, they looked out to see the lines growing as students rushed to get the PIN needed to register for classes. Either the students did not want to be there in the first place and the staff rushed them through, or they did want to be there, but the staff did not allot sufficient time to address their real questions or problems. Either way, they were leaving the advising office upset and frustrated. The survey results reflected this, but the stories that they told of this unfortunate situation illustrated it even better.

The second point that rose to the surface is that this was a systemic problem. It was not the result of one unqualified or poorly performing advisor. That would have been a relatively easy problem to solve. This was a deeper problem involving the entire system. There did not appear to be any "quick fixes" for the advising problem.

The third point that became clear is that this problem had been around for a long time. One of the advisors had been at the university for eighteen years, and looking back over that time, she could not remember a time when things had been better. This problem had been around the School of Business for years. It was unclear if the administration and staff had attempted to correct the problem, but it was clearly not a new one. This chronic aspect of the problem was an indication of its deep, systemic nature.

These three aspects of the situation made it an ideal problem to model using causal loop diagrams and system dynamics modelling. The model discussed in this paper does a good job of showing how the causes of low student satisfaction rest with the advising process. The implications of the model and most of the proposed policy recommendations are clear—the number of students requiring advising is simply too high, given the system's capacity. Although not all of the suggestions include this variable, it is probably the most important one. This is a variable with much leverage. Decreasing the number of students who are required to see advisors to register for classes has dramatic effects on the other key variables, most importantly student satisfaction. In conclusion, it is worth repeating the first recommendation—to alter or eliminate the requirements that compel students to seek advising as the best way to improve overall student satisfaction with the system.

## EPILOGUE

So far, the School of Business has adopted two of these recommendations— curricular simplification and faculty advising. The faculty have gone through a detailed restructuring of the School's undergraduate curriculum, placing most courses in a "core" and adding simply defined majors and concentrations to it. They hope that this will improve the advising situation as time passes.

About two years after this simplification effort, an advisor left and, for budgetary reasons, the School could not replace him. This led, for the first time, to

faculty advising. The faculty were very pleased that they had earlier instituted a simplified curriculum, as it eased the burden of their new advising task. Faculty advising has also had the predicted effect of keeping curricular complexity in check. In the context of the present chapter, the Faculty Loop (B4) has operated as described earlier.

Students were apparently pleased as well—the exit survey results after the first year of faculty advising showed great improvement in student satisfaction, with School of Business graduating seniors rating their advising experience the best of any at the university. Those results have been stable ever since.

The School is currently examining the other suggested options, especially changing the criteria for required advising and having students do a greater amount of automated advising. As this chapter showed, both of these options would require fewer students to see the advising staff and faculty advisors, improving the experience for all concerned.

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## AFFILIATION

*John Voyer, Ph.D.*
*Susan Bassi Brown*
*Nathan Gage*
*Dmitry Kovalenko*
*Travis Williams*
*All at the University of Southern Maine*

TECHNICAL APPENDIX

*A Detailed Examination of the System Dynamics Model*

As mentioned earlier, most of the data about the dynamics of the system were qualitative, so it was necessary to use many lookup tables to model the nonlinear behavior of the system as the consulting team understood it to be. The model includes two stocks and their respective flows, with various input variables and lookup table functions controlling the flows. This Technical Appendix includes a discussion of the issues related to the use of all these table functions.

The first bit of stock and flow structure in the system dynamics model has "Queue Length" as the stock (defined as the number of people waiting in line to see an advisor). The inflow to this stock is the "Student Arrival Rate" (number of students entering per week), and the outflow from the stock is the "Advising Departure Rate" (number of students leaving the system per week after being advised). An interesting question was how to determine these arrival and departure rates. If there were no factors influencing when students wanted (or were able) to see their advisor, then the number of students seeing advisors would be evenly distributed across the eighteen week ("Length of Semester") time period. Each advisor in the system advised four hundred students, so an assumption in the model is that the number of students who meet any of the four criteria that required them to meet with an advisor to obtain a PIN was equal to half of the assigned student load, or two hundred students per advisor. Additionally, throughout the course of the semester, relatively few students came into the advising office to see their advisor voluntarily, so the assumption in the model is that this number was fifteen students for each advisor. With nothing else influencing their decision, both groups of students would come in to see their advisor at the rate of roughly eleven students per week (the "Normal Arrival Rate" equals the "# of Students Seeking Advising" divided by the "Length of semester").

At this rate, the advising office could easily handle the inflow without accumulating a backlog in the "Queue length", meaning that the "Advising departure rate" would also equal eleven students per week and the system would remain in equilibrium. If that were the case, there would have been no problem, so something else must have been influencing the arrival and departure rates. That something else was "Schedule Pressure", and we represented it by the sets of equations above the "Queue Length" stock in figure 3.

"Schedule Pressure" was a function of two variables. The first was a dimensionless time pressure factor. This was simply a representation of the time remaining in the semester, 18 at week 0, 17 at week 1, down to 0 at week 18 (see figure 6).

The other variable was the "Schedule Pressure" look-up table that provided values for the range of time pressure values (0 to 18). "Schedule Pressure", therefore, took the "Time Pressure Factor" and related it to the correlated values provided by the "Schedule Pressure Function". In arriving at the values for the "Schedule Pressure f" graph (see figure 7), the consulting team considered what it had learned from its interview with the advising team.

Time Pressure Factor :

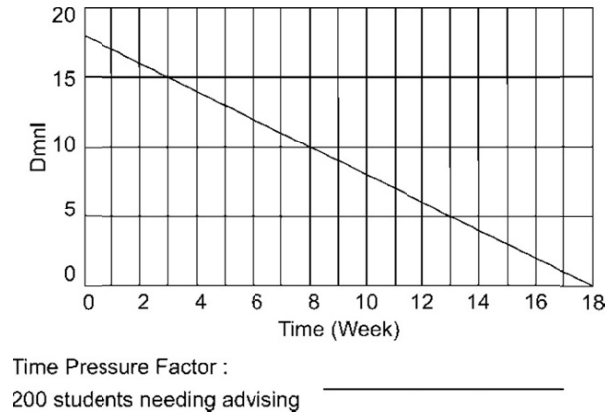200 students needing advising

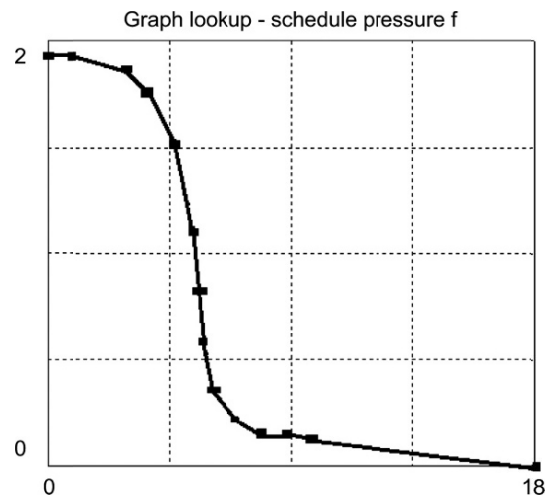*Figure 6. Time pressure factor.*



*Figure 7. Schedule pressure function.*

At the beginning of the semester, with 18 weeks remaining, there was little "Schedule Pressure". Similarly, the first 14 weeks of the semester also went by with very little "Schedule Pressure". Then, with 4 weeks remaining in the semester, a sharp increase in the pressure began and continued until it leveled off at the new elevated rate. The team formulated the shape this way because, when it spoke to the advisors, it found that students went through most of the semester without thinking too much about their schedule or without feeling the need to see an advisor. Then, with around four weeks remaining, the registration period began and suddenly a large number of students needed to speak with their advisor and they began to rush into the advisors' offices. This rush intensified as the deadline

to register for classes (and the end of the semester) approached. "Schedule Pressure" acted on both students and advisors, but they reacted in different ways. The model represents this by the two arrows leaving "Schedule Pressure", one to "Effect of Schedule Pressure on Students" (figure 8) and the other to the "Effect of Schedule Pressure on Advisors" (figure 9).

The two were different because, although both experience pressure—student pressure came as the window to register closed and advisor pressure came as students began to flow through their doors—they differed in how they were able to react to the situation. As soon as the window opened and students were able to register (around week 14), they began to flow into the advisors' offices. When the amount of pressure on students was between 0 and 1 (below normal to normal), students' reactions were normal. They went to see their advisors at the normal rate
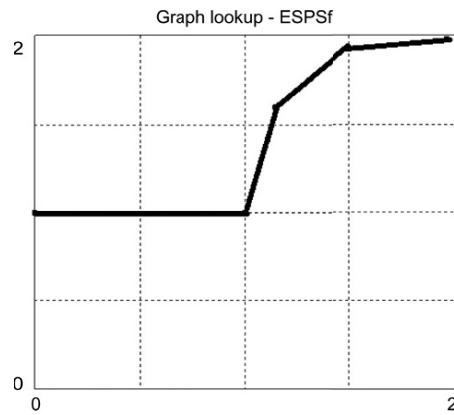


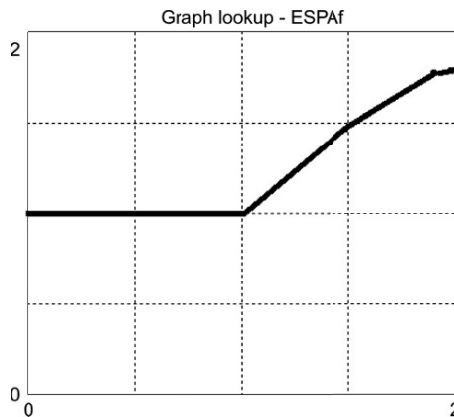*Figure 8. Effect of schedule pressure on students.*



*Figure 9. Effect of schedule pressure on advisors.*

to handle all issues and questions—not just schedule problems, but other services that the advisors provided. Then, the window opened and students had to register for classes. Figure 8 illustrates this with the sharp upturn all the way to the maximum (2) in the "Effect of Schedule Pressure on Students" graph. Students immediately headed to the advisors' offices to get their PIN and approval for their chosen class schedule. This drove a large increase in the "Student Arrival Rate" at the point in the semester when student registration began (figure 10).
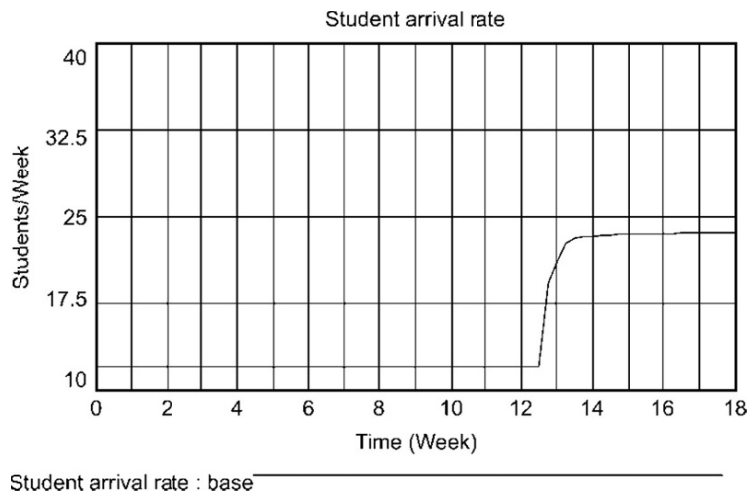


*Figure 10. Student arrival rate over time.*

Figure 9, on the other hand, shows the advisors' reactions to changes in the schedule pressure. Like the students, when the "Schedule Pressure" was below normal to normal (0–1), the advisors were able to advise at their normal rate and could handle the inflow as it came—and therefore no backlog in the queue developed (see figure 11).

Then, as the window opened for students to register, they began to flow into the advisors' offices. The difference is that advisors were unable to react immediately. Because of the manual nature of their work, the required preparation for their advising sessions with students caused a delay. Therefore, the curve for "Effect of Schedule Pressure on advisors" rises much more gradually once pressure goes above normal (that is, above 1). Additionally, no matter how high the "Schedule Pressure" on advisors got, there was a limit on how fast they could advise students. The length of their workweek and the minimum length of advising sessions limited them. Therefore, as shown in figure 9, the line never reaches the maximum of 2. Instead, it levels off at roughly 1.8. The result is that although the "Advising Departure Rate" increased sharply, the advisors were not able to keep up with the students flooding their office (see figure 12).
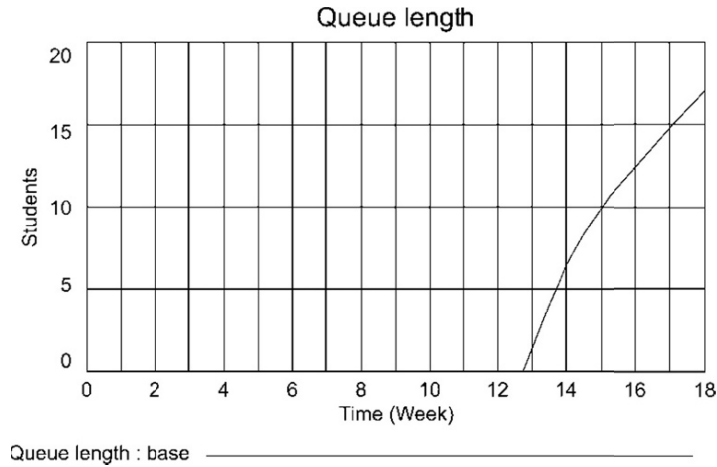
## Queue length



*Figure 11. Advising queue length over the semester.*

This model, which accurately reflects what happens in the advising office queue, allows analysis of the larger picture of Student Satisfaction.
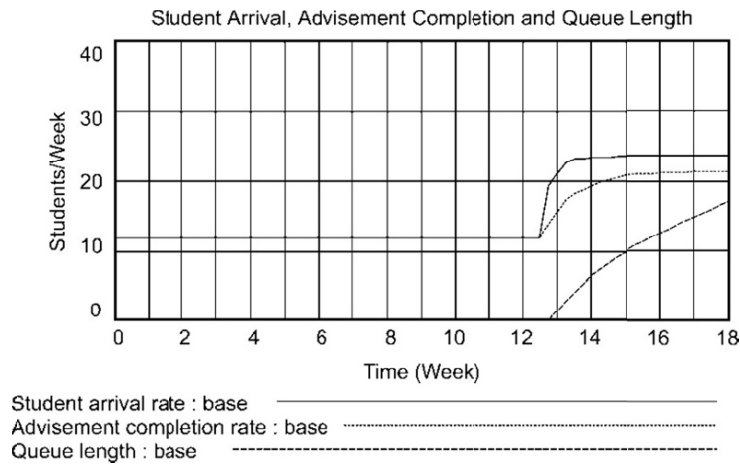


*Figure 12. Student arrival rate, advising departure rate, and queue length.*

The survey results indicated that many students rated the quality of the advising they receive at the School of Business as very poor, and the consulting team wanted to show the effect of the long queue on the quality of advising. Although the team does not feel that queue length itself explained the poor survey results, it may be linked directly to the chief cause of dissatisfaction—time spent with students. To link the "Queue Length" with the "Time Spent with Students", the variable "Queue Length Pressure" quantified the pressure

resulting from long queues. The equation for this variable is simply the total queue length divided by two. Data showed that if the queue were two or fewer, then advisors would not feel rushed to limit appointment times below the optimal length of thirty minutes. The output of this equation is a dimensionless ratio that represents pressure put on the system by long queues. As shown by figure 13, "Queue Length Pressure" is zero for most of the semester and grows between weeks 14 and 18 to a highpoint of eight at the end of the semester. This number feeds into the "Effect of Queue Length Pressure" variable, which has a look-up table leading into it that converts that pressure score to a fraction. This represents how much time the advisors could spend with students. The shape of this curve represents the system behavior as the advisors described it to the consultants.

For most of the semester, when there was no queue, advisors were free to spend the optimal time with students. They were even able to go beyond that time and spend up to an hour with students. When there are two or fewer students in the queue and the ratio is 1, then advisors were still able to spend the full thirty minutes with each student (1 * the Optimal Time Spent = 30 minutes). However, as the number of students waiting in the queue increased, the amount of time that advisors were able to spend with students decreased, as shown in figure 14. This is a sharp drop. When the queue grew to just three, the advisors felt sufficiently pressured that they cut their time with students roughly in half to manage the increased workload. There is a minimum amount of time spent with students which the advisors estimate to be about seven minutes, which translates to 0.233 (7 ÷ 30) in the look up table. Regardless of how high "Queue Length" got, advisors could not go below this minimum amount of time spent with students.
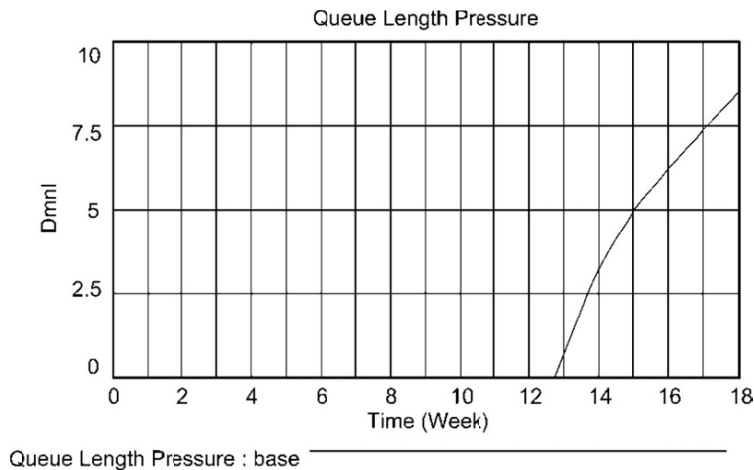


*Figure 13. Queue length pressure over time.*
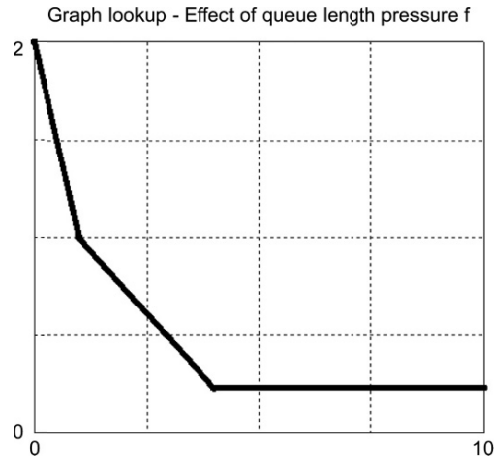
J. VOYER ET AL.



*Figure 14. Effect of queue length pressure.*

The graph of "Time Spent per Student" (figure 15) shows that over the course of the semester, advisors were able to spend up to the maximum one hour per student. It also shows that when the "Schedule Pressure" hit, the time dropped sharply, such that by week 15 they are going through students at the hurried pace of one every seven minutes.

To make the connection between "Time Spent per Student" and "Student Satisfaction", the consulting team started with the idea that the students had expectations about what advising should be. The assumption was that they expected to spend at least thirty minutes with their advisor discussing their schedule and any progress that they were making in their particular academic
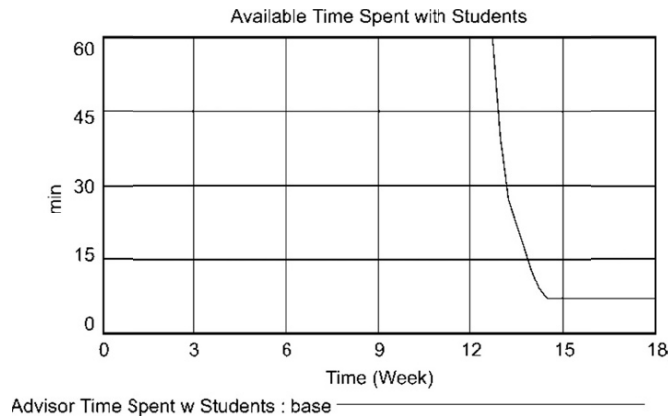


*Figure 15. Time spent per student over the semester.*

program. When their actual time was less than this expectation, a ratio of less than one (actual time spent/expected) was created. This "Expectations Ratio" fed into a variable called "Effect of Time Spent", which acted on the level of "Student Satisfaction". Obviously if students had to wait in line to receive required advising and they only received seven minutes of rushed advising on their proposed schedule of classes, they were not overly satisfied with the process. To show this, the "Effect of Time Spent" (figure 16) variable incorporated a look-up table to relate the size of the "Expectations Gap" (the lower the number, the higher the gap) to the level of satisfaction, a dimensionless variable that fed into the "Change in Student Satisfaction per Week". The output of this variable is a number between 0 and –1.

This number becomes a multiplier in the "Change in Satisfaction per Week" in-and-out flow. One potential weaknesses of the model is that it indicates when satisfaction declines, but is not able to indicate when satisfaction rises above the current level. Although this does limit the model's ability to mirror reality completely, it does not diminish its ability to show the important aspects of the advising process. The problem the team modeled was the decrease in student satisfaction with advising over the past several years prior to the study. For that reason, showing only the decrease in satisfaction did not limit the ability to model this particular problem. As shown in figure 16, the level of satisfaction began to fall when the amount of time the advisors spent with students fell below 30 minutes (a ratio of 1). At 25 minutes (roughly 0.85), students were still satisfied enough not to change their satisfaction level. When advisors began spending fewer than 20 minutes (roughly 0.65), student satisfaction levels began to plummet and they bottomed out at the minimum 7 minute session with a score of –0.8386. The existing "Satisfaction" stock level multiplies the figure from this look-up table and it becomes the inflow to "Satisfaction", either keeping the level stable or lowering it ("Change in Satisfaction per Week").
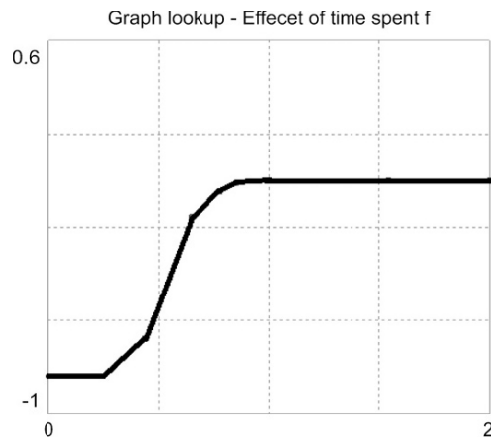


Figure 16. Effect of time spent.

The goal of this project was to help explain why some students were giving the advisors low marks for the quality of their advising experience at the university. Figure 17 and the survey results show that a number of students were satisfied.
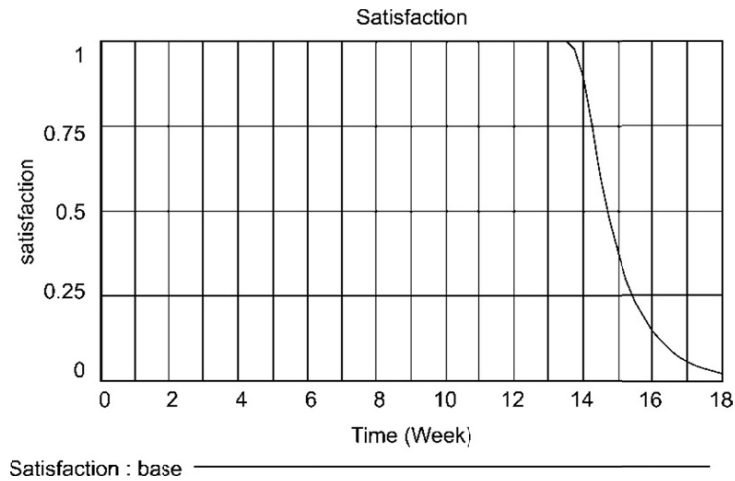


*Figure 17. Satisfaction levels over time.*

This group included those students who saw their advisors throughout the first two-thirds of the semester, and who therefore had the advantage of no queues and who experienced long meetings with their advisors. However, the survey results suggest that there were also a large number of students at the other extreme. These students gave their advisors very low scores on their surveys. The model suggests that these students were the ones whose only experience with their advisor was when the process forced them through the bottleneck at the end of the semester, and they consequently receive a hurried, incomplete advising session. It is important to note that figure 17 shows the satisfaction of the students receiving advising at any given point in time and does not represent an aggregate total of satisfaction. Therefore, students squeezed in during week 18, as time was running out, were not at all satisfied with the service that they received.

UMMESALMA MUJTABA

# 9. ENHANCING THE STUDENT EXPERIENCE: SETTING UP A STUDENT EXPERIENCE UNIT

## INTRODUCTION

There is plenty of literature available that reflects on different aspects of the student experience. It is a difficult term to define, and implementation of the concept is a large scale project requiring project management skills (McCaffrey (2010).

With the student experience being a vital component of service delivery in higher education, the "how" to accomplish it in the most effective manner is of great interest to many. This chapter explores a practical approach to offering an outstanding student experience, in the light of the author's practical experience in establishing a Student Experience Unit.

The account below provides a conceptual breakthrough in suggesting how higher education institutions could benefit by using existing resources to enhance students' experiences and serve them better.

The discussion begins by describing a variety of interests that form the student experience at an institution. This is followed by a practical example drawn from personal experience of what students value as important to their experience and what higher education institutions can offer that can enhance their experience.

This allows the description of some practical advice and observations on enhancing the student experience through the development of the Student Experience Unit – an innovative notion that could support any higher education institution in offering a superior student experience.

## WHAT IS STUDENT EXPERIENCE?

There are many different ways the student experience is expressed and researched in academia and particularly higher education. It is an extensive subject with various dimensions, encompassing a variety of academic and non-academic occurrences. A diverse range of activities ranging from learning and teaching strategies, assessment feedback and extra-curricular activities to student life at campus, fall under the heading of the student experience.

It is prudent to say that the student experience is the "why we exist" for any Higher Education Institute (HEI). Simply put, all HEIs exist to provide the best experience a student can have during their years of stay with them. Surely, the student experience is the "value added" component that a student anticipates receiving on enrolling in a particular institution, in addition to the vast gains of conceptual knowledge students attain whilst studying towards a degree.

Many HEIs worldwide are focusing their resources so as to develop the student better by enhancing their experience. A comprehensive approach to student development requires the institution to offer wide ranging pursuits in order to accommodate the diverse interests students possess. When there are more opportunities to engage in different experiences, there is greater potential for learning (Gurin et al., 2002).

### *Theory of Total Student Experience*

Total student experience refers to all facets of student engagement at HEI's. The term was first used in a report entitled "Total Student Experience", by Harvey, Burrows and Green (1992). Since then, the term has been used by various universities. For example, the University of Edinburgh (2004) mentions a varied and extensive student experience, Davies (2003) reports similarly for Napier University, Savani (2003) for London Metropolitan University and many other HEIs refer to the total student experience as one of the foremost and leading themes in student satisfaction surveys.

Students appreciate and value an all-round experience; Attwood (2011) reports in the Times Higher Education's annual Student Experience Survey on the success of Loughborough University:

> But one university seems to have the edge when it comes to an excellent all-round experience. Top of the poll – for the fifth year in a row – is Loughborough University, which excelled in respect of its sports facilities, extracurricular activities, campus environment, facilities, social life, students' union and library.

Loughborough University has focused on a variety of activities in order to boost student involvement on campus as part of the total student experience.

### *What are Students Looking For? Firsthand Experience*

Understandably, less than a decade ago, the reputation of a university and the choices made by prospective students for study destinations revolved around academic excellence only. This is no longer the case and now the emphasis is seen to be given to a range of activities that expand an individual's skills and competencies. It is perceived that an institution needs more than academic distinction. The need is for additional aspects that can make an institution and its students unique.

In parts of the world where parents fund higher education for their wards, the reasons for choosing a study destination cover a range of factors. Their main motivation is to consider the range of factors related to the student experience before finalising their choice at enrolment. The range of options available logically influences the choices students make, when they embark on their university life.

In my experience (being solely responsible for looking after the student experience at my campus) I encountered many cases where both students and

parents had diverse reasons for deciding on a particular higher education study destination. It is enlightening to read the factors stated below.

### *Continuity of Sport*

A student who loves cricket: In my experience of overseeing and attending to prospective student queries, I met a number of students whose choice of enrolment in two HEIs offering the same program of study, would depend on the wholesome experience offered by them. I cannot forget remarks from a parent, who was earnestly looking for an institution that had a University Cricket Team; his son was an avid cricket player. So much was his interest in the sport that it was his sole reason of enrolling at my university since we offered unsurpassed quality in sporting activities. Our university cricket team comprised of national players, we ran regular training sessions with professional coaches, participated in inter-university events and held one of our own that was very popular amongst the youth.

### *Future Career Prospects*

A student who cares about future placement: Many prospective undergraduate students are concerned as to what sort of careers advisory services are offered by the institutions. The focus is on career fairs, CV writing support, networking opportunities and so on. Thus the student's future employability prospects are seen as a large area of concern and interest by many parents and students alike.

### *Student and University Relationship*

A student that shows interest in the institution's corporate activities: Some students just stand out and want to be part of every initiative taken by the university; in essence they own the institution. They take responsibility for themselves as representatives of the university and exhibit this by showing the desire to participate in all university initiatives such as; open days, school visits, and education exhibitions representing the university. Such students want to be part of the university's success. They are the restless souls who love to divide their time between being a student, and being a university ambassador.

### *Student Support in Academic Study*

I am here to get educated: There are always exceptional students and, of course, those who need academic support to succeed in their courses. Prospective students are often anxious about the assistance offered for coping with university academic life and further advancement. They are looking for addition assistance, over and above the regular lectures and tutorials. Many of them find the presence of a subject related society (such as "Statistics Champions", a study club catering for

students studying statistics for beginners) to be of great interest. To them their university life must yield an educated being.

*The Networker*

How do I keep in touch with the university after I graduate? Does the university facilitate any alumni gatherings? Strong alumni divisions mean a lot to some students, in my observation students to whom alumni departments matter are the ones who come from highly educated backgrounds, generally where parents and/or extended families have studied from renowned universities.

Interestingly, the pursuits identified above can be easily be mapped to the different generic departments at HEIs as shown below in table 1.

*Table 1. Student choice mapped to departments within the HEI*

| Student choice | Corresponding university department |
| --- | --- |
| Continuity of sport | Sports centers |
| Future career prospects | Careers Advisory Services |
| Student and university relationship | Marketing, Registry |
| Student support in academic study (Learning groups) | Students clubs and societies |
| General student services | Students office/services |
| The networker | Alumni services |

In addition to the departments identified above, there are general student services offered at all HEIs. Generic services could range from admissions and registry, catering, accommodation and visa facilities (in case of United Arab Emirates and other GCC countries, a study visa is facilitated by the institution the student enrols in and the student is sponsored by the HEI and remains on its visa for the stated study duration).

BRAINSTORMING EXERCISE

At this point let us try a brainstorming exercise. Try to align activities that are solely student experience related with the range of activities of various different departments at your institution. (Needless to say departments have core activities and still serve students in one way or the other, as seen in table 1).

As a result of this exercise you will notice that in reality a student's engagement is spread over a large domain in the institution, implying that partial activity in one form or the other within each of these departments is contributing towards the larger student experience. Interestingly, the results from the brainstorming exercise

and table 1 would probably look alike with more or less the same departments participating. The various factors established above are actually the skills set commonly acquired outside the academic curriculum which are deemed to be most valued as student experience activities.

This is also seen in a report of the 1994 Group of UK universities (Student Experience Policy Group, 2007), results of which underlined the significant role that the non-academic aspects of the student experience play in our institutions.

### *What Have We Just Found Out?*

As an institution, if you want to build on the current student experience and improve upon it, you have just identified all the related zones you need to work with. That means that in order to advance the student experience, part of each of these departments will need to be developed. The new question born at this stage would be: within an institution, who is responsible for student experience development, the spread of which is at times across the whole of the institution? How is enhancement of the student experience currently achievable at the macro level?

Reasonable answers recorded would suggest that each department works on their amelioration respectively. This really implies that activities related to student experience are not dealt with by one department at a macro level. There isn't any one administrative area accountable for the most widespread activity at our institutions. Instead student experience related activity is a small part of a number of departments at our institutions i.e. numerous departments currently handling "the why we exist" of our institutions.

This discussion leads to a natural and relevant question: is there a way to remodel the work being done currently? The answer to which is yes; the student experience can be remodelled via proposing a new Student Experience Unit (SEU).

### NEXT STEP: THE STUDENT EXPERIENCE UNIT

An agreement to form a SEU immediately raises the question of what would a SEU look like? Does it involve a lot of new staff? Does it involve more budget allocation, more resources? Would there be visible gains to the institution?

To provide some answers we look at the working model of a Student Experience Unit.

### *The Working Model of a SEU*

The SEU is an amalgamation of representatives from different departments that have been identified in the exercise conducted above. It clearly resembles the structure of a project team because the members already have a distinct role within their primary department; they essentially come together to be part of the SEU representing their departments, but otherwise have a stable designation within the institution's structure. Simply put, the SEU has a project team structure headed by a project manager – the Student Experience Manager (SEM).
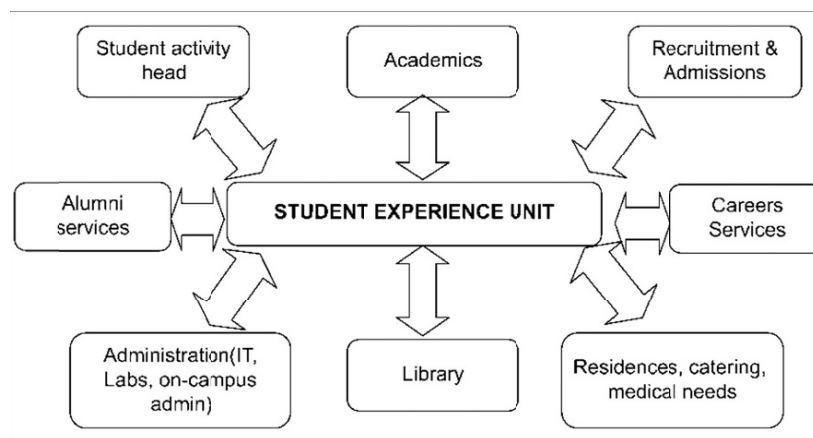
*Figure 1. Student Experience Unit – A working model.*

In an endeavour to denote clearly the variety of factors involved, figure 1 offers a diagrammatic illustration of the SEU. The two-way arrows depict the communication flow between the SEM and the respective departments involved with regards to student needs. Arrows also indicate interaction and connection, suggesting the large number of possible interfaces between various divisions within the institution that contribute to the student experience.

The core idea in figure 1 is self explanatory; the SEU connects and gathers the total student experience under a single umbrella, with representatives from each of the departments participating in a project structure (departments have been identified in table 1).

From the above diagram, suggested team members for the SEU that work under the Student Experience Manager are:

– student activity representative (student president);
– marketing representative (recruitment and admissions);
– school officers (academic representative);
– student services (admin, IT, Lab representative);
– general facilities (residences, catering and medical needs representative);
– library;
– alumni;
– careers advisory representative.

The team members are expected to carry out their set of responsibilities in the SEU such that they are representing their department for a particular student experience related activity. Thus, in essence they shall belong to the SEU only to fulfil the relevant student experience role.

Within the SEU the team members bring in information relevant to pertinent issues faced by students within their domain. This brings all student experience related issues to be handled under a discrete division.

The SEM delivers the management of student experience related issues via effective coordination of all representative members. There can be various mechanisms to achieve the goal stated above. The main concept remains though: to gather all stakeholders of the student experience, collect relevant information, feed in the pending issues and provide input as to the needs of the stakeholders.

A typical meeting scenario at the SEU is sketched below in order to exemplify the working of the SEU. The modest setting below is a common exemplar of what we expect during an academic semester.

### *Scenario Setting*

Departments have a few on-going activities such as:

– careers service has requests from students to arrange part-time work opportunities;
– recruitment and admissions are holding an open day and therefore need students to assist;
– alumni services are looking to arrange an informal meeting of graduate members;
– the student officer wants to invite guest speakers and is looking for some industry contacts;
– residences have a competition between different blocks and want to promote the event institution wide.

### *The "Before" Picture (Before the Establishment of the SEU)*

Because departments are unconnected and independent of each other, there is no one unit where requests can be placed and solutions sought within the sphere of the institution. There is no interdependency between departments solely for student experience purposes (although interdependency can exist between departments for various other operational reasons). Therefore student experience issues would require separate sets of responses from departments as required.

### *The "After" Picture (the SEU Meeting Scenario)*

After the SEU is set up, the required demands can be accommodated within the structured meeting scenario as described above. Now, there is a clear understanding that students looking for part-time work can work for the university on open days. Students looking for voluntary work could assist in arranging the alumni event. Student officers can attend the alumni event, put up posters or other publicity material in order to attract some guest speakers. Residences competitions can be promoted using the accommodation/admin officer after discussion at the meeting. Thus, the collated requests and information is

disseminated to the right department in an efficient fashion. Furthermore, records on the success of these activities can be maintained and can be later published as "campus student experience activity" – good marketing material for the institution.

This simple description depicts some of the advantages (at a very basic level) of establishing the SEU. There are, of course, numerous other ways that the SEU can be beneficial to student experience enhancement. Not only is the SEU responsible for bringing together the various divisions (as explained above), it is also the dedicated unit that engages in student feedback. Where campuses are spread over acres of land the SEU would offer one portal where students can place their ideas, discuss their concerns and would be assured of committed services. Feedback is expected to come in from students on various improvements, pending issues, areas of concern, features that they appreciate etc. With an array of student feedback resting with the SEU, meetings and any further interaction would be more productive since there would be a two way communication flow.

The SEU setup does not impinge on the core function of the departments; rather it assists them in providing the best service they can by offering students a one portal solution.

Under the unit's banner the Student Experience Manager is responsible for ensuring adequate participation from representative departments. The envisaged mission of the unit is to:

> Connect all student related activity at the campus under one banner to facilitate the development of a first class student experience, to create satisfied students. This shall be achieved via the use of existing resources in a refined, effective manner raising student experience to new heights.

## INDICATORS OF STUDENT EXPERIENCE UNIT

What would establish the requirement for an SEU within an institution? Should size in terms of student numbers be the deciding factor? Or perhaps size in terms of acres of land the campus is built on?

Figure 1 illustrates the support departments that exist in many institutions. The simplicity of the SEU structure reaffirms that the SEU is an initiative that can be taken by any higher education institution that anticipates a need to enhance the student experience. The principal indication is the will from the institution to demonstrate a continuously improving experience of university life by students.

### *How Can the SEU be Checked Against Standards Set Currently?*

The "Enhancing the Student Experience" policy report (Student Experience Policy Group, 2007) launched on 28 November 2007, underlines the seven priority areas for the Higher Education sector to take forward in order to meet the challenges of a changing environment of student experiences and expectation.

These seven priority areas are:

- a requirement to provide transparent and accurate information around the student experience;
- towards the 2020 workforce: promoting the well-rounded graduate;
- promoting the student voice;
- engagement with schools and colleges;
- student-focused resources;
- international strategy and internationalisation;
- excellence and enhancement in teaching and learning.

*Table 2. Solutions offered by the Student Experience Unit*

| Priority area set by HE sector | Solution offered by the SEU |
| --- | --- |
| A requirement to provide transparent and accurate information around the student experience. | The SEU is a one portal solution, facilitating the collection, collation and dissemination of feedback to the respective responsible department. Further, being one division totally responsible for student experience related activity, checks and balances can be clearly ensured and maintained. |
| Promoting the well-rounded graduate. | The project team structure allows more opportunities for students to get engaged in campus activities. Prospects of student involvement across a variety of activities improves the chances of producing a well-rounded graduate. |
| Promoting the student voice | The SEU is envisaged to be a department dedicated to address student needs. Thus the absolute notion behind the formation of this arrangement is to appreciate, acknowledge and listen to the student voice, to work with students and identify their needs and hence to instigate the required action. |
| Student-focused resources | Through student representation alongside the presence of the stakeholders, there is a simpler and more straightforward process for acquiring student focused resources. |

From the discussion in table 2 it is evident that the SEU offers solutions to the majority of the priorities set by the higher education sector. Further as the unit grows and working procedures are formed further growth can be realised.

Collins and Porras (1997) suggest that organizations should focus on what they are doing to invest for the future and decide whether they are truly early adopters of the innovative ideas that will eventually become commonplace across the rest of the industry. The SEU is an ideal proposition if an institution is forward looking and planning to ensure that the experience of university life continues to be an attractive and useful one.

## SUPPORT FOR THE STUDENT EXPERIENCE UNIT

Any new initiative requires support from the senior management, and this is true of the Student Experience Unit. The required involvement and commitment needs to come from the top level of the management pyramid. This is evident since the unit plans to connect institution wide stakeholders in order to recognize different aspects of the student experience. Such initiation and continued support must come from high-ranking positions within the institution.

There should be an institution-wide understanding of the SEU's stated mission, and this is significant because of the institution-wide involvement necessary in the SEU.

The senior management of an institution play a key role in driving both the formation and subsequent operation of the unit. The phrase "the student experience" has become something of a mantra for the higher education sector in recent years, and there has been a sharp increase in the number of Pro Vice-Chancellors and other staff whose roles are dedicated to improving it.

## REBRANDING YOUR HIGHER EDUCATION INSTITUTE USING STUDENT EXPERIENCE

HEIs are constantly looking at novel marketing ideas, and the SEU could become a unique selling point for any institution. Its importance to the institution is clear since it indicates the additional responsibility the institution is willing to shoulder by devoting itself to enlarging the opportunities available to students, by providing them with the opportunities to discover and develop their skills.

## TRANSNATIONAL EDUCATION (TNE) AND STUDENT EXPERIENCE

With the rapid growth of information and communication technology and the growing international market for higher education, a variety of different forms of transnational education have developed. According to the Council of Europe and UNESCO (2000) transnational education includes:

> All types of higher education study program, or sets of courses of study, or educational services (including those of distance education) in which the learners are located in a country different from the one where the awarding institution is based. Such programs may belong to the educational system of a State different from the State in which it operates, or may operate independently of any national system.

One of the largest challenges faced by any form of TNE is to be able to impart and transfer a similar student experience as offered by the parent campus. Whilst marketing any new TNE arrangement, generally the focus is on using phrases such as "Experience UK education in the comfort of your home country". It takes a lot of effort, both on the academic front and from the support functions to deliver comparable quality. Furthermore, it can take years before the student experience offered can be of an exact and comparable quality. This could be partly because

branch campuses (as a form of TNE) start small and it is easier to induce a culture than to reinvent it.

The suggested SEU can take the form of a services support group that would integrate the services being formed in order to satisfy student needs over time as the branch campus grows. Thus, challenges become opportunities; it is surely easier to instil culture than change it!

## SYSTEMS THEORY AT THE HEART OF STUDENT EXPERIENCE UNIT

The concept of the SEU derives its inspiration from systems theory. Fredrich Hegel (1770–1831) described the essence of Systems Theory in that the parts of a system are dynamically interrelated or interdependent. The SEU is formed exactly on the same founding principle. It accentuates the fact that within any HEI, student experience related activity overlaps and interconnects with all departments. Thus suggesting that the total student experience can be enhanced if the interrelationship between the parts of the systems, in this case the different departments at a higher education institution involved in the student experience, are identified and the subsequent impact studied.

The central idea of Gestalt psychology launched by Max Wertheimer (1880–1943) states that the whole is greater than the sum of the parts. As elucidated in the above discussion, that SEU works upon creating an aggregate effort by involving modest student related activity from each department and collating the effort under one umbrella. Thus, the cumulative effort from each of the divisions could yield student experience gains incommensurate with the individual effort. This also falls in line with Maturana and Varela (1972), who explain how from the perspective of Systems Theory, management has a primary and necessary management function, and further secondary and optional functions.

The SEU also takes into account the concept of boundary as described by Downing Bowler (1981). In his summary regarding general systems as a viewpoint, he states (p. 220):

> Every system has a set of boundaries that indicates some degree of differentiation between what is included and excluded in the system.

Based on Downing Bowler's summary, the primary assignment within any analysis based upon Systems Theory becomes the definition of the under consideration system and determination of its operational boundaries. Figure 1, the working model of SEU, illustrates the description.

The SEU is careful not to intervene in the core function of the individual departments and their routine functions run as normal. It makes use of one member from relevant departments as required to contribute to the information and communication process pertinent to student experience enhancement.

The SEU is therefore functioning as a sub-system within the institutions' open system with its own well-defined boundary and lucid procedures for interaction. The SEU is an open subsystem since it takes in additional inputs from the environment. The SEU encourages intra-departmental communication within the institution.

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The beauty of systems theory (being psycho-physically neutral) is that it has application to both material and non-material phenomena (Von Bertalanffy, 1967) and hence has application to HE organisations and allows us to realise the true utility and substance of the SEU.

Excellent staff, the use of advanced technology and a commitment to improving stakeholder value can be elements of vision statements for many HEIs. By deploying the systems theory approach, HEIs can work towards accomplishing their vision statement. The systems theory approach assists by providing a focus for exploring the potential of various departments at the institution from an integrated system perspective, rather than adopting a more traditional reductionist form of analysis.

The result is a SEU with a team dedicated to enhancing the student experience. Katzenbach and Smith (1993, p. 45), explain why teams outperform individuals. Their definition of team fits the SEU members well.

> A team is a small number of people with complementary skills who are committed to a common purpose, performance goals, and approach for which they hold themselves mutually accountable. Teams need to develop a common approach.

## CONCLUSIONS

Good quality student experience is certainly the objective of all higher education institutions irrespective of their location. Certainly there are numerous composite factors, the interaction of which affects the student experience. In this chapter, enhancement of the student experience is identified as an activity spread over various departments. These departments (with their own core activities) each deal with part of student experience, leaving no one administrative section wholly responsible for the student experience.

In order to manage the student experience the author describes a dedicated unit for student experience enhancement that is structured along the lines of a project team. Under this structure, representatives from different departments meet regularly under the Student Experience Manager, who heads the student experience development exercise.

The notion behind the proposed structure is a dedicated low cost department that does not require extra resources, instead the structure utilizes the current resources to enhance student life on campus. This is achieved by bringing in all concerned department representatives on one platform, where they can initiate, propose, share, obtain and gain ideas on the various aspects of student life improvement.

The SEU is an entity that considers the entire campus as a part of the community serving students and in which the student learning experiences are mapped to enhance the quality of this experience.

The SEU identifies and resolves the principal challenges faced by the institution in order to meet student expectations and enhance their experience in the years of study.

This provides a solid foundation to allow the beginning of a new modus operandi for supporting students. To individual institutions this initiative offers an opportunity to stand out and reinvent their brand. As Roger Brown, former Chief Executive, UK Higher Education Quality Council (2006, p. 13) states:

> The most important misconception is that higher education is about satisfying students' wishes as customers rather than about changing them as people.

The Student Experience Unit bases its foundation on bringing about a change in a student's life rather than just the stand-alone motivation of serving students as customers.

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## AFFILIATION

*UmmeSalma Mujtaba*
*School of Management and Languages*
*Heriot Watt University*

OZLEM BAK

# 10. WEB-BASED LEARNING ENVIRONMENTS

INTRODUCTION

In higher education web-based learning environments have been used to support student learning, to provide a platform for a dynamic engagement between students and lecturers outside the physical classroom and to enhance student autonomy. This chapter will introduce the reader first of all to the use of web-based learning environments in higher education, followed by a description of the implications in United Kingdom (UK) higher education of web-based learning environments, and finally explore this context within a case study on the issues associated with the use of curriculum and learning resources within web-based course support systems and the implications on learning environments. The first section will introduce the use of web-based tools in the UK and the importance of web-based supported learning in higher education followed by the description of the course and why the concepts are important in such a course and, finally, a discussion on the implications of web-based supported tools on students learning.

USE OF WEB TECHNOLOGIES IN HIGHER EDUCATION

In the last ten years, higher education literature has focused much attention on web-based tools, their implications as well as their application in higher education institutes (HEIs). This move is also partially in response to the increasing use of information and communication technologies (ICT) promoted by HEIs in response to "market forces [which] are pushing universities increasingly towards online learning" (Corbyn, 2011, p. 8). The use of ICT is not, however, without any side-effects. Web-based supported learning environments (WSLE) have changed not only the ways students learn but also how knowledge is disseminated accommodating different learning styles in a web-based learning environment. With the use of web-based technologies the traditional lecturer-centred learning practices (Clark & Robinson, 1994) have moved towards more student-centred learning practices.

Thomas in 1995 explored (in his relationship flexibility model) learning as an interactive process engaging the learner, context, the tutor and the learning resource. Taking the notion of flexibility that is required in an online web-based environment the context would include students attending from different countries, cultures, backgrounds and with differing skill sets and so requiring different levels of support and guidance (Bak et al., 2008). Note here that online courses (courses or modules solely taught in a virtual environment without the physical presence of students and lecturers in a common location) are not part of this chapter. A detailed

discussion of the design and delivery of online courses and modules can be found in Ieronmachou and Stair (2011). In this chapter we will rather investigate the use of a web-supported learning environment as an additional arena for learning, rather than as a tool for learning. The students who may have different learning styles (Coffield et al., 2004) might be impacted at different levels where two methods could be utilized; a) face-to-face (on campus) and b) online (off campus) complimented and facilitated the teaching and learning process (Bak et al., 2008). It has been known that both methods have their merits and weaknesses. Therefore a good balance in alternating face-to-face and online tutor/student interactions to encourage deep learning and critical thinking skills is essential to ensure student engagement and learning (Marino, 2006). The rich mix of case background and the literature indicates a wide and disparate ICT and learning interaction (Bundy, 2004). Besides, the students' learning needs also differ very much according to their intellectual skills, social skills and temperaments. Indeed, even in the presence of a well planned and guided web-based learning environment, where technology and pedagogy are well supported, the structural and technical knowledge skills might challenge the student-lecturer engagement with e-learning (Oliver & Dempster, 2003).

This engagement, although highly related to the delivery method, is also dependent on the "individual users' background, training and style as well as the ability to engage with the changing technologies" (Ieromonachou and Stair, 2011, p. 36). Certainly there are factors affecting both the delivery and engagement, such as the content, provided level of support, or the level of engagement that is envisaged (group work, team based learning, task oriented delivery etc.). The use of web based learning environments have also been highlighted as a strategic tool in teaching consultancy modules where "… in addition to students acquired knowledge and their individual skills, students are equipped with tools via web-platform, access to electronic library, company materials and other industry relevant documents, however how they use the tools or whether they want to use it is completely dependent on the students choices." (Bak, 2011, p. 5). The degree of usage of the system also relies highly on the users' knowledge of the system and their level of engagement. In cases of less advantaged students such as overseas students with limited language skills, or those with special needs, there might need to be more tailored delivery methods and customised guidelines to enable them to achieve an optimum benefit from self-paced learning.

Similarly Noble (2001) adds that web-based learning environments (as compared to just teaching with the technology) necessitates additional training, education which is seen as rather a separate activity. Noble links this notion to the pressure that higher education is facing to realise cost reduction benefits in terms of staff and resources utilised. Research indicates that a good standard in education requires a labour-intensive, personal relationship between students and academics (Holley & Oliver, 2011), and delivering it in a web-based learning environment has its own challenges. The challenges might also relate to the particular context in which the education is placed, hence the next section will introduce web-based learning environments and their use in the UK higher education arena.

WEB-SUPPORTED COURSE DELIVERY IN THE UK HIGHER EDUCATION ARENA

In the 1990s the higher education environment in the UK was relatively safe in terms of student and staff retention. However, considering the shifts in the UK education landscape, the increase of student fees and reduction of research grants (Scherer, 2010), it is hard to believe that favorable conditions will remain long-term; therefore, becoming an adaptable organization is critical for that organisation's wellbeing. With the increase (in the last ten years) of the number of students entering higher education in the UK, a parallel development can be observed of investment in, and use of, web-based learning environments to manage and improve the delivery for a wider audience The reasons for the particular growth in web based learning environments can be related to the UK's attempts to develop alternatives to traditional classroom teaching and can best be understood within wider international concerns about meeting the needs of a "knowledge economy" (Curtis, 2002; Holley & Oliver, 2011). This is also important as the technology enables the free flow of information and creates bridges for educators across the borders (White & Davis, 2002). This becomes an important issue when considering UK higher education where the Universities and Colleges Information Systems Association Survey (UCISA, 2008) identified only three institutions not having a web based learning environment. This is an interesting result indicating that most universities already utilise web based learning environments, believing them to support sector specific needs wherein students are encouraged to develop as independent learners (Higher Education Academy, 2010). The UCISA's 2008 survey also assessed the variety of technologies used in the UK higher education and these included: e-assessment (77% of HEIs); e-Portfolios (68%); Blogs (72%); Podcasting (69%) and Wikis (64%). To assess the impact and the use of web-based learning environments HEFCE established an "Online Learning Task Force" in 2009.

The task force was also to address how UK higher education might maintain and extend its position as a world-class leader in the use of online learning. The task force also highlighted the issues and challenges faced by web-based learning environments referring to online pedagogy and the technological support needed by institutions to take full advantage of rapidly developing and ever changing technology and student demands. Cousins (2005, p. 121) states the challenge posed by technological change as: "... an inherently unstable process of change from one media age to another, and promises no loss where there is always loss" highlighting that with every new technology and process there will be always some level of loss faced by the institutions.

Conole et al. (2008) in their study investigated UK university students and how their learning was influenced by web-based learning environments. Their findings suggested that students used web-based learning environments to reflect their own needs and requirements. Hence, from this study we can see that the challenges faced by UK higher education institutes are not solely based on the technological challenges of delivering web-based learning environments, but also the challenges faced in engaging students through the web-based learning environment and customising content and delivery according to student learning needs. Although

research suggest that an online environment supports and generates a collaborative learning environment within and among groups of learners (Tsai 2001), there is a range of issues to overcome including those related to aspects of online assessment processes.

### *The Case: An Undergraduate Web-Based Supported Learning Course*

This chapter uses a case study to explore "how" and "why" the web-based learning environment was utilized in the case organization. A case study, according to Yin (1994), is an empirical enquiry that uses multiple sources of evidence to investigate a contemporary phenomenon occurring in a real-life context where the boundaries between the phenomenon and the context are not clearly evident. This case study explored the use of web-based learning environments in a single department within a "new university". The term new university in the UK refers to universities founded in or after the 1960s (after the Robbins Report on higher education) some of which were former polytechnics, institutions or colleges of higher education given university status by John Major's government in 1992. The case explored the implementation of such web-based and supported learning in a UK university with its implications for students, student learning and the delivery by the lecturer.

The web-based tools were used initially for undergraduate first year students, since the students could get introduced to the tools at an early stage, there were limited sessions to run online, and these could work alongside on-campus classes. The case in this chapter will be introduced under three stages; Stage 1- the preparation, Stage 2- roll-out, and finally Stage 3- operational challenges for the lecturers.

*Stage 1-Preparation.*  Before the rolling-out phase of the web-supported tools, the lecturers were selected and informed that they would be part of the pilot programme, and that they would need to amend/alter the content and structure of their lectures and tutorials in line with the web-based learning environment. Initially the idea was challenged by the lecturers based on the changes to content, the skills necessary to utilise such a web-based environment and the additional workload. However, the project design allowed for a learning technologist to be assigned to help with the technology and design side of the course, and additional financial awards were in place for the additional workload.

Although the project was well planned, lecturers involved had mixed views about the success of the web-based teaching environment. One lecturer stated "I don't think it will run smoothly unless we have face-to-face sessions with the students, where I can see in their faces whether they understood it [the subject] or not…" while another lecturer noted "why don't we try and see how it works". This highlights also the limited participation of the lecturers in the decision-making as to whether these tools should be used or how they would be beneficial to the organisation as such.

The planning stage entailed first of all the development of materials for a web based learning environment. In this stage the learning materials were mapped into three distinctive units: engagement of student with student, student with tutor/lecturer, and student with course material. The main reason for such a classification was the sheer variety and range of levels of interaction. For example interactive online learning activities required from weekly to monthly engagement on asynchronous discussion boards as well as participation in the review of course materials/resources. In addition, it is necessary to provide online learning students with a reasonable level of instructional assistance, with structured written guidelines and reading lists. The engagement based on course content was at the core of the preparation of the project and entailed: development of guidelines for structure and content design; allocation of hours for specific tasks; milestones and audit stages; and group meetings to compare and contrast experiences.

The preparation stage was an important stage where the active, engaged aspects of learning could be tailored and controlled within a context, and overcome what Smith & Oliver (2002) refer to as learning that can easily be ignored. To explore whether the preparation stage had been successful the next stage would be to engage in a rollout phase, assessing the validity and reliability of the devised web based learning environment for the audience, in this case the students.

*Stage 2-Roll-Out.* The first roll-out happened through the use of one pilot module, before going ahead with the remaining ones. The module was developed based on existing lecture and tutorial content, but the dissemination of lectures and tutorials were tailored to the online environment, wherein tasks were developed on online discussion forums, and students were linked to files or papers for additional readings or articles that may enhance the learning within the case. The idea was to create the necessary support environment with enough guidance so that students, if they could not participate in class, could go through the sessions online. This would also help the later delivery of distance courses, where students would only attend certain residential weekends, but the interaction would remain mainly limited to the WBLE.

Sharing experiences allows students to learn from each other's experiences and to understand that the other students have been facing similar challenges, limitations or to see how they had overcome the obstacles and motivated themselves (Kirkpatrick, 2001). Taylor et al. (1996) draw on the work of Olcott and Wright (1995) who suggest that it is important to publicize teaching and course developments to current students. Therefore, the benefits of beginning with the description of the wider context and a clear set of expectations in terms of learning outcomes set the boundaries between the learner, the course and the lecturers. As stated earlier it was important that the principles of the web-based supported learning course were clearly and effectively communicated to all parties concerned. At all stages of the introduction of flexible learning it was important to engage students in discussion, explore the problem statement and its possible solutions, share experiences and reflect. In this context we created a discussion

forum, where the students could log in and ask each other questions, discuss the materials, ask the tutors etc. The discussion forum created an environment where students and lecturers could share their experiences. Later, as students became more involved during the course they also had opportunity to share their experiences with each other and for others to find out what was going on. This allowed also the inclusion of each participant.

Therefore we designed work in discussion board questions, where the students had to reflect to fellow students their ideas and everybody could give feedback including lecturers. This also enabled the lecturers to assist students in the early stages of the work and recognize the weaknesses and strengths of the particular cohort. Initially the roll-out phase was only envisaged within the UK, but we aimed to move from the local context to a more global context, in which delivery for overseas partner universities could be established through the web-based learning environment. This would enable the users to access the materials and have access to a diverse range of groups, from different localities on one common platform. With this roll-out there were two learning environments; one the physical and the other the virtual. Although there might be an impression that the two worlds are completely separate and independent from each other, in this case the success of the roll-out phase was rather dependent on how the integration of both environments took place.

The roll-out phase for the selected course took place in a confined classroom environment were the potential students went through with the lecturer a set of lecture slides and tutorials with the use of the web-based environment. The aim was to see how students were utilising the system, how they were responding to the lecture and tutorial materials, in what way they were challenged and also to gain initial feedback. In order to assess the effectiveness of the web-based learning environment, the students were provided with a questionnaire covering three main areas of the usage and impact of web-based learning environment, that is; (a) the effectiveness of the level of student interactions, (b) the suitability and accessibility of materials provided, (c) the effectiveness of delivery and support. Identifying these main three areas enabled an assessment, which was supported with some unstructured interviews. Some highlights from the pilot session were noted. As an example one of the students felt really discouraged despite being provided with lecture slides and additional notes and materials, the student noted "I wouldn't want to go through the materials by myself, it is really discouraging for me" and when asked for clarification on what parts the student did not understand, it became clear that the student did not like the isolation of the delivery "I want to ask questions, but for that I have to place a question on the discussion board, even if it's a silly one". This is an interesting point - how do we encourage students in online participation with the classes without loosing the student-tutor/lecturer synergy?

Through the pilot run, the materials based on content and structure were amended, the delivery time shortened, more online discussion sessions established, each so the tutor and students could further interact in a web-based environment. The other modules on the course were developed accordingly.

*Stage 3-Assessing Operational Challenges for the Lecturers.* The pilot run of the modules indicated that there was a gap between what is delivered and what is assumed to be learned by the students. Although the discussion forums seemed to be one of the useful tools for clarification and engagement between students or with students and their lecturers, questions were asked hesitantly which were either via phone calls or personal emails. Although the delivery could be used later on for a sole virtual teaching environment, tools such as video conferencing, one-to-one or group discussions and virtual rooms are other ideas that would need to be researched so as to provide and create the synergy between the learner, the deliverer and the material. In this trial, it was difficult to ascertain the level of student interaction; one lecturer noted "in classes I can see their faces, observe how the lecture and tutorial is going, however it is rather difficult to read behind the lines and without any sort of assessment, I wouldn't actually know what they understood and to what extent". This also highlighted challenges for delivery in web-based learning environments.

The delivery of the courses also led to a learning curve for the lecturers/tutors as with the new system the delivery method and students' needs had changed. The change in the student needs and course delivery prompted additional learning for the individual lecturer. However this learning curve differentiated between the new users of the system and existing users of the system, as some of the parts of the system were in use with limited capabilities. Although IT Support systems and guidance on the helpdesk was possible, students were in some cases contacting their lecturers as a first point of interaction. This also adds another layer of complexity for existing lecturers' responsibilities.

In this chapter we have not analysed or referred to the individual applications such as Blackboard, WebCt and other platforms. The reason for this is not that each technological web-based learning environment has its own peculiarities and challenges, but rather that all web-based learning environments do include some level of similarity in the three phases of web-based learning environment adaptation, and the case study has tried to raise additional issues for further exploration. The next section will conclude our observations for the case study and its impact on the wider education community.

## CONCLUSIONS

Having looked into the development of web-based learning environments and their development in higher education this chapter introduced a real life case which embedded three stages; preparation, roll-out and challenges faced by the academics. Having looked into the three stages, we recognised that each stage necessitated new skills and resources, which were dependent on time and resource development. However the case study also highlighted that although well establishes web-based support tools can be used to enhance and promote teaching outside of the boundaries of the traditional teaching class, nevertheless its impact is dependent on its users and how they utilise the resource, and checking the level of

engagement should be one of the main operational issues that needs to be explored within the higher education sector.

Although some authors have investigated the increased "openness" that web-based learning environments may bring to the on- and off-campus delivery of educational programs (Taylor et al., 1996) unless we remove the barriers associated with diversity issues, and provide appropriate training in new skills both for lecturers and students, learning environments cannot be fully operationalised. In summary web-based learning environments can encourage a variety of delivery methods reflecting such requirements as independent learning, resource bases, and delivery requirements (perhaps being on-campus, off-campus, local, international), all of which may require customisation of what is being delivered and how it is being delivered.

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## AFFILIATION

*Dr. Ozlem Bak FHEA.*
*Senior Lecturer, Business School, University of Brighton,*
*United Kingdom*

PART 4


**MANAGING THE BUSINESS OF HIGHER EDUCATION**

PETER GALBRAITH


# 11. MAKING A BED TO LIE IN: SYSTEM DYNAMICS BEHIND UNIVERSITY MANAGEMENT STRESS


## INTRODUCTION

In locating this chapter within an Operations Research perspective some assumptions need to be made explicit – in particular the audience for this paper may range from those with no knowledge of system dynamics, to experienced practitioners. Hence an effort will be made to discuss essential background ideas along the way, and my apologies then, to those who find some material redundant. Among other attributes, System Dynamics takes the position that in dealing with dynamic models it is not acceptable to omit a process of significance from consideration on the grounds that "hard data" are absent. Put another way, when dealing with systems, processes must be included because of their significance in the real world, not on the basis of the ready availability of data, although such should be used when available. To "omit" a process deemed important on the grounds of insufficient data is not to omit it at all – but to include it with an assigned weight of zero! This is a far more serious structural error than getting the shape of an effect correct but its detail approximate. The simulation of models across ranges of uncertainty in some parameters will frequently result in robust behaviours that strengthen, rather than weaken confidence in outcomes.

Leadership of organisations, approached from a system dynamics perspective, adds a dimension different from those encompassed in the discussion of other leadership styles (transactional, transformational, moral, charismatic…) that have received attention. As earlier literature confirms (e.g. Yukl, 1997), these are behaviourally based, with emphases on how leaders relate, cajole, inspire, and encourage involvement in organisational activity; no criticism of these leadership models is implied. The additional dimension, provided by System Dynamics, involves utilising the importance of dynamic structural relationships for understanding behaviour and achieving sustained change. While systems thinking and its distinctive approach to organisational learning have achieved prominence through the Fifth Discipline (Senge, 1990), and its relatives and descendants, the underlying discipline of system dynamics pre-dated this work by 30 years. And application to the art and practice of the learning organisation continues to be developed and extended by workers in the field.

Many years ago Forrester e.g. (in Miller, 1972) powerfully summarized the challenges faced by policy makers and managers in terms of the complexity of system behaviour, in terms that are as relevant today as when it was written.

> Complex systems differ from simple ones in being "counter intuitive", i.e. not behaving as one might expect them to. They are remarkably insensitive to changes in many system parameters, i.e. ultra stable. They stubbornly resist policy changes. They contain influential pressure points, often in unexpected places, which can alter system-steady states dramatically. They are able to compensate for externally applied efforts to correct them by reducing internal activity that corresponds to those efforts. They often react to a policy change in the long run, in a way opposite to their reaction in the short run. Intuition and judgment generated by a lifetime of experience with the simple systems that surround one's every action create a network of expectations and perceptions that could hardly be better designed to mislead the unwary when s/he moves into the realm of complex systems. (Forrester in Miller, 1972, p. 50)

When considering matters of leadership decision-makers can be considered information converters, receiving incoming information flows and combining these into streams of managerial actions.

Most discussion around this theme seems to be organized as in figure 1(a). That is some information about a problem is identified, some action is proposed, and an outcome is expected. But in practice the expected outcome often does not materialize, and the reason for this is contained in the alternative structure of figure 1(b), which more realistically portrays the relationships at work. The problem symptom, action, and outcome are not isolated in a linear cause-effect sequence but in a closed chain of causality (feedback loop) whereby, for example, the outcome of the first action provides new information which forms the basis for further action and so on. An action may not necessarily reduce the problem symptom, but may cause fluctuation or indeed even accentuate the very factors that produced the symptoms in the first place. Taking a non-educational example, the problems we find easiest to solve are "local" in space and time. To give the remarks of Forrester a contemporary setting, there is really no need to cry over spilt milk, for the spill is contained in the immediate area and easily removed without further consequences – it is a local problem with a local solution. The same cannot be said about the "spill" of pollutants, which has consequences far beyond the immediate in both space and time. Current moves for more stringent emission controls can be recognised as consequences of earlier industrial practices, reverberating through a series of industrial, environmental, economic, political, and ethical relationships to impact years later at the source of the problem—levels of industrial pollutants released into the atmosphere. A disciplined approach to systems thinking is needed to trace circular chains of cause and effect through successive stages, and to articulate the associated mental models that provide the key to alternative outcomes. And of course our interest is in how similar systemic problems arise, and are addressed, within educational organisations.
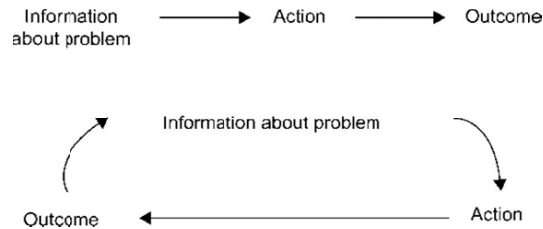
*Figure 1. (a) Linear cause-effect chain; (b) Circular cause-effect chain.*

## METHODS

A System Dynamics approach aims to identify how streams of decisions and resources interact to produce behaviours recognised as problematic for an organisation, for the purpose of intervention and performance improvement. It takes a view with respect to responsibility, shared by individuals as diverse as Shakespeare "The fault dear Brutus, is not in our stars but in ourselves that we are underlings"; and the cartoon character Pogo: "We have met the enemy, and he is us." That is, most persistent organisational problems are of our own making, and while external events can impact severely, the long-term quality of organisational responses is ultimately a consequence of internal decision making, and of the structure within which actions are framed and implemented. So the articulation of structure becomes the focus and has three significant components.

- The relationship between elements that interact in actual decision-making processes;
- The identification of circular chains of causality (cycles) formed from such links;
- The estimation of time delays that act to induce lags in action-impact links and hence in the cycles.

In simple cases system behaviour may be inferred from standard loop properties (archetype approach). In more complex cases, such as management of a university, models must be developed and behaviours simulated to identify the source of problems, and to seek and test intervention strategies (simulation approach).

## A LENS AND SCALPEL FOR MODEL BUILDING

Systems thinking, anchored within a system dynamics approach, acts as both a lens and scalpel for the building of models to support organisational learning, and underpin organisational change. To illustrate the lens dimension it is helpful to use the concept of "viewing distance" for which a traffic analogy is helpful. A driver's view is preoccupied with the detail of the immediate environment; operation of driving controls, fuel and temperature readings, detail of surrounding vehicles and

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their passengers, immediate obstacles to progress such as traffic lights etc. A driver is not however in a position to observe traffic patterns in the wider road system, and needs to tune in to traffic reports for advice to avoid potential (system) problems. Now we consider the view accessed by an observer at traffic control headquarters. Here foot and hand movements of individual drivers are not visible, individual intentions are not accessible, small differences between vehicles are blurred. But very evident are the overall flow patterns in the area, how these are being affected by sets of traffic lights, disabled vehicles, lane closures, accidents and so on. This is a systems view in which the behaviour of the whole is understood only through the interrelation of the individual parts, not merely through the presence of the parts. So it is with a systems approach to organisational management, learning, and decision making.

Managers of organisations need the "systems perspective" to complement experience gained in the hurly-burly of what is sometimes referred to as "the fray". Most of our experience in organisations resembles the driver in traffic, rather than an observer at Traffic Control. We're in the "traffic flow", reacting to emergencies, writing memos, attending meetings, resolving that conflict, planning that new course, refurbishing the laboratory, making decisions on the run, and so on. Living in the "fray" we develop an arsenal of fray conditioned responses; look after the immediate problem and hope the ramifications of our decisions don't return to hurt us – particularly in relation to fiscal decisions. All this reinforces our propensity for one-way thinking, actively subverting the systems view that searches for chains of consequences to inform future actions. The tools of system dynamics are provided to develop this complementary view, whose attainment is threatened when never ending demands for instant action diffuses the intensity with which necessary planning, and the ramifications of decisions, needs to be engaged.

The scalpel dimension focuses attention on systemic relationships; this time in the sense of Occam's razor, seeking the identification of key structure, adequate for explaining organisational behaviour, and able to provide both leverage for change, and means for sustaining change. This means identifying the major growth and balancing processes and the nature of their combination, together with delays that impact on their activity, so influencing outcomes.

The mathematics of system dynamics is most usefully accessed through the documentation provided with simulation software such as iThink, Powersim, and Vensim. (e.g. Powersim Studio, 2011).

## UNIVERSITY MANAGEMENT ISSUES

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 two have faced stringent operating environments. These have 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) drew early attention to a discourse indicating an increasing tension between dollarship and scholarship. There is documented evidence of downsizing and closure of academic units, voluntary or forced redundancies, the replacement of tenured positions by short-term appointments, punitive debt management strategies, and the imposition of broad national priorities in directing and rewarding research effort, whether or not this is always appropriate to the specifics of a particular department or school. He 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. But the ways in which universities manage budgets is typified by the following remarks by the Vice-Chancellor of a major Australian university, in late 2009.

> The viability of the tertiary education sector won't be threatened because institutions will have to take sensible changes to make sure they live within their budgetary capacity.

What he described as "sensible changes" is indicated by the announcement that his university will slash next year's budget by $45 million, which according to The National Tertiary Education Union (NTEU) would involve axing 300 jobs. (*International Students for Social Equality*, 2010).

In fact given that faculties and schools have found themselves continually competing internally for funding derived from government grants, it is not

surprising that they have sought funds from sources from outside the university where such competition is absent – specifically overseas student income. And now, as will be considered later, a further crisis is looming because of a downturn in student demand from this source.

This chapter reviews the implications of university managerial decision making in two contexts. Firstly to examine the implications of institutional management decisions in terms of the competitive mechanisms used to distribute funds internally, together with associated debt management strategies. Secondly, to examine the potential outcomes of alternative responses to the emerging "crisis" in funding, triggered by a downturn in overseas student demand, in the wake of the Global Financial Crisis. These are not independent, for the extent of this "crisis" has been materially affected by the search for external funds to ameliorate the impact of internal managerial policies, that have created financial stresses on faculties and schools.

With respect to the first of the above, in terms of university decision making, 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 a 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. (Although another view argues that faculties experiencing rapid growth need funds more quickly, so one-year retrospective funding is appropriate.) In practice internal managers apply combinations of local policies in ways reminiscent of the actions of business managers in classic system dynamics literature. With respect to applications, the author's work in this field and more broadly in educational leadership is represented in (Galbraith, 2004, 2003, 1999, 1998a&b). Papers representing cognate work by other authors include (Guzman & á Gutierrez, 2007; Kennedy, 2000).

GENERIC STRUCTURES IN UNIVERSITY MANAGEMENT

Two generic (fundamental recurring) structures appear repeatedly within the competitive organisational structure of publicly funded Australian universities. All institutions distribute a substantial proportion of funds on the basis of student load, for government allocations are strongly determined by enrolments at undergraduate and postgraduate level. The structure describing this process is shown in figure 2, and represents a proportional mechanism with "equivalent full-time student unit" (EFTSU), the unit around which the process is based. Nomenclature may vary, but some measure of student load is at the heart of all such activity.
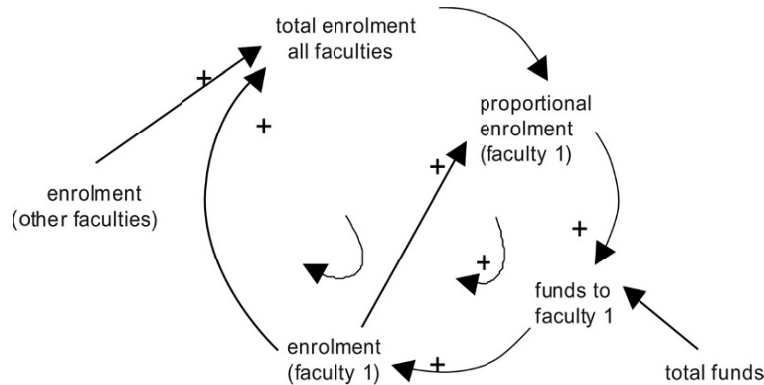
*Figure 2. Generic student load funding loop.*

While an increase in a faculty enrolment increases student load and hence tends to increase dollars earned (positive loop), it also increases the total load for the university, reducing the dollar value received per student when the total funding is limited (negative loop). The positive impact of higher enrolment is negated by the lower return received for each student. Consequently a faculty can grow in student numbers and yet suffer a reduction in funding if there is greater relative growth elsewhere in the institution. Under conditions where the total university grant is frozen or reducing, the worst possible circumstance is to be the slowest growing unit in a growing institution. Proportional formulae operate on the assumption that all other things are equal apart from numerical size that the formula is designed to provide for. But across a university other things are far from equal and such formulae ensure that in these circumstances winners and losers must emerge.

The second generic structure operates in the other major area of academic activity (research). Major research universities, keen to encourage and reward the research excellence of their academic members provide incentives through the allocation of a proportion of operating grants to faculties on the basis of their relative performance, say, in grant winning, publications and graduation of thesis students. (The precise choices here may vary but the resulting behaviour modes are the same). This is a soft managerial translation of hard managerial government pressure to direct and reward universities for "approved" activity. As with enrolments, when total funds remain relatively steady greater productivity results in a lower return per product. Every additional grant won, every additional paper published, and every new thesis student graduated ensures that less income is received for that particular product than the previous one. More and more effort is required just to maintain a relative position. A faculty or school working at maximum efficiency has nowhere to go but down, and smaller units are particularly vulnerable when total output is the criterion. The situation may be recognised as a version of the Tragedy of the Commons (Hardin, 1968). The relevant structure is shown in figure 3 in a scaled down form (two faculties).
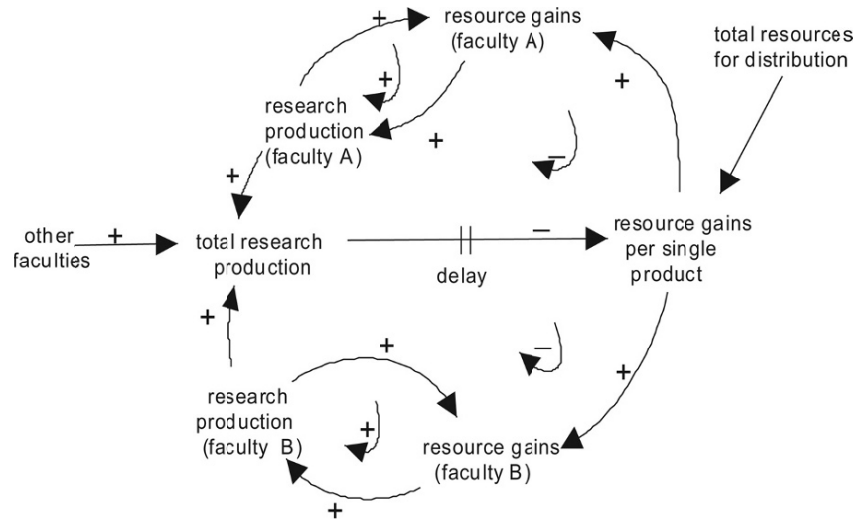
*Figure 3. Generic research funding loop.*

Now there are clear similarities between the structures shown in figures 2 and 3, but also important differences. Although proportional policies are enacted in both, for the enrolment sector, a mixture of natural processes (waxing and waning of demand) and legislated limits on access (quotas) serve to protect the common resource from excessive plundering by any particular faculty or school. Put another way principles for managing a commons act fortuitously to limit excesses in relation to enrolment pressures although these may be still severe. There are no such natural restraints within the research sector, as perceived monetary rewards to institutions and faculties, and promotional rewards to individuals based on increased research production drive the process so that units and individuals work harder and harder for less and less return per effort.

This structure can be identified at all levels, nationally between institutions, between faculties within institutions, and between schools within faculties. A build up of pressure to perform has been clearly evident for some time, but the ultimate price has been beyond the powers of institutions to predict.

There is a way to ameliorate the worst excesses of a "tragedy" policy, but this involves preserving a portion of the "commons" from quantity based free-for-all competition in favour of allocation based on quality. It involves allocating a proportion of available funds on the basis of agreed levels of performance, irrespective of the actual number of products produced. In this way a faculty or school that is losing staff on account of financial stringency may obtain some compensating reward if the remaining members maintain high quality performance. Under the free-for-all allocation policy such a unit is increasingly penalised, as total production falls in proportion to reduced staff establishment, and hence in relation to competitors.

PROBLEM SETTING

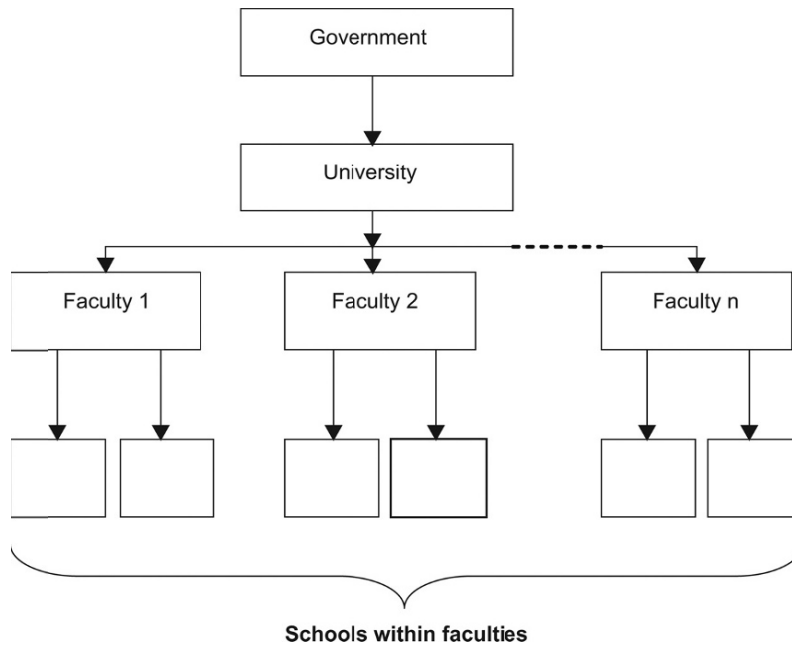The structure of a typical university is generally as depicted in figure 4.



**Figure 4. Typical structure of a public university.**

*Key University Decision Issues*

– Funding stringency (external);
– Performance accountability (external and internal);
– Management structures (internal);
– Behavioural outcomes (internal);
– Corporate-Educational tensions: scholarship vs dollarship.

*Typical Institutional Mechanisms (Funding Formulae)*

$$\$i = \left( Ps \frac{Fi \times EFTSUi}{\Sigma(Fi \times EFTSUi)} + Pr \frac{Ri}{\Sigma Ri} \right) G \qquad (1)$$

– $\$i$ represents the money allocation to faculty or school I;
– $Fi$ is a weighting index for the faculty or school;
– $EFTSUi$ represents the equivalent full-time student units of the faculty or school;
– $Ri$ represents the respective research index;

- G represents the total funds available for allocation;
- Ps and Pr are the respective proportions of G allocated on basis of student load and research performance respectively: (Ps + Pr = 1; e.g. Ps =. 85 and Pr =. 15);
- $Ri = \lambda_1(pi) + \lambda_2(gi) + \lambda_3(ti)$;
- The $\lambda$'s are multipliers (that sum to 1) and p, g, and t are respective counts of publications in approved outlets (p), a measure of competitively won research grants (g), and thesis student graduations (t). Typical values for the multipliers would be 0.5, 0.3, and 0.2 respectively.

### Basic Management Principle

- maintain balanced budgets in all faculties and schools.

### Supporting Principles

- maintain competitive funding practices between faculties and schools;
- encourage each unit (faculty & school) to set targets by way of individual strategic and business plans;
- maximise the performance of all faculties and schools as well as of the institution as a whole!

### A UNIVERSITY MODEL

The purpose here is to model the decision-making processes of an institution, subject to typical espoused management principles, to identify their behavioural ramifications, and the associated implications for policy.

### Model Structure

Figure 5 depicts essentials of the causal structure of a model designed to address the problem outlined with respect to university decision making. 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 5, 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, postgraduate coursework, 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 that 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), which 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 – representing lower or increased non-research workloads. 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), research grants (staff), 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 a federal policy decision to weight grants: publications: thesis student enrolments = 6:3:1 (such policies are amended from time to time). 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 and administrative responsibilities relative to the average values assigned as "normal".

As constituted for this application the model boundary contains all variables except for undergraduate and postgraduate coursework 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
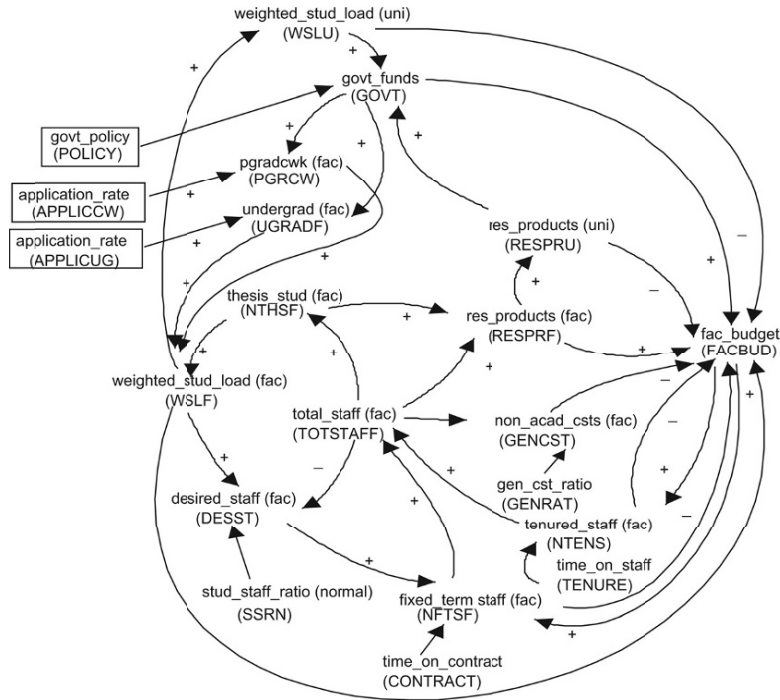
*Figure 5. Basic generic structure of the university management model.*

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, as shown above, 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. 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 was the subject of an earlier separate modelling exercise

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(Galbraith 1998a&b). 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 5 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. (Actually 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

This 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 received per product from the fixed (or slowly changing) pool are reduced, leading to a reduction in contribution to the faculty budget.

    These latter two loops taken together 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 (averaging) 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. For example the course length (three year) averaging time of equivalent full-time student units (contributing to WSLF) for providing input to the faculty funding rate, together with the management time frame chosen for the elimination of a surplus or debt (here three years), means that a delay of six years occurs between an initial enrolment increase and the final year of its flow-on impact to increased staff numbers. Large research universities allocate a substantial proportion of their operating funds (15% or more) for competitive allocation on the basis of research productivity. The associated loop incorporates aggregated staff research products (publications and grants) that make up the majority of this activity and performance is calculated in terms of products per staff member, averaged over a time period (2 or 3 years). An initial increase in faculty budget sets in motion a chain of consequences that lead eventually to a further increase in that budget. The effect takes about 3 years to fully impact at the source in consequence of the averaging process. A similar loop structure defines the contribution to research based funding on the basis of thesis graduates. In this case the loop delay is about 7 years since in addition to the averaging process full-time thesis students (Ph.D. and research Masters) spend an average time of about 4 years in candidature. Substantial stresses emerge when these positive loops run in reverse.

*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 grants received per research product or per EFTSU; 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. Sample parameters used in the model are shown in the table below. It should be noted that the

actual numerical values are unimportant in terms of simulation output, since it is behaviour and not numerical values that matter. Representative values are adequate.

*Table 1. Sample parameters*

| Description of sample parameters forming part of model structure | Representative parameter value | Type |
|---|---|---|
| Averaging time for student load/research output | 3 yrs | Policy |
| Fractional contribution to faculty budget on basis of eftsu | 0.85 | Policy |
| Grant per eftsu | $3315 | System condition |
| Initial non-thesis eftsu intake (Faculty) | 540, 810, 1080 | System condition |
| Fractional contribution of research products to faculty and school budget | 0.15 | Policy |
| Research products per staff member (normal) | 8 | System condition |
| Revenue received per research product (spread over 3 years) | $1980 | System condition |
| Fractional weighting of staff research to total research products | 0.8 | Policy |
| Assumed value for student/staff ratio based on efts (normal) | 22 | System condition |
| Fractional weighting of thesis graduations to total research products | 0.2 | Policy |
| Thesis students candidature time | 4 yrs | System condition |
| Thesis students per staff member | 2 | System condition |
| Faculty debt target elimination time | 3 yrs | Policy |

*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, 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 – which would use institution specific formulae and parameter values. 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, as they are significant for information purposes. Figures 6 to 12 contain output from base runs as described below.
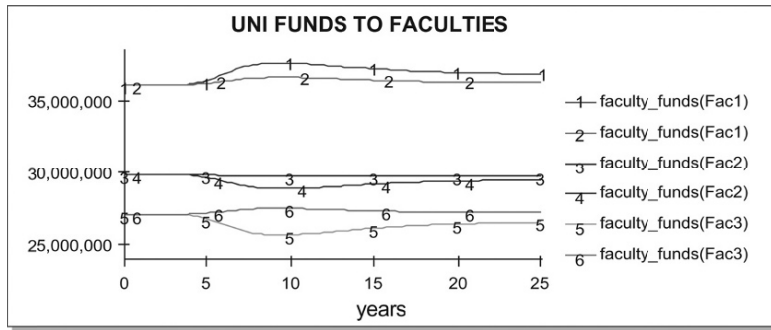


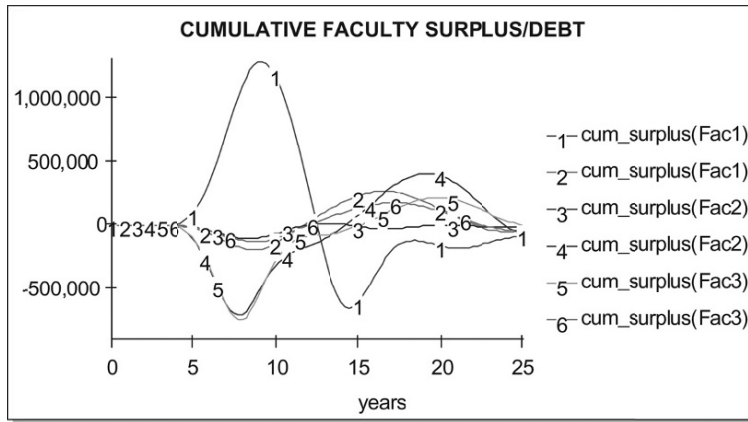*Figure 6. University funds distributed to faculties by formula (enrolment shock).*



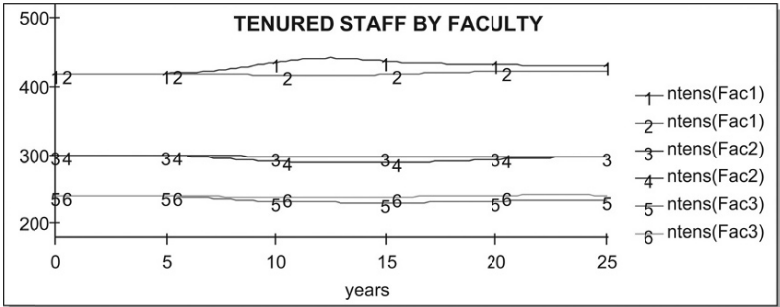*Figure 7. Cumulative debt and surplus by faculty.*
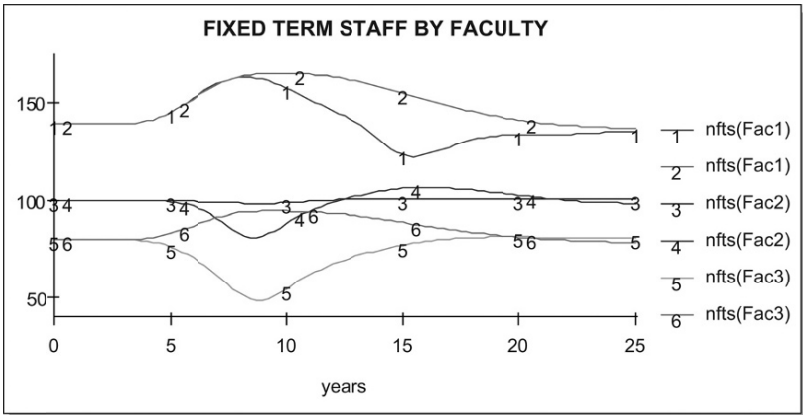
*Figure 8. Tenured staff by faculty.*



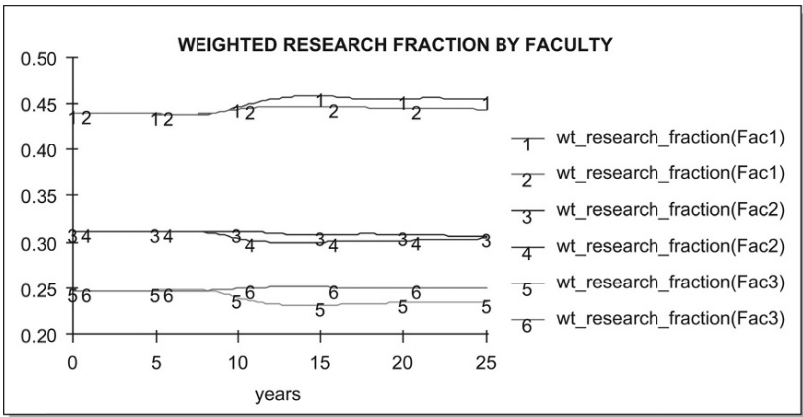*Figure 9. Short term contract staff by faculty.*



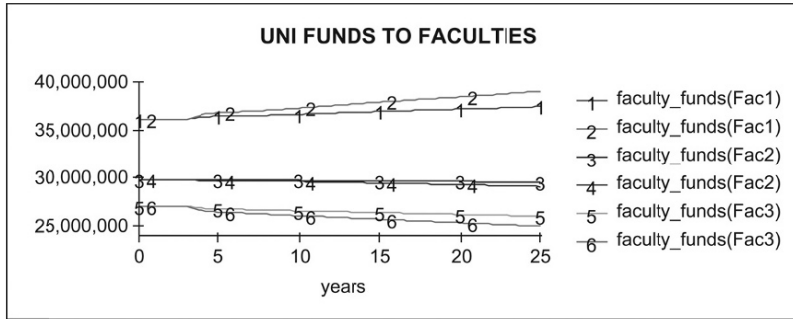*Figure 10. Weighted research fraction by faculty.*

*Figure 11. University funds distributed to faculties by formula (research weighting).*
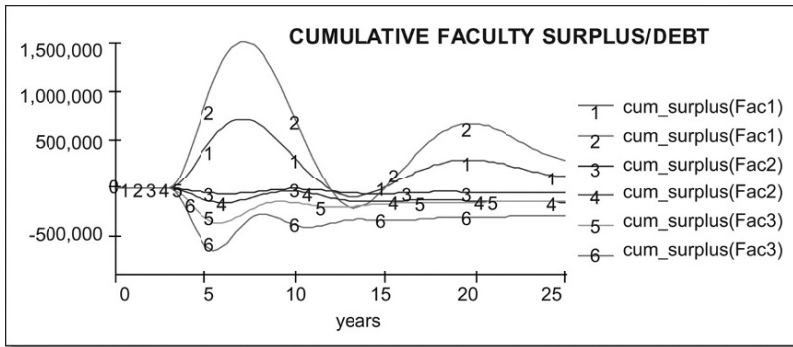


*Figure 12. Cumulative debt and surplus by faculty (research weighting change).*

It is assumed that government funding for student load remains fixed – ramp functions can be used to allow for change over time, and the fundamental behaviour modes remain the same. Figures 6 to 10 contain output from two basic model runs. In run A (graphs 1,3,5), faculty 1 experiences a step increase in enrolment in years 3 through 5, while faculty 3 experiences a similar proportional decrease. In run B (graphs 2,4,6), both faculties experience increases. For both runs faculty 2 experiences business as usual, and continues to enrol at its equilibrium rate. In constructing the model the faculties have been varied in size from faculty 1 (largest) to faculty 3 (smallest). The funding indices have been varied in reverse order, indicating that faculty 1 teaching costs and overheads are least; non-academic staffing cost ratios are assigned to be consistent with this. These assumptions can be reversed and parallel output generated. In run A, faculty 1 receives additional funds at the expense of faculty 3, and because of compensating effects the impact on faculty 2 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 7. Fluctuations in

tenured staff and adjustments to contract staff numbers in response to the budget fluctuations are shown in figures 8 and 9. Figures 6 and 7 show that the impact on resources triggered by the enrolment shocks is robust, persisting well after the intake levels return to their original values. Research output (figure 10) roughly follows the pattern of tenured staff and helps to maintain the initial advantage enjoyed by faculty 1. Likewise the disadvantage to faculty 3 persists. Run B demonstrates the severe consequences for a faculty that is maintaining enrolments when surrounded by growing competitors. Figure 7 shows that the creation of debt in faculty 2 (graph 4), reaches early levels as severe as those experienced by faculty 3 following a loss of enrolments in run A (graph 5). 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.

Figures 11 and 12 contain output for a different scenario in which the proportion of funds allocated on the basis of research performance is increased from 15% to 30% after 3 years. This represents a policy change that rewards increased research output at the expense of student load. Graphs 2, 4, 6 show how faculty 1 is advantaged and faculty 3 most disadvantaged. Because of its size and low student load weighting, faculty 1 gains from additional research based income, and the reverse applies in faculty 3 – illustrating 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 simply cannot provide – with likely costs that an institution will never know. The next section develops the consequences of organisational units needing to survive financially when subjected to the stresses imposed by questionable management policies.

*Aftermath*

And we can now see the consequences of the uncertainties created for schools and faculties. Given such an operating climate, which has existed over the past decade and more, it is natural that budget managers should look for external funding

sources where they do not have to compete internally on the basis of models designed to distribute funds by formula, which by definition will create winners and losers. In this they have been independently encouraged by government. Such a source has been the international student market, which in total has grown to be the third largest export earner in Australia. But the way in which international fee income has been used to subsidise university operations at large has created its own problems, as the student market has suffered a downturn in the wake of the Global Financial Crisis. The extent to which universities, and their faculties and schools, have come to depend on such funds has become a major current issue throughout the sector. Universities Australia has warned that a 10 percent decline in international student numbers will start to bite into university budgets with up to 7500 education jobs set to be cut in the next three years, to offset the fall in foreign students, who have been lucrative sources of revenue. (Whyte, 2011).

In a major sense then, the present situation has been fashioned as the almost inevitable consequence of a period in which internal institutional managerial strategies have pushed their faculties and schools into a search for stability through the acquisition of funds from outside their government grants – that is from international fee income.

## REAPING THE WHIRLWIND

Following on from the previous section individual Australian universities now depend on overseas students for up to 36 percent of their income, with many large universities exceeding 20 percent. In a similar vein to the above, Maslen (2010), in an appraisal reported in University World News, noted that international student numbers grew steadily from 2002, but there was a 15 percent drop over the 2009–10 business year compared to 2008–09, and it was http://www.universityworldnews. com/article.php?story=20100903180348516&mode=printpredicted that enrolments by overseas students could plunge by more than 100,000 by 2015. This translates to a potential fall in university revenues of $7 billion (currently US$6.4 billion) over the next five years. In the same article the National Tertiary Education Union warned that the fall in applications from foreign students had the potential to undermine the financial viability of universities and other education providers that have become increasingly reliant on international student fee income. "This drop in international student visa applications clearly indicates Australia is becoming a less attractive study destination for international students," said the union's Victorian Division secretary. (Maslen, 2010).

### *Significant Factors Influencing Student Choice*

According to the study International Students for Social equality (2010), a number of factors are contributing to the decline, including the high cost of studying in Australia, which has risen sharply due to the recent strength of the Australian dollar in the wake of the Global Financial Crisis. The researchers found that over 50 percent of prospective international students could not rely on their parents'

income as their sole source of funding, so that cost of education and of living are substantial issues.

A recent survey (Shah & Nair, 2010), indicated that the five most important reasons influencing student choice of university is quality of teaching staff, quality of academic facilities, employment prospects, links with industry and professions, and location of the university. These outcomes are similar to those found in a variety of other studies; for example: Briggs (2006) found that academic reputation and distance from home and location were key factors in student choice, while an earlier study by Coccari and Javalgi (1995) found that that quality of teachers, academic reputation and cost were the three top ranked items. Ahmad (2006) identified eight specific factors motivating Indian students in their choice of an overseas study location, and noted that reputation of the university seemed to be the unanimous top influencing factor among the students' decision-making criteria.

Before the emergence of the current situation qualities influencing perceptions of potential students about study in Australia were recorded in a commentary (Withers, 2007). The then Chief Executive Officer of Universities Australia, noted that "International students have rated quality of education, reputation and future employment prospects as the primary reasons for choosing to study at an Australian university". (International Students, 2007). Therefore there is much to lose in the present climate.

### Impact on Standards

In concert with the downturn in overseas enrolments, rumours have been circulating concerning the lowering of both entry standards, and course performance standards, required of international students in educational programs. These include claims that some universities had dropped standards to make it easier for foreign students to get degrees in Australia, with up to a third of international students in Australia allowed to graduate even though they were not proficient in English (Moor, 2010).

And new research has reported that poor written and verbal language skills of international students and locals from non-English-speaking backgrounds do not stop universities passing them. (Rowbotham & Matchett, 2011).

In a project funded by the Australian Research Council, University of NSW economist Gigi Foster used data from the business faculties at two universities to analyse selection and performance data for more than 12000 students (Trounson, 2011). She found international students and others from non-English-speaking backgrounds performed significantly worse than domestic students, and that the higher the concentration of international students in a course, the more their marks were buoyed. If widespread, this would mean international students may not be getting value for money because they are being allowed to perform at a lower standard than their Australian classmates. She says "The inferior results of international and NESB students need to be addressed before they inflict irreversible damage on Australia's educational brand image overseas and drive foreign students elsewhere" (Trounson, 2011).

The report notes that if Foster's research applies to all universities, the future of the international education industry is far from assured, since no family overseas will pay high course costs if they believe there are quality control problems in Australia.

In the same report, a business academic at Flinders University is quoted as saying that he has long complained of "soft" marking of international and domestic students with poor English skills, saying that academics are subject to implicit but unvoiced and unwritten pressure from management to overlook the lack of English skills of students.

*A Causal Loop Model*

To address implications for institutional management we consider the construct of a "typical university", operating in the environment described in the previous section. We take as given a step decrease in international enrolments from its previous (normal) operating conditions.

From the foregoing discussion, the following aspects define the operating environment. The university has come to depend on income from international students to fund other aspects of its operations as well as to service the needs of its overseas clients. Cost is a major factor for students and has been the primary cause of the decline, but other factors are important and may add a future impact. Program quality and university reputation rank highly, and if these are seen to erode there will be consequences for future enrolments given that overseas students have options, not just for other Australian universities, but in the global educational market place. Also valued are career prospects and employment success, and if graduates from the university no longer retain the favour with employers they once enjoyed, the message will not be lost on prospective students who will go elsewhere.

How might the university respond? In the first instance measures might be taken to shore up enrolments by accepting students with lower entry qualifications than previously, and progressing such students through degree courses. The earlier discussion has featured reports of this practice having already been implemented in some institutions, and the comments are not pretty.

Then there is the question of what happens with the reduced fee income. If a higher proportion than currently is siphoned off to subsidise the other university programs that have become dependent on it, then course quality, teaching, and infrastructure stand to be eroded – it has been reported that in some universities student-to-staff ratios now exceed 25:1 where once they were 13:1. A combination of weaker students and poorer resourcing will lead to a downgrading of quality, with impacts on future enrolments as described above, when these aspects reach public awareness. So whether a university holds the line on course quality or further diverts overseas student income for other purposes is a potentially major policy decision.

These and associated factors have been used to define the structure of the causal loop model shown in figure 13. A discussion of important aspects of the link and loop structure follows.
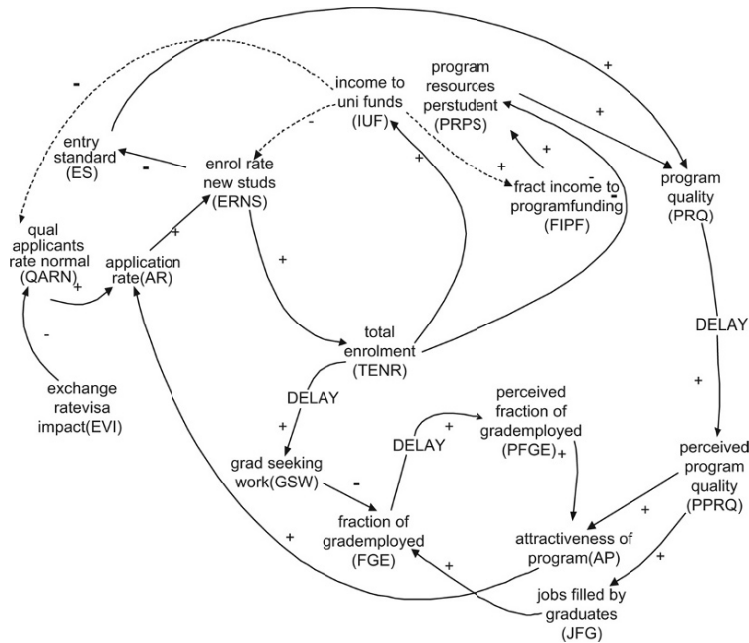
*Figure 13. Causal loop model of university operations.*

The interpretations of many of the labels in the diagram are obvious – the following descriptions are intended to clarify other essential meanings.

– AP: Attractiveness of the university program for potential students is determined jointly by the perceived quality of the program, and the perceived success of graduates in obtaining employment;

– FIPF: Is the fraction of the university income earned from international fee income that is used to support the courses (teaching and resource support) undertaken by these students;

– JFG: Jobs filled by graduates of this university;

– PQ: Program Quality is determined jointly by the academic quality of entering (and hence progressing) students, and the level of resourcing of the programs in which they are enrolled;

– PFGE and PPRQ: Perceived fraction of graduates employed, and perceived program quality. The impacts of changes in the fraction of graduates employed, and of program quality, are not immediately evident, but take time to filter through to a changed public perception, which then impacts on the attractiveness of the university programs;

– QARN: Refers to the number of qualified applicants typical for the university under "normal" conditions – that is prior to the impact of cost shocks.

## *Feedback Structure*

The solid arrows represent links that define the operation of the model in normal circumstances. The dotted lines represent specific policy options that are possible responses to conditions that impact on the operations of the university – reduced student demand. In total nine feedback loops are defined by the given structure. They are represented below by chains of causality that begin and end with the same quantity. Their polarity is obtained by following the corresponding signed chain of links in figure 13. Loop properties are derived under assumptions of ceteris paribus (all other things being equal) – an extended argument is provided for loop 1 as an illustration.

Loop 1 (-ve): AR → ERNS → TENR → GSW → FGE → PFGE → AP → AR

A decrease in the application rate (AR) leads to a decrease in the enrolment rate of new students (ERNS), and thence to a decrease in the total enrolment (TENR). In turn this leads to a delayed decrease in the number of graduates seeking work (GSW) and thence to an increase in the fraction of graduates employed (FGE). When this occurrence is perceived as enhanced employment conditions (PFGE) the attractiveness of the study program (AP) is increased which leads in turn to an increase in the application rate of students (AR) seeking a place at the university. Thus the negative (or balancing) property of the loop is confirmed.

   The structure and polarity of other loops is now summarised.

Loop 2 (-ve): AR → ERNS → ES → PRQ → PPRQ → AP → AR
Loop 3 (-ve): AR → ERNS → ES → PRQ → PPRQ → JFG → FGE → PFGE →
               AP → AR
Loop 4 (-ve): AR → ERNS → TENR → PRPS → PRQ → PPRQ → AP → AR
Loop 5 (-ve): AR → ERNS → ES → TENR → PRPS → PRQ → PPRQ → JFG →
               FGE → PFGE → AP → AR

These five balancing loops adjust to cope with fluctuations that occur during normal operating circumstances that includes planned changes in enrolment levels over time. However under conditions of extreme shock (sudden drop in qualified applicants) they struggle to provide the institutional stability needed – dealing with a sudden loss of income. In these circumstances institutional managers may enact various policies aimed at restoring institutional fortunes. These are depicted by the dotted arrows, and generate additional loops when brought into play.

Loop 6 (-ve): IUF → ERNS → TENR → IUF

This loop represents the policy of responding to a drop in income by reducing intake and course standards to increase and hold enrolments, hence increasing income. We note that the drop in entry standard (ES) will reverberate elsewhere as this quantity is also a component of loops 2, 3, and 5 above.

Loop 7 (+ve):  IUF → FIPF → PRPS → PRQ → PPRQ → AP → AR → ERNS
→ TENR → IUF

Loop 8 (+ve):  IUF → FIPF → PRPS → PRQ → PPRQ → JFG → FGE →
PFGE AP → AR → ERNS → TENR → IUF

The key policy link in these loops is the positive link joining IUF to FIPF. This says that when income to the university from overseas funds goes down, the dependency of other university functions on such external income means that the fraction retained to support the education needs of the overseas students (PRPS) is reduced, so that course quality suffers as a result.

Loop 9 (-ve): IUF → QARN → AR → ERNS → TENR → IUF

The key link here is the negative link joining IUF to QARN, and represents a policy that as far as traditional practice is concerned, involves thinking outside the square.

Foster (Trounson, 2011) raised what she described as a key policy implication – that international students from non-English-speaking backgrounds should have extensive language and cultural training before starting higher education programs. She goes on to say that

> The sector is too cash-strapped, or thinks it is too cash-strapped, that it isn't willing to put the fees international students are paying towards that.

What this loop does is boost the numbers of qualified applicants that form the normal pool from which the international intake is drawn – that is acts directly at the point of impact of the downturn. There are two ways in which this might be envisaged. One is to provide training to elevate the level of English competence among potential students who are otherwise academically capable. The argument is that this could be done for a fraction of the fee income that such students would generate when subsequently enrolled. The other way would be to offer a fee discount to entering students that would compensate for the additional costs presently inhibiting their enrolment – again a fraction of the fee income brought by students who would otherwise not be enrolled.

*Policy Implications*

One of the drawbacks of causal loop diagrams is that while they are excellent for conveying the loop structure, precise outcomes are difficult to predict because of the complex interactions and shifts in loop dominance that occur. For this simulation is required. In the present case a compromise has been utilised – simulations have been conducted using coarse quantitative assumptions to instantiate the model variables and relationships described above. It is not appropriate to include their detail here but the outcomes have proved robust across a range of values, and as such are helpful in developing the implications of the causal loop structure.

The most significant implications are the following. The short term influence of the negative loop (loop 6) that represents direct action to shore up income by letting under qualified students enrol, is neutralised in the longer term by the action of other loops that share the key variable "entry standard", through its ultimate impact on perceived program quality and the flow on to affect future application rates.

The most damaging action is that represented by loops 7 and 8 which result from the diversion of already diminished funds away from funding the programs undertaken by the international students, because other parts of the university have come to depend on support from this source. The two positive loops respond as vicious cycles to worsen the enrolment and hence funding situation – the simulations indicate that "holding the line" is a critical measure to prevent further erosion and position the institution for a comeback.

Loop 9 represents an almost counterintuitive policy – respond to a downturn by increasing outlays. Simulation suggests it is one of the fastest and most effective if it can be made to work. If the institution already has a presence in target countries, as is the case with many, the first option discussed in the previous section looks feasible, as the required tuition can be provided without the prospective students leaving home. The discount option is more straightforward but perhaps less effective in a world where other institutions might outbid the bidder. The first option also suggests greater commitment to the potential student.

One final question invites attention, noting that it links the modelling described in previous sections. In the light of what has emerged, will universities be moved to review their internal policies that led to faculties and schools becoming so dependent on foreign money in the first place?

## SUMMARY

As the modelling issues that have emerged indicate, 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 guarantee a familiarity with the concepts appropriate for an understanding of the system dynamics of a university in its operating environment. It is relevant also here to review historical circumstances that make the university context different from the business community that to date has provided most examples of learning organisation culture. Many of these examples have been drawn from companies able to reflect on their current performance against a backdrop of fluctuating fortunes, over a time-scale long enough to evaluate the outcomes of their existing and past policies. The university environment we have considered is relatively young – of the order of a decade or two, and there has not been time for the implications of many of the policies to be experienced in full. Some extended loop delays have been noted, but managers have felt impelled to act on emerging data without realising that the very data that concerns them are a product of their own decision making.

Secondly university administrators come from a much more homogeneous background with respect to management than their counterparts in business and industry, and this adds two further compounding factors. In a company the different divisions such as advertising, sales, and production, as we have often been reminded, may pursue goals and policies each designed with the best of intentions, yet creating problematic total outcomes for the company. However in contributing to a systemic attack on company problems, individual division managers are likely to accept the expertise and field experience of their counterparts with different industrial backgrounds in those respective parts of the organisation in which they are expert, and for which they are responsible. In universities those responsible for planning and resource allocation across an institution have a common academic heritage, albeit in different discipline areas, in that they have been successful teachers, researchers, and administrators within their fields. There is a tendency to equate this background with a similar uniform ability to successfully design and implement policies to achieve successful outcomes for what appears to be a sequence of individual objectives. In the absence of a systemic understanding of organisational dynamics other backgrounds, however expert in their fields, are rarely sufficient.

The other related matter is again a consequence of the way universities manage their internal structure. While there may be tensions between the different divisions of a company, there is a common purpose to see their organisation thrive – a common enemy exists in the form of external competitors. With the creation of competition between faculties and schools, internal managers in universities find themselves as much in competition with each other as with threats from outside. Energy stands to be fragmented, and synergy suppressed, as suspicion enters together with new ideas. The resulting diversion of effort generates a cost that is impossible to measure, in both monetary and human terms. The way in which co-operation is in tension with competition within university structures, remains one of the major challenges to the capacity of an institution to function as a genuine learning organisation.

In this chapter I have illustrated how an understanding of the system dynamics approach is important for addressing issues that have emerged in the management of universities. Fundamental is the endogenous point of view – that the sources of problems in organisations are significantly caused and exacerbated by decisions made internally, that reverberate through feedback structure to impact on future performance. In this respect it is salutary to reflect on Senge and Sterman's (1994) discussion of management difficulties experienced by executive administrators challenged to respond to simulated operating conditions representative of their organisational contexts. 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. These quite different organisational contexts shared common feedback structures, even though the particular clothes in which they were dressed varied from case to case.

Through its systemic and structure based approach, system dynamics provides an approach to organisational modelling that can address problems that linear methods in particular, are not equipped to deal with. The task may be straightforward or difficult, but insights stand to be generated that other methods are not equipped to provide.

Perhaps a profound irony accompanies the problem of university management. The past twenty years has seen corporate businesses increasingly seek to enhance their performance through the systemic insights provided through engagement with the theory and practice of the learning organisation movement. During this same time period, universities which should arguably be the ultimate learning organisation, seem to have been have been doing their utmost to head down the path that such corporations have been leaving – the path that prides itself on priorities that the thinking behind the Fifth Discipline (Senge, 1990) and subsequent developments have challenged.

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## AFFILIATION

*Peter Galbraith*
*School of Education*
*The University of Queensland*

CHARLOTTE GLADSTONE-MILLAR, ASHRAF LABIB,
RICHARD TONGE, AND DAVID SMITH

# 12. AN OPERATIONAL RESEARCH TECHNIQUE FOR THE FORMULATION OF HIGHER EDUCATION INSTITUTIONAL STRATEGY AND FUTURE DIRECTIONS

## INTRODUCTION

Complex situations such as environmental changes and their impact upon higher education institutions are major challenges that require innovative and efficient approaches to model and provide decision support.

In a review report commissioned by the EPSRC (2004) to review the status of Operational Research (OR) in the UK, the significant importance of this field has been highlighted, and a comprehensive SWOT analysis was carried out by an expert panel of world-class OR academics and UK practitioners. Shortcomings identified in the report included the UK's weakness in specific OR areas compared with other countries. Among the weaknesses highlighted in the report was that "although the emphasis on applied OR is remarkably strong in the UK, a gap can still remain between the output of a successful research project and what is needed for direct use by industry", (p. 4). It is therefore important to investigate means of bridging this gap and in this chapter we contribute to overcoming this weakness by demonstrating use of OR techniques in the field of Higher Education Institution (HEI) strategic management.

In many decision scenarios there are multiple goals which need to be achieved and which involve a variety of stakeholders who have different and sometimes conflicting objectives. Therefore there is a need to evaluate decisions based on multiple criteria.

In this chapter we propose an OR methodology named "multiple criteria decision making" (MCDM). We use a technique linked to MCDM called the Analytic Hierarchy Process (AHP) to help address issues related to the formulation of a model that can represent different factors and alternatives, assess their priorities, and provide a decision-making mechanism. We demonstrate this approach using an example that shows the underlying theory of the OR approach in order to enrich management understanding and, as a whole, offer a "tool box" of OR approaches for HE management.

The proposed model is dynamic in that it adapts to changing economic and environmental conditions and hence has the capability to provide what-if analysis. It is applied in the context of strategic decision making for a business school and

involves "influencing factors" such as economic conditions and competitive environment. It also involves key stakeholders in the decision making process who have responsibilities for strategic functions within the HEI and the school, namely; academic quality, research, student experiences, and innovation. The model also incorporates the different objectives of the key stakeholders. Finally it considers strategic options for investments. Thus we demonstrate a way to apply OR approaches such as MCDM and resource allocation in the context of strategic decision making in HE, taking into account external conditions, that enable us to prioritise key stakeholders, and their objectives. The proposed dynamic model is able to adapt the outcomes in line with the influences of changing prevailing external conditions on stakeholders' priorities.

## Challenges for HEIs

In the early twenty-first century HEIs are performing a variety of roles. They are introducing many more people to degree level study, conducting increasingly applied research, and working with and for businesses, local communities and the public and voluntary sectors. Part of this diverse role is to help all these sectors to prosper and HEIs are expected to engage locally, regionally, nationally and globally. Indeed in many towns and cities the HEI is one of the largest employers and a focal point for the community.

However HEIs are also experiencing increasing expectations from government and society at large, and there is growing competition between individual HEIs and from private providers of degree-level study for students and research funding. To resolve these pressures HEIs need to be ever clearer about their missions and strategies to create the best return on public and private investment in higher education and on the resources available to senior management.

In common with other sectors of society, the pace of change is increasing, meaning that it becomes ever more important for higher education institutions to be able to gather knowledge and respond swiftly to changes in student expectations, employability trends, funding regimes, international border controls, technological developments, and agendas pertinent to local industries and the voluntary sector, to suggest just a few. Strategic planning using OR techniques provides senior managers with a tool that will allow them to model the changing scenarios in order to refine their strategic plans in response to external and internal drivers.

## Importance of Strategic Planning in HEIs

In 2000 the Higher Education Funding Council for England (HEFCE) produced a guide to strategic planning in higher education for heads and senior managers of institutions and members of their governing bodies (HEFCE, 2000). The guide is not prescriptive but identifies common principles and provides examples of good practice "to help heads of institutions and senior managers to plan more effectively and so stand a better chance of achieving their institutions' strategic goals" (p. 3).

One of the key messages in this guide is the importance that should be placed in analyzing the institution and its environment in relation to medium and long-term goals in a methodical and systematic way. The HEFCE guidance draws on key literature sources to provide the academic background which has been used extensively to influence the development of strategic planning practices in HEIs. The model they recommend focuses on identifying the institution's long-term direction using a cyclical model with the three phases of planning, documentation, and implementation and monitoring to adapt future strategy. They caution against a mechanistic approach associated with a detailed timetable for an annual planning cycle which can stifle creative thinking and impede flexibility and opportunism.

Strategic planning involves planning for the organization as a whole, rather than planning for individual elements such as production, cash flow, or workforce planning. However strategic planning is recommended for semi-autonomous segments of an organization such as a business school to give direction to separate elements including the marketing strategy and human resources strategy.

For a UK business school its vision might be expressed as:

> By [date] the Business School will be recognised nationally and internationally as a leading UK centre for business and management education and research.

To achieve this vision would involve continued excellence in learning and teaching, research and knowledge transfer, meaningful engagement with business and the public and voluntary sectors, and the development of a vibrant executive education portfolio. It would also require strategic investment in areas of excellence. To achieve this vision, important areas for strategic investment would include engagement with business and the public and voluntary sectors, a focus on students' employability, and growth in applied research, academic entrepreneurship and executive education.

Discussions among the senior management could lead to a strategy expressed as:

– To integrate our research, learning and business and community engagement to enhance the student experience and give benefit to the economic, social and environmental well-being of the locality and beyond;
– To ensure that everything we do is sustainable, with high standards of ethics and integrity;
– To develop further strategic alliances with academic, public sector, voluntary and business organisations and seek opportunities for collaboration within the university and with external partners;
– To continue to build a national and international reputation for our achievements.

The business school is then faced with a quandary. How should limited resources be allocated to the strategic aims? Should each one be pursued with equal vigour, or will an emphasis on just one or two enable the business school to realize its vision sooner? These are questions that the OR model described below can make a valuable contribution towards answering.

A BRIEF OVERVIEW OF THE ANALYTIC HIERARCHY PROCESS (AHP)

The Analytic Hierarchy Process (AHP) is a multi-criteria decision making method that helps the decision-making unit facing a complex problem which has multiple conflicting and subjective criteria, such as location or investment selection, project ranking, and so forth (Ishizaka & Labib, 2009). It can accommodate the views of a number of decision-makers (actors) and the trade-off of their objectives.

The AHP is designed to solve complex decision-making problems when there are multiple objectives or criteria to consider. This approach has been introduced by Saaty (1977, 1980 & 1994) and requires the decision maker(s) to provide judgments about the relative importance of each criterion and then specify a preference on each criterion for each decision alternative.

The first step in the AHP is the decomposition of the problem into a decision hierarchy (Vassoulla et al., 2006). This may take the form illustrated in figure 1.
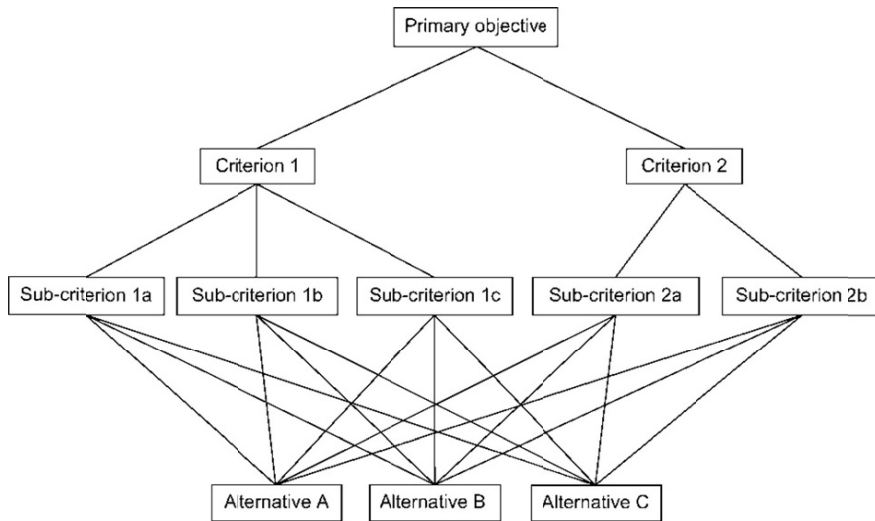


*Figure 1. A typical AHP decision hierarchy.*

The next step is to establish priorities amongst the elements in the hierarchy by making pairwise comparisons of the criteria and alternatives. These comparisons are carried out using Saaty's (1980) predefined one-to-nine ratio scale.

One of the most practical issues in the AHP methodology is that it allows for non-consistent pairwise comparisons. In practice, particularly with multiple decision-makers, perfect consistency is unusual. The pairwise comparisons in a judgement matrix are considered to be adequate if the corresponding consistency ratio (CR) is less than 10% (Saaty, 1980).

After the alternatives have been compared with each other in terms of each one of the decision criteria and the individual priority vectors have been derived, the priority vectors become the columns of the decision matrix. The weights of

importance of the criteria are also determined using pairwise comparisons. Therefore, given that there is one goal, m criteria and n alternatives, the decision maker will create one (m × m) matrix for the criteria and m (n × n) matrices for the alternatives. The (n × n) matrices will contain the results of n.(n-1)/2 pairwise comparisons between the alternatives. Finally, given a decision matrix the final priorities, denoted by $A^i_{AHP}$, of the alternatives in terms of all the criteria combined are determined according to the following formula:

$$A^i_{AHP} = \sum_{j=1}^{n} a_{ij} w_j \,, \; for \; i = 1, 2, 3, \ldots, m. \tag{1}$$

Clearly, the AHP is most efficiently applied when the total number of criteria and alternatives is not excessive and so this approach can facilitate focus on key criteria for "the customer's value to us".

There are three outputs that can be produced from the AHP process:

– An overall ranking, which helps in understanding how each customer is compared to the others;
– A measure of the overall consistency of the decision maker's preferences which is a useful feedback for validation of consistency, as explained before. Overall inconsistency of less than 10% is normally acceptable as a measure of consistent preferences;
– A facility to perform sensitivity analysis (what-if analysis) which provides information about the causal relationships among the different factors. This capability can help us to explain and predict the different relationships among criteria and alternatives and is particularly valuable in creating scenarios for movement in relationships (positive or negative). This helps to overcome concerns about customer analysis as static and unhelpful in predicting future resource allocation needs.

## STRUCTURE OF THE PROPOSED MODEL

The AHP is not only a decision support tool for helping decision makers to select or allocate resources, it also helps to construct a mental model of understanding the nature of the problem (Labib, et al., 1997).

Beginning with the goal to identify investment priorities to achieve strategic objectives in an HEI, a hierarchy (see figure 2) is developed.

Moving down from the apex of the hierarchy, the first level of the hierarchy deals with the perceived likely conditions that the HEI may experience. The second level identifies the decision makers, or the actors, who are related to educational quality, research, students and innovation. In this case the actors are the existing Associate Deans for those functions at a business school which is the subject of this example. The third level is concerned with the objectives of the business school, derived from mapping the objectives of the actors involved. The final tier of the hierarchy considers the alternative strategic options which are to be prioritised. The following discussion deals with the elements of each level in this hierarchy in more detail.
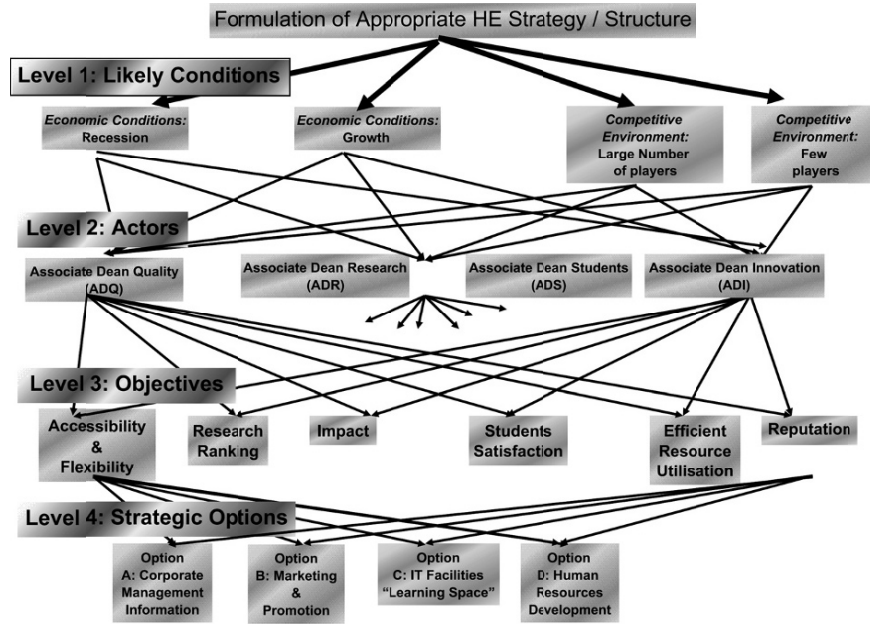
*Figure 2. Proposed hierarchical model based on the AHP.*

## Likely Conditions (Level 1)

The first level of the hierarchy contains the status and environmental conditions categorised into four categories which relate to economic conditions, and competitive environment. Economic conditions are classified as either in a recession or a growth condition. Competitive environment (in the context of higher education) is categorised as either large number of players indicating intense and diverse competition, or few players indicating that the market still offers limited opportunities (and thus a degree of power) to its incumbent suppliers.

## Actors (Level 2)

An actor is an individual or a group playing a significant role in responding to forces that shape current events and, therefore, future outcomes (Labib et al., 1997). The main actors in this case study spanning the full range of activities in the business school are the Associate Deans of quality, research, students, and innovation (encompassing knowledge transfer and collaborative arrangements). For abbreviation we use the following terms: ADQ, ADR, ADS, and ADI. They are considered to be the most suitable decision making body within the HE institution interested in the prioritisation of the HE strategy at business school level. This is especially true with respect to deriving a league table ranking based on performance indicators, since the majority of indices used are usually the main concerns of those managers. Other actors can be included in the hierarchy

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according to the structure of each organization, such as for example, heads of departments, faculty manager, and so on. The aim of this exercise is to present a methodology and a framework rather than a rigid model. This shows that the concept of hierarchies is stable and flexible; stable in that small changes have small effect and flexible in that additions to a well-structured hierarchy do not disrupt the performance (Labib et al., 1997).

### *Objectives (Level 3)*

Prioritisation of strategic options will depend on a multitude of objectives, some of which are conflicting, and others are related or complementary. Prioritisation is useful for either a selection decision (choose the best), or as a portfolio resource allocation decision (allocate resources to all options according to the percentage of weights allocated to different alternatives). The objectives of the HE institution in this example are to increase: accessibility and flexibility, research ranking, impact of research and knowledge transfer, students satisfaction, and reputation, as well as to maximise efficient resource utilisation (defining "resource" as time, effort, money and people).

### *Strategic Options (Level 4)*

Finally, in any hierarchy, one usually considers the specific options that need to be prioritised.

### A DETAILED ANALYSIS USING A CASE STUDY

The intention here is to present an example of how the proposed model can operate. Assumptions and data used here are illustrative and not intended to be definitive.

Decision applications of the AHP are carried out in two phases: hierarchic design and evaluation. In the previous section, the hierarchic design phase was considered. In this section the second phase, namely the evaluation phase, is considered. The first step is to assess the likelihood of the conditions in relation to the type of industry. Each of the two likely conditions, economic conditions and competitive environment, is divided into two options where the decision maker needs to score the highest and lowest values with respect to each pair in those four categories.

The next step is to establish priorities amongst the elements in the hierarchy by making pair-wise comparisons of the criteria and later on we apply the same to other levels in the hierarchy until we reach the options level. Given Criterion i and Criterion j, these comparisons are carried out using Saaty's (1980) predefined one-to-nine ratio scale. Figure 3 shows how such comparison was done using a "questionnaire" mode in the Expert Choice software which facilitates the application of AHP.

*Figure 3. Example of pair-wise comparison.*

The evaluation is done through a pair-wise comparison by asking: "Which of the following two scenarios is most likely to occur in our current planning cycle?" In this particular case study we have identified the prevailing economic condition to be of a recession, and it can be observed that in row 1, Recession scores the highest value of 9 when compared to Growth. In terms of competitive condition, it is assumed in this case study that competitive intensity is high and hence Large Number of Players scores 9 when compared to Few Players.

The number of pair-wise comparisons is equal to n.(n-1)/2 = 6, where in our case n = 4. Once the table is completed, the relative likelihood of the 6 scenarios is obtained based on the AHP method explained in the previous section. These priorities are on a ratio scale from 0 to 1 and they all add up to unity as shown in the last column of table 1.

From table 1, it is evident that the likely conditions with the highest score of 0.450 in the relative likelihood column are attributed to recession and large number of players.

The computation of the relative likelihood is as follows: the elements of each column are divided by the column sum and then row averages are calculated to obtain local priorities. There are other methods of computing relative priorities as reported in Saaty (1980) and Ishizaka and Labib (2009).

*Table 1. Relative likelihood of scenarios*

| With respect to: HE Strategy | Recession | Growth | Large Number of Players | Few Players | Relative Likelihood |
|---|---|---|---|---|---|
| Recession | 1 | 9 | 1 | 9 | 0.450 |
| Growth | 1/9 | 1 | 1/9 | 1 | 0.050 |
| Large Number of Players | 1 | 9 | 1 | 9 | 0.450 |
| Few Players | 1/9 | 1 | 1/9 | 1 | 0.050 |
| | | | | | CR =0.0 |

The next stage assesses the priorities of each actor considered with respect to one of the scenarios. The analysis is based on the relative strength and influence of each actor in shaping the priorities. One approach is to consider their influence with respect to the upper level (Level 1) in the hierarchy that concerns the different prevailing conditions as in figure 2. If the case of a large number of players is considered, then the importance of ADS is medium, whereas ADQ is very high, and ADI and ADR high. The task to assign weights (importance) to the different decision-makers of the group is often a difficult one. We propose a simple and fair method, where the weights of the members are judged by the other members of the group (Ishizaka & Labib, 2011).

The next step is concerned with finding the priorities of the various actors under each of the four conditions. This is shown in table 2.

*Table 2. Priorities of actors under each condition*

| | | Actors (Stakeholders) | | | |
|---|---|---|---|---|---|
| Conditions: | | ADQ | ADR | ADS | ADI |
| Economic Conditions: | Recession | VH | VH | M | M |
| | Growth | M | M | VH | VH |
| Competitive Environment: | Large Number of Players | VH | H | M | H |
| | Few Players | M | M | VH | M |

In assessing, for example, the priorities of the actors with respect to a "recession" and "growth", the following comparison matrices are obtained as shown in tables 3A and 3B.

These results correlate with table 2, where in the "recession" row, ADQ and ADR have very high (VH) priority, and followed by both ADS and ADI, who score medium (M). Whereas in "growth" economic conditions, both ADS and ADI score VH, and ADQ and ADR score M. Again, here we emphasise that the aim of this exercise is to present a methodology and a framework rather than a rigid

model and hence one can vary importance of actors by performing sensitivity analysis (what-if) and the model will dynamically alter the importance of alternatives as we will see later on.

*Table 3A. Priorities of actors' level (level 2) with respect to condition 3 (recession) in level 1*

| With respect to: Condition 3: Recession | ADQ | ADR | ADS | ADI | Global Priority of actors with respect to Recession |
|---|---|---|---|---|---|
| ADQ | 1 | 1 | 6 | 6 | 0.429 |
| ADR | 1 | 1 | 6 | 6 | 0.429 |
| ADS | 1/6 | 1/6 | 1 | 1 | 0.071 |
| ADI | 1/6 | 1/6 | 1 | 1 | 0.071 |

*Table 3B. Priorities of actors' level (level 2) with respect to condition 3 (growth) in level 1*

| With respect to: Condition 3: Growth | ADQ | ADR | ADS | ADI | Global Priority of actors with respect to Growth |
|---|---|---|---|---|---|
| ADQ | 1 | 1 | 1/6 | 1/6 | 0.071 |
| ADR | 1 | 1 | 1/6 | 1/6 | 0.071 |
| ADS | 6 | 6 | 1 | 1 | 0.429 |
| ADI | 6 | 1/6 | 1 | 1 | 0.429 |

Continuing on in the same fashion, the priorities of each objective under each condition are derived, as shown in table 4.

*Table 4. Local priorities of level 2 relative to level 1.*

| | Economic Conditions: | | Competitive Environment: | |
|---|---|---|---|---|
| | *Recession* | *Growth* | *Large Number of players* | *Few Players* |
| ADQ | 0.429 | 0.071 | 0.535 | 0.167 |
| ADR | 0.429 | 0.071 | 0.196 | 0.167 |
| ADS | 0.071 | 0.429 | 0.073 | 0.500 |
| ADI | 0.071 | 0.429 | 0.196 | 0.167 |

Note that the summation down each column must equal to unity. The results demonstrate, for example, that the importance of the ADQ is significant during recession economic conditions and in the existence of large number of players as a competitive environment whereas the importance of ADS is significant in a few players situation and in growth economic condition. Again this correlates with the data given in table 2.

To derive the global priorities of the actors (i.e. how important these actors are to the overall goal and not just to each scenario), one must weight their relative (local) priorities (table 4) by the priorities (likelihood) of the scenarios themselves (table 1); this yields a vector (table 5), which should also add to unity.

*Table 5. Global priorities of actors.*

| Actors | Priorities |
|--------|-----------|
| ADQ | 0.4457 |
| ADR | 0.29315 |
| ADS | 0.11125 |
| ADI | 0.14995 |

When dealing with different actors, if no consensus is reached, then a geometric mean can be used as suggested by Saaty (1980) to average the judgements. This completes the prioritisation of the first two levels, namely that of the scenarios and the actors.

The actors' objectives are to increase: accessibility and flexibility, research ranking, impact of research and knowledge transfer, students satisfaction, and reputation as well as maximise efficient resource utilisation. For the sake of brevity the judgements of different actors when considering the scenario of "large number of players" are presented in table 6. The judgements for these assessments were carried out by asking each of the actors to complete pair-wise comparisons with respect to their preferred objectives under every scenario.

*Table 6. Local assessment of different actors' objectives with respect to the scenario of large number of players*

| With respect to: Large number of players | accessibility and flexibility | research ranking | impact of research and knowledge transfer | students satisfaction | reputation | efficient resource utilisation |
|---|---|---|---|---|---|---|
| ADQ | 0.364 | 0.024 | 0.047 | 0.104 | 0.352 | 0.108 |
| ADR | 0.058 | 0.268 | 0.105 | 0.268 | 0.268 | 0.033 |
| ADS | 0.248 | 0.195 | 0.071 | 0.204 | 0.185 | 0.097 |
| ADI | 0.049 | 0.081 | 0.139 | 0.248 | 0.451 | 0.032 |

Note that the priority figures of each actor in table 6 are in the form of decimals, and their summation across the rows adds up to unity. As shown in table 6, due to his/her concern to maximise student numbers, the ADS prioritises his/her objectives to increase *student satisfaction* and maximise *accessibility and flexibility*, while the ADI prefers to increase *reputation* with some emphasis on *students satisfaction* and *impact of research and knowledge transfer*. The ADR's, major concern is *research ranking, reputation* and *student satisfaction*. The ADQ's major concerns are *accessibility and flexibility,* and *reputation.*

Finally, we consider the relative attractiveness of alternative strategic investment options, and we start by identifying areas that we need to prioritise with respect to each objective and then find the local priorities of the strategic options with respect to each objective. In order to minimise space, the detailed comparison matrices will not be presented but a summary of how alternatives are prioritised globally is shown in figure 4 below.
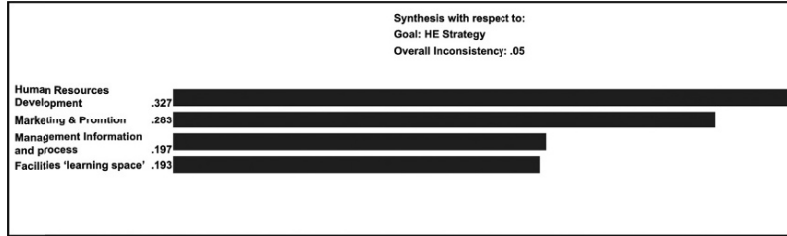
*Figure 4. Global priorities of alternative strategic investments.*

## RESULTS OF SENSITIVITY ANALYSIS

The results of sensitivity analysis can be shown in figures 5 and 6, where the criteria are depicted as columns in figure 5. For example we show the scenario where recession is more likely than growth, and with a large number of players more likely than few numbers of players. Figure 5 also shows the performance of each of the objectives with respect to each of the scenarios in the high recession scenario: Human resources > Marketing > Management Information > Facilities "learning space" (where ">" signifies "more important than"), whereas in the scenario of large number of players: Marketing > Human resources > Facilities "learning space" > Management Information. Hence in terms of global (overall) priorities: Human resources > Marketing > Management Information > Facilities "learning space".



*Figure 5. Sensitivity analysis: Alternative strategic investments with respect to different scenarios.*

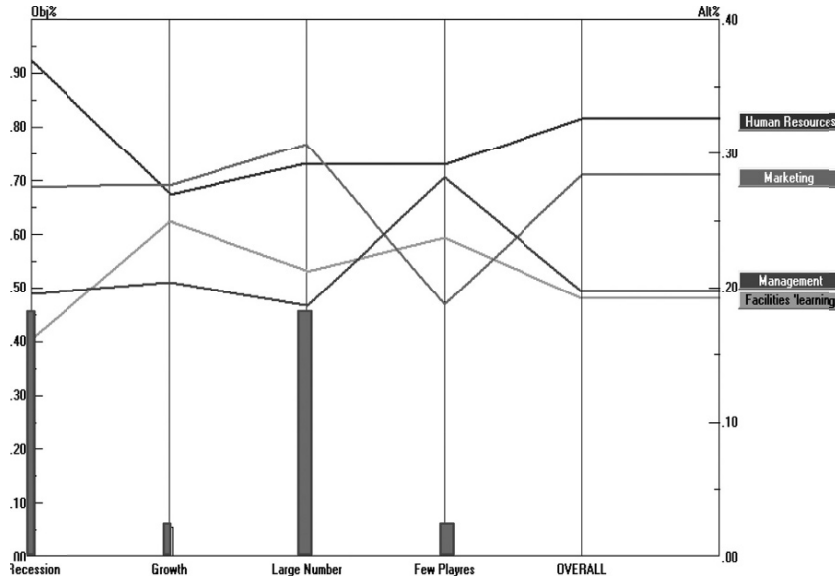But what happens if growth becomes more likely than recession with a large number of players? The impact on the rank order of global investment priorities (shown at the right of figure 6) can be noticed when the column growth is increasing as well as the column at large numbers of players. So at the "Overall Column" at the very right the importance of the alternatives Marketing will increase, followed by Human Resources, followed by Facilities, and finally Management Information, and so on. This what-if analysis is very powerful as it can help us to predict the importance of alternative strategic investments in changing environments that will affect the importance of different scenarios.
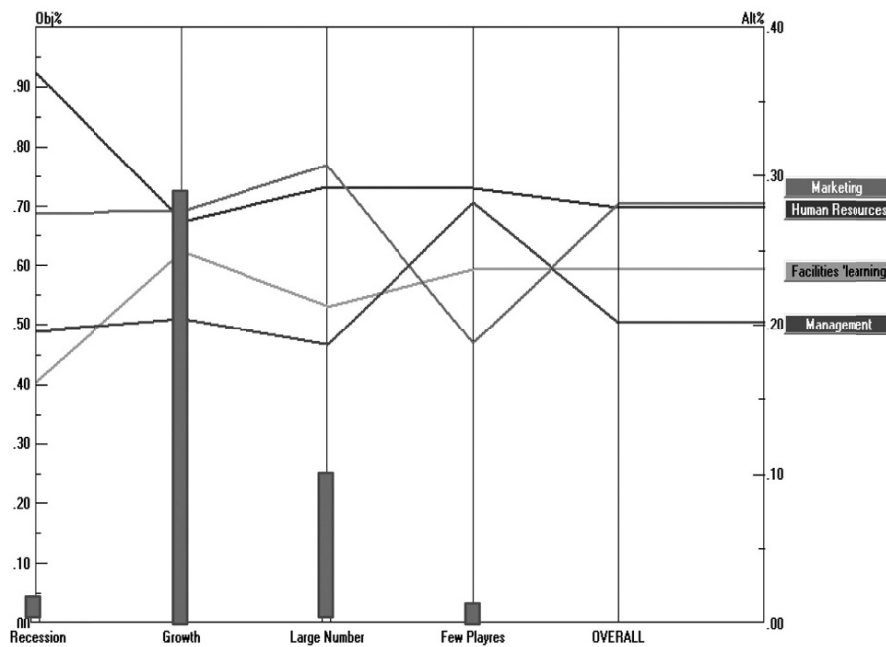


*Figure 6. Sensitivity analysis: Alternative strategic investments with respect to different scenarios. What if Growth increases as well as Large Number of Players?*

CONCLUSIONS

In this Chapter, we described a novel approach for classification of one of the most critical issues in HE – strategic investment. We focused on the importance of strategic decision making in prioritising particular strategic objectives. We applied AHP in a manner intended to achieve more dynamism in strategic planning analysis and to provoke more predictive thought by accommodating aspects of the external business environment to modify the relative power positions of the members of the decision-making unit in HE, and thus the relative importance of the objectives. The model, once built, can then be subjected to sensitivity analysis, allowing the

decision makers to explore "what-if" scenarios, in a way which is rarely possible with strategic analysis based primarily on past financial performance.

Although the total number of pair-wise comparisons were 204 per actor, this process of performing pair-wise comparison has served to refine the judgements, rather than depending on just a few judgements which may be subject to errors. In other words, if one is making an experiment by taking readings and repeating the process many times, this will produce better results, rather than relying on just a few measures where a single error would be significant. In order to monitor the quality of the judgements, the consistency measure was used as a feedback mechanism and when high inconsistency was observed the actor was asked to double-check that particular judgement.

In this chapter we have used an example of a business school to identify focus for its strategic investment, but the same approach could easily be applied to other settings, for example the entire HEI strategic plan, or indeed smaller units, such as other individual faculties, or service centres such as Information Services or Marketing. The method is also flexible, and generic, in that it can consider other conditions, actors, objectives and strategic investment options.

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## AFFILIATION

*Charlotte Gladstone-Millar, Ashraf Labib, Richard Tonge, David Smith Portsmouth Business School*
*University of Portsmouth*

IAN KENNEDY WHITE AND ROSANE LESSA PAGANO

# 13. CHALLENGING CUSTOM AND PRACTICE IN COURSE DESIGN

*The Lessons from Project Management*

## INTRODUCTION

Traditionally course design in higher education in the U.K. had been shaped mainly by intellectual pursuits and the research agenda. Since the Dearing Report (Dearing, 1997), it has been driven mostly by quality assurance processes, either leaving out other necessary processes or not being concerned to integrate them. Typically, the quality processes driving the design of new courses are the "programme specification" incorporating a set of "module specifications". These are supposed to ensure a focus on the student clients that potentially or actually are seen as having putative learning needs. Learning programmes are expected to address those needs, and these key documents are intended to express this, aiming primarily to provide public information and organizational accountability. Internal and external stakeholders other than students may be considered and consulted in the quality-assured approval process, but in accordance with the phases of that process instead of those intrinsic to effective curriculum development.[1]

The difficulty is that a process developed institutionally to demonstrate accountability and the maintenance of academic standards does not adequately fit all the structural requirements of good course design, which must embody a specific educational approach to the curriculum and set out how that approach is to be realized in actual, well-integrated and aligned learning and teaching activities. A course design can only be actualized sequentially over time, with learning resources brought into play consistently through the implementation of a particular teaching strategy; yet it is precisely the temporal dimension that is not taken sufficiently into account by quality assurance processes.

There is also a temporal sequence to the course approval process itself. This sequence is usually set by the institutional approval cycle, which in turn is constituted by quality assurance procedures. Once the course design process starts to be driven by the approval process, the quality assurance requirements either become the primary constraint on the management of course design or, worse, they are seen by academics as an extrinsic imposition that has nothing to do with their educational aims and interests, or even with the need to be responsive to rapidly changing conditions in the student recruitment market. This leads to major organizational tensions, where institutional purposes and procedures are seen by practitioners in specialist departments to be about as useful and beneficial as wasps at a picnic.

Temporality is a key dimension of projects and their management, so it seems likely that the application of project management principles to course design would overcome these twin problems, particularly as that design process should have a definite duration, which is an essential characteristic of a project (OGC, 2007).

As the organizational environment where higher education institutions currently operate presents continuing challenges relating to the cost and the quality of courses from a client perspective, if course design were to be approached as product development through a project management framework this could improve institutional responsiveness to that environment and interaction with it. Adopting this approach should also achieve a better understanding of three areas of integration management: the impact the project output will have on future operations of the higher education organization; the co-ordination of external inputs to the project through the management of curriculum resources and development processes within an educational community of practice; and the scalability of planning at an institutional level to enhance the student experience.

This chapter considers critically the prevalent existing view of managing the course design process and argues for the benefits of systematically and formally viewing this process as a project. It outlines ways of using tried-and-trusted project management principles to achieve that design with utility and structure, taking into account complexities that are necessarily beyond quality assurance and approval purposes.

## THE COURSE DESIGN PROCESS

Degree course design has come a long way since the days when the curriculum was divided into a series of disciplinary and specialist units, mostly according to the academic interests of the lecturers teaching it, and the main planning decisions concerned the sequence of lectures and the comprehensiveness of voluminous reading lists. In the U.K. particularly since the nineteen-nineties the quality assurance process has ensured that, if nothing else, the design process does document much more that is relevant to shaping students' course experiences. Yet in some ways the traditional emphasis on the syllabus and the relative neglect of practically all else at the design stage was not entirely misplaced. It often indicated more about the values and intentions of tutors than can be derived from the extensive yet bland boiler-plated information that fills the text boxes of all those completed quality assurance pro-formas. Despite the requirements to specify outcomes and modes of assessment, an instructional approach dominated by the transmission of content is still much in evidence in course design, though it is often to be found merely lurking in the shadows of official documentation submitted for institutional approval. Paradoxically, the demand by quality assurance regimes for greater specification in course proposals has led to an increasing gap between what tends to happen in the design process and what happens in the approval process. This has also reinforced academics' notions of that approval process as merely a bureaucratic obstacle race to be survived before the real course is run. Nevertheless, minding the gap has meant that all too often higher education

institutions have endorsed the view that the process of course design is driven by the agenda and timescale of the approval process.

That process presupposes an identification of existing or prospective students' needs not yet met or inadequately met by current course provision. This should lead to a proposal for a new award or the amendment of an existing one, in alignment with institutional goals and strategic plans. What follows from this is usually a two-stage approval process, as indicated in the U.K.'s Quality Assurance Agency for Higher Education (QAA) official Code of Practice (QAA, 2006; McGhee, 2003) The first stage endorses the proposal in line with known resource and staffing needs, and often market research information regarding student recruitment and anticipated career destinations. The second stage is the final approval or validation of the course design as expressed in a programme specification. Many higher education institutions also have an interim approval gateway normally associated with external comment being sought from one or more academics who are recognized specialists in the same discipline or knowledge domain as the proposed course. The purpose of this impartial external comment is to confirm or question the upholding of the academic standards claimed to be embedded in the course. It is an important quality assurance precept, according to the QAA Code of Practice (2006). Yet for all the rigour of the approval process, the quality assurance requirement is not conducive to ensuring that the design process is managed either efficiently or creatively.

The gap between approval stages is too great to enable proper monitoring and control of the stages of course design. This is a necessary consequence of a quality assurance procedure, otherwise quality assurance turns into quality control and few academics would countenance a more intensive monitoring of their deliberations on course design by quality officers. But for this very reason more systematic principles should be brought to bear on what is typically an unevenly managed trial-and-error situation or one that defaults to being a burden placed on one academic well-versed in getting courses through approvals committees.

It is not just a lack of monitoring and handling of change requirements that means efficient and innovative course design is often produced more by chance allied to individual expertise than by the application of a systematic approach. A course design process driven by quality assurance precepts, however valuable these might be, will tend to overlook much that should be taken into account or leave too much to the operational management of a course once it is running. This is evident from a view of what has to be specified for approval purposes. The programme specification is the prime definitive document for a course leading to a Higher Education award. It was introduced following the Dearing Report (1997) which defined a programme specification as an outcomes-based description of a course that categorizes the course outcomes according to knowledge and understanding, cognitive skills, professional or subject specific skills, and transferable skills. From the quality assurance perspective, this is the essential output of the course design process. The programme specification does have to include more than the course outcomes. Typically it will contain information about the admission requirements, the structure of the learning components in modules or

units, the assessment strategy, teaching and learning methods, forms of learning support, modes of delivery and course management arrangements. It may include detailed module or unit specifications containing syllabus content and indicative reading as well as particular module learning outcomes. It is unlikely, however, to provide sufficient specifying information about how the course will actually be implemented, even though the Dearing Report regarded it as a document that should be made publicly available to prospective students, becoming "a vehicle for clearer understandings about the content and standards of programmes" (Dearing, 1997: section 9.54). There are a number of reasons for this.

Firstly, the quality assurance focus is on the alignment of proposed assessment with learning outcomes. The methods and modes of assessment should transparently show the tasks that students are required to undertake in order to demonstrate that they are meeting the outcomes. For example, an outcome specifying oral communication skills cannot be met by writing an essay; conversely, an oral presentation does not provide the best opportunity to demonstrate a capability in written academic English. Although this focus ensures that assessment methods are fit for purpose in a proposed course, it does not of itself indicate anything about the ways in which students may arrive at the assessment tasks. Because the approval of an assessment strategy usually does not require any specification of diagnostic or formative assessment, and because summative assessment tends to be placed near the end of a module or course, what precedes it cannot normally be identified with any precision. Although good practice should integrate diagnostic and formative assessment into course planning, frequently it is left for a tutor team or individual lecturers to do after the course approval process is completed, but with no clear and optimized time-line for this within and across modules.[2]

It might be expected that the specification of teaching and learning activities would at least outline how the taught aspects of a course would provide a path towards the undertaking of assessment tasks, yet often a programme or module specification only provides an identification of the teaching methods to be employed, rather than a sequential structure of the kinds of activity students will have to undertake. Moon, for example, in providing published guidance on completing a programme specification, recommends that in referring to a course's teaching, learning and assessment, "The section is best represented by a list of methods..." (Moon, 2002, p. 110). At most, a module specification might indicate the proportions of total study time to be taken up by particular teaching methods, but the lack of sequencing constitutes a second reason for the specification not making clear what the pattern and rhythm of course experience will be like.

A third difficulty arises even though the programme specification cannot be said to lack all sequencing. The course's modular or unit structure is normally set out according to levels in a qualification framework, which in the U.K. since 2001 is a national framework developed and maintained by the QAA (2008). There is also an indication of when modules or units would be available to students with respect to the institution's academic calendar expressed as semesters or terms or both. However, this outline module structure is rarely associated in the design process

with the timed planning of learning resources and tutor workloads. Confirmation of resource availability in a teaching department may be a requirement for approval, but the planning of resource utilisation is regularly left until a course becomes operational, often with resultant difficulties when that course has to compete with other courses for the use of learning and teaching spaces. The timetabling of taught sessions in appropriate environments is rarely considered in the approval process, yet it can be crucial in determining the quality of the student experience. This disconnection between modular structure and resource constraints as a necessary time-situated activity can result in the course facing operational difficulties that should be anticipated in the design process.

Fourthly, the approval process does not require careful time-related planning of how the proposed course will deal with the learning development needs of its students. As D'Andrea & Gosling point out, students entering higher education have to "negotiate the transition into a new set of institutional and disciplinary cultures" (2005, p. 89). The modular or unit structure sets out the progression points for students with respect to stage levels and intermediate awards. Yet this does not account fully for the key aspects of students' cognitive and academic literacy development that should be considered in course design.[3] Within modules or units the specified syllabus or indicative content may offer a sequence of topics or concepts that correspond to the order of a lecture outline, though there may be sound pedagogical reasons why this order departs from the logic of the topics' conceptual structure. But a lecture series usually occupies only a small proportion of the cognitive and practical demands placed on students throughout a module or course. With any course that adopts a problem-based or enquiry-based approach, a syllabus of concepts will be of little direct use in determining the required student progress through that course from a learning development viewpoint. Further, indicative reading lists and statements of provision for personal support and guidance give no direct description of the sequential, experiential quality of learning opportunities likely to be encountered by anyone undertaking study within a particular course stage or period.

These missing components, crucial to an understanding of how a course will realise its proposed curriculum in practice, all share a similar characteristic: a course becomes actual over time. What this missing specificity points to is an inadequate incorporation of temporality in the definitive course documentation that is regarded as an essential product of the approval process. This is a matter of both sequence and performance. It also concerns more than the operational management of a course. As Toohey (1999, p. 49) argues, "The most accurate picture of the educational values and beliefs inherent in a course is usually to be found not in the statement of goals but in the way time is allocated to different topics and learning activities...as well as in the kinds of assessment". By paying insufficient attention to the temporal quality of course design the quality assurance requirements may confirm the standards of learning outcomes and the means of assessing students' achievement of them, but they cannot and should not act as the main framework of constraint or as setting the key measure of performance for the successful planning of effective courses.

WHY USE A PROJECT MANAGEMENT APPROACH?

Part of the problem stems from the fact that course design rarely starts from the logical departure point implied by the quality assurance process. The impetus for a new course or a major revision of an existing one can arise from a perceived need to recruit different kinds of students; to change the manner of course delivery, perhaps from face-to-face teaching to a blended learning or distance learning mode using new learning technologies; to respond to professional body requirements or those of other external stakeholders; to respond to internal institutional changes such as departmental restructuring or the merging and rationalisation of different academic centres; or to take account of changes in academic staff at either a managerial or scholarly research level, which may also be accompanied by a change in values or strategic vision.[4] Whatever the prime cause, and there is usually one key aspect that provides the stimulus (Toohey, 1999):

> It is rare that course design proceeds by identifying programme outcomes then working back to how they should be assessed and then to how students can be assisted to do the learning to achieve those outcomes (D'Andrea & Gosling, 2005, p. 119).

Providing a systematic way of enabling projects with similar outputs to be initiated from different start-up points is just one of a number of advantages in adopting a project management approach to course design. Probably the most important for that design process is that it necessitates a team approach. Project planning is more likely to facilitate mutual support and an understanding amongst team members of each other's educational values and orientation, helping to produce a more cohesive and coherent course, rather than "a pastiche of individual units" (Toohey, 1999, p. 49) that reflects different implicit pedagogical theories. The team approach, with clear responsibilities and lines of communication, appears to enhance responsiveness to the current market demands on educational organizations at course level, as opposed to a more individualistic approach determined by the personal styles of tutors who may or may not give priority to these concerns or have the time and skills to engage with stakeholders and innovation, particularly in areas such as e-learning (Chapman & Nicolet, 2003).

The emphasis on individual originality, which is the trade mark of academia, has traditionally permeated course design by the way module or unit tutors assert their right to autonomy. Their having to think outside of their specialism for project collaboration purposes and for the purpose of producing a coherent design would be beneficial both for the tutors' own professional development and for institutional communities of practice in teaching and learning. A commitment to continually improving innovative research-informed course content is not the same as a commitment to adopting a common approach to course design improvement. Some degree of standardized procedure increases efficiencies and reduces risk—critical at a time when there is very little slack in the system to deal with administrative inefficiencies and disaster recovery. With a project team undertaking a common approach to the design process the risk of unexpected crises is reduced, if not avoided.

If senior stakeholders are prepared to resource project management, that would save them time, money and unnecessary risks in the longer term. A common project management approach means that a programme of course design projects across one or more teaching departments is easier to plan and execute, facilitating more productive communication regarding good practice across the institution, increasing economies of scale and flexibility in how staff are deployed. It provides a common discourse that makes interactions amongst stakeholders more efficient and effective in achieving some consensus through different subject-specialist pedagogies rather than despite them. Developing new lecturers' essential design and planning skills by bringing them into course design project teams means that experience can be more easily shared, therefore avoiding reliance on one or two knowledgeable individuals as currently is typically the case. Costs of staff development may also be reduced through more systematic project approach.

Organizations can be seen as predominantly project-based, organized internally on a project basis, or predominantly process-focused, organized on a functional basis. The latter is typical of the higher education sector, perhaps with some flexibility and variation where a matrix structure might be used. Generally it is relatively easier to run projects within departments or functions, particularly with regards to lines of authority and allocation of resources, but harder to run projects that cut across multiple functions. The need for a comprehensive programme of course development across the institution in response to an increasingly competitive market would indicate that there would be an advantage to becoming a more "projectized" organization (Köster, 2010). Course design as new product development, at much shorter demand-orientated cycles, should encourage educational organizations to adopt more widely a project management approach, but this needs to be supported by an appropriate organizational structure.

Temporality and resourcing are critical to a course operation's success. Student evaluations of courses often show that their perceptions of good teaching depend on, or are even conflated with, their perception of how well their course is organized (Toohey, 1999). As has been argued in the preceding section of this chapter, these associated dimensions to course planning are often insufficiently considered as design activities before a course is actually implemented, leaving academic and administrative staff to account for them as they go along, after the course approval process is completed. Demand is moving away from a model of course implementation based on weekly face-to-face contact only, and embracing more flexible, blended or wholly online patterns of tutor-student contact requiring careful planning that should be integral to establishing the course design. Innovative approaches to teaching in order to enhance the student experience often exacerbate the pressure for developing new learning resources. Ultimately, identifying and securing resources associated with a specified time schedule should be part of the course design project.

While this is often acknowledged for online course development using instructional design principles (Abdous & He, 2008), it is not usually considered as appropriate for modes of course implementation that rely on a high proportion of face-to-face teaching. Yet those more conventional forms of design can benefit

from what has been learned in online course development, particularly if all forms are brought into a project procurement management approach. That approach foregrounds some critical factors: temporality of procurement, knowledge of the institution's procurement procedures, relationship with the institution's procurement staff, and details of the procurement agreement with suppliers (internal or external). Regardless of what is usually called "the mode of delivery" all courses nowadays have to consider the use of information and communications technologies (ICT) as integral to their design. Because there is a need to weave ICT into the fabric of learning, ICT procurement has an importance beyond considerations of institutional infrastructure. Resources under project or internal function control are likely to have to be complemented by resources from outside the project's direct control, that is, across the organization. Further, this type of procurement is generally accepted as having a high risk associated with it. This scenario is intimately related to the need for systematic approach to communication with stakeholders. Often the impact of a new course on some stakeholders is forgotten, such as ICT and administrative staff. The systematic approach to temporal resourcing encompassed by project integration management enables those additional pedagogical and administrative considerations to be brought into course design. By requiring a communication plan as part of the project approach, the risks involved are reduced, compared to a view that everything will be sorted out with central institutional services at an operational stage.

Engaging with an increasing number of stakeholders in new course development that aims to utilize and optimize the use of resources across an educational function-based organization is a challenge, not least because of the complexity which that aim entails. It merits the appointment of a project manager with good communication skills in working with others across disciplinary and cultural boundaries; not all academic staff charged with course design have such skills at the outset, but if their role is seen to include project management then both the assignment of such responsibility and the institutional support for whoever has to lead a course design team will be more likely to receive strategic consideration.

Strategic concerns and outcomes can easily become lost in a course design process that is not explicitly required to relate these to educational values and pedagogical practice. Because the impetus for course design can have so many varied sources, the insistence in project management on making explicit in a start-up phase how the driver for a new or revised course relates to outcomes beneficial to the organization, and how the constraints on the project relate to critical success factors (OGC, 2007), means that it is clear to everyone involved that a successful course design is an output that is but a means to an outcome, and that this outcome expresses a definable scope placing the course in its appropriate organizational context, for which maintaining the quality of academic content and standards is but one aspect.

Explicitly defining the scope of a project is itself, if applied to the course design process, a good way of improving communication and information flows within higher education institutions, with their tendency to operate as a series of academic

tribes policing their specialist territories (Becher & Trowler, 2001). A department rarely just wants a new course; it may want to change the profile of its student body, for example, with respect to the proportion of postgraduates to undergraduates; or alter the focus of its course portfolio by increasing its transdisciplinary courses and those run jointly with other departments; or it may be seeking a major revision of the way it uses e-learning and new learning technologies across a suite of courses. What is this new course design going to do to contribute to these departmental aims, and what is it not going to do? At a strategic institutional level, a university does not just want departments to develop new courses; it wants to improve the quality of its educational provision and to enhance the distinctiveness of that provision compared to other institutions. It is important that all tutors involved in the course design understand explicitly these wider aims and exactly what the design team will control in order to contribute to them. A project management approach will not guarantee that these significant aims are achieved, but the characteristics of this approach and what it requires practitioners to take into their practice make their achievement more attainable.

## COURSE DESIGN AS A PRODUCT DEVELOPMENT PROJECT

So, if project management principles were to be followed, what might the course design process look like? There are two temporalities that need to be taken into account: the time of the design project, which runs from the initial scope definition to the point where the course starts running, and the time of the course operation itself, which involves the life-cycle of the course and the timescale for each iteration of it within that cycle.

Note that the first temporality does not begin with a course development proposal but with the planning of that proposal. Who is going to produce the proposal? Who is going to be responsible for defining the scope of the project, do a stakeholder analysis, and identify the target student constituency from which the course will recruit? Note also that the project does not end with final institutional approval of the course design and the go-ahead to start running the course. The project closure phase requires, amongst other things, the documenting of follow-up actions that should be undertaken by the teaching team and course administrators, a plan specifying when and how the achievement of the anticipated benefits will be evaluated[5] and an evaluation of the design process itself (OGC, 2009).

Also part of the phase of defining the course design process, in addition to a scoping statement, are the specification of major milestones, including time and clear processes to allow creativity in developing content and structure (Maylor, 2003), and the production of a work breakdown structure[6] (Köster, 2010).

If the phase of defining the project is important for ensuring that the design outcomes and scope are clearly established, then the project planning phase is important for ensuring that the outputs of the design process are aligned with the project outcomes. Just as there are two temporal dimensions to course design, so there are two kinds of outputs. First, there are the outputs essential to the success of the design project; second are the outputs essential to beginning operation of the

course itself. However, a key document should be the Course Design Project Plan, which encompasses the first kind and identifies the second. Hence, the Project Plan should consist of the outputs of the design process, and a description of the definitive course documentation for its operational management. We call this Project Plan the Project Dossier, to distinguish it from the Course Dossier, which would consist of the actual course documentation and any other deliverables.

The precise nature of the Project Dossier will vary according to the particular institutional context and procedures, though it is likely to include most if not all of the components given here as an example:

– the course design project definition. This will be the outputs from the project defining phase, including the scope statement and the work breakdown structure;
– a sequenced plan derived from the work breakdown structure, indicating timescales and associated resources and costs, together with any tolerances. This would often be expressed as a flow diagram providing an overview of the design process, which could then be used for detailed task planning in the implementation phase;
– a stage plan. As should be obvious from the argument of this chapter, the stages might include quality assurance milestones but should not be reducible to them.
– An exception plan. How is the course design team going to handle any changes or deviations from the initial course proposal or project timescale, and who is going to be responsible for this? An exception plan should provide the answer. It is a good example of something that project management principles expect to be done at the beginning of the design process, rather than when changes or problems actually occur, as usually is the case;
– an evaluation plan. This would show how the design process itself is to be evaluated so that lessons can be learned for future course development elsewhere in the department and ideally across the whole institution, though differences in disciplinary contexts would prevent the use of a generic course design model;
– a communication plan. One of the main causes of a course not receiving institutional approval to run comes from a failure to communicate the specific characteristics of the course design to stakeholders at appropriate times prior to the final approval or validation event. Another main cause is a failure by management or a quality office to communicate and discuss with the project team crucial constraints, desirable features or policy changes impacting on the proposed course. By establishing early in the planning process the frequency of two-way communications and the methods for ensuring information flow back and forth between the project team and other interested parties including tutors who may not be part of that team, the design process is much more likely to keep to time or avoid the last-minute imposition of changes that have not been consensually agreed. Either of those difficulties can lead to the start of a course being delayed or to teaching staff having to run a course whose value they don't believe in;

– a risk log. It is a good idea at this planning phase to create a list of identified risks and the likelihood of their occurrence. This would be regularly updated throughout the implementing phase of the project. Although a comprehensive risk analysis often will not be needed, the identification in advance of the consequences of a tutor with particular subject-specialist expertise falling ill or getting a job elsewhere would have saved many course designs from significant delay or from failing altogether;

– a quality plan. This would show how the design timescale aligns with, but is not reducible to, the quality assurance process; this would include specifying when documentation essential to the approval process, such as Development Consent forms and External Comment reports, have to be produced.

These suggestions for a project dossier might seem to be asking for the production of a weighty volume, but it is important to recognize that this planning phase requires careful balancing of the need to make the planning explicit with the need to provide a concise, top-level view of the whole process. In practice, the different components suggested here are analytically distinct though not necessarily that extensive. What is vital is that all of the planning aspects covered by these components are considered and made explicit. The details should not be left to reside inside the head of whoever is ultimately responsible for the course design being produced and approved, whether or not that person is formally designated as the project manager.

The project implementation phase is where monitoring the work done and controlling risks and possible deviations from the project plan can be undertaken systematically. Here, the project management concept of a work package is a useful way of tracking aspects of the course design process than can otherwise lead to major deviations from what is planned or to the work not being completed in time. Two typical examples of a work package might be: the development of an individual module specification, with responsibility for this handed to a module leader; and the obtaining of external comment and determining follow-up actions to take this comment into account, communicating both comment and follow-up to a quality office.

This phase is also where the management of stages in the design process can avoid a tendency to sudden crises over timing or completion of work. Crisis management is often what happens in practice in course design, rather than the preferable and less stressful risk management approach. There are likely to be four areas of risk: risks related to specialist knowledge and pedagogy, risks related to the external environment, risks related to the organizational environment, and risks related to the project management process itself. In the first area there can be uncertainties over the extent of innovation required, the performance of any subject specific technological support, student employability requirements, and the degree of innovation required to meet students' expectations. In the second area uncertainties can arise over the delivery of materials from external suppliers, the judgement of the market for a particular course, or new government regulations emerging. In the third area uncertainties occur over availability of organizational teaching and learning resources due to competing course design projects, or the allocation of sufficient

team members with the required specialist knowledge. With regards to the risks related to the project management process itself, at present in educational organizations we typically find: conflict between academic positions regarding the curriculum; missing tasks and their dependencies due to the current, relatively loose approach to course design; and resistance to change and cultural issues. The probability of each risk occurring and the impact on the course design need to be quantified and monitored much more closely than is generally acknowledged. The risks identified in those four areas may generate the need for change in the output of work packages. For example, it is easy at module design level to lose sight of the overall requirements for the new course, even though module outcomes are mapped onto overall course outcomes. Here, the three components of configuration management – change control plus understanding the characteristics of work products plus auditing conformance to requirements – are of paramount importance to achieving the project outcomes, as well as ensuring that the course outcomes that students will have to achieve will remain meaningful to them and to their tutors.

## CONCLUSIONS

This chapter has argued for a more systematic approach to the management of the course design process than is currently evident in the U.K. higher education institutions. Too often, where a systematic approach is adopted, it tends to be driven by quality assurance approvals process and procedures. Those quality assurance purposes have inherent limitations for the proper management of the course design process and for enabling a move away from individualistic practices of curriculum planning while maintaining the professional academic responsibility of practitioners for that design.

It has been argued that the limitations of allowing the institutional approvals process to set the main constraints and milestones for the course design process have led to insufficient attention being paid in the design process to the crucial temporal resourcing dimensions of running a course. Those planning dimensions are usually left to the operational management of the course, resulting in frequent difficulties arising from courses competing for scarce resources such as teaching spaces or ICT learning facilities. The temporal resourcing of the design process itself can also be neglected, resulting often in a lack of time and planning for communication amongst academic and administrative staff involved in the course design, and for engaging stakeholders.

The application of project management principles to the course design process can provide a systematic approach to the management of the process that has significant benefits not just for that particular course but also for an academic department and institutionally for the whole organization. Strategic outcomes can be more readily and efficiently realised by properly aligned outputs of the design process, allowing for a department to learn from each course design that is undertaken, and institutionally for the organization to become more able to coordinate course development as a series of projects that bring into being coherently managed programmes for a distinctive curriculum.

A project management approach to course design has been outlined to show how the requirements of this approach insist on due account being taken of elements that too easily can be overlooked. In particular, the emphasis on an explicit project plan as a dossier that documents design aspects involving a project team, and the identification and management of risks in a timescale that is more detailed than a quality assurance approvals process could or should specify, is proposed as a means of overcoming the problems that can beset a design team.

Finally, it is worth noting that the project management approach advocated in this chapter implies a particular product-oriented model of the higher education curriculum. This model is the dominant one and will remain so as long as outcomes-based education continues to be required as a matter of sectoral policy. It is of course well known to many practitioners that they prefer to pay lip-service to this model of the curriculum—their courses would be rarely approved institutionally if they did not do so—while in practice they attempt to implement a more process-oriented curriculum model. The result is often an uneasy hybrid of product and process that does not entirely fulfil the advantages of either (Kelly, 2009). This too leads to the relative neglect of course design documentation once that course is approved.

Although we have argued for a project management approach to the curriculum model, in principle this approach may also be adopted for course design using a process model. The main differences would be that students as users and clients would be much more involved in the project planning, and that the temporal considerations would have to take account of syllabus content and outcomes not being fully specifiable in advance of the course being operated. It would lead to the kind of negotiated curriculum associated with the work of educational theorists such as Paulo Freire (1972). In turn, the course approval procedure would have to change radically to accept this very different engagement of students and other stakeholders. As this is unlikely to happen in the foreseeable future for mainstream higher education courses, we have not considered it further here.

What we have considered is how to ensure that good practice in course design is no longer seen as, and judged by, compliance with quality assurance procedures and codes of practice. As vital as these are to the proper management and functioning of a higher education institution, to rely on them as the compass for the direction of course design may well lead, in the present climate of globalized higher education, to a drift into the perfect learning storm.

## NOTES

[1] The quality assurance discourse uses the term "programme" whereas in this chapter we prefer the more generic term "course". This is partly to avoid confusion with the use of "programme" in the discourse of project management, where it refers to a coordinated set of related projects (OGC, 2007). By "course" we mean a coherent sequence of structured learning activities comprising one of more distinct units. In the U.K. institutionally defined units are usually termed "modules".

[2] It can be argued that this allows for flexibility of delivery and relative autonomy of tutors, and for students potentially to negotiate how they will achieve outcomes. In practice it leads all too often to

activities determined largely by custom and practice, and which are inconsistently aligned with assessment.

[3] For a definition and discussion of the concept of academic literacy, see D'Andrea & Gosling (2005).

[4] See Toohey (1999, p. 21-25) and D'Andrea & Gosling (2005, p. 119-121) for these and other examples.

[5] Part of this could be through the annual monitoring and review process but it is likely to need additional evaluation beyond that quality assurance activity.

[6] A work breakdown structure is "a hierarchical decomposition of the work to be completed in order to achieve the project's deliverables". (Nokes & Kelly, 2003, p. 149)

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## AFFILIATION

*Dr Ian Kennedy White*
*Centre for Educational Studies University of Hull; and*
*Dr Rosane Lessa Pagano*
*Manchester Metropolitan University Business School*

ANTONIO MATURO AND RINA MANUELA CONTINI

# 14. FORMALIZATION OF MODELS AND STRATEGIES FOR DIVERSITY MANAGEMENT IN A MULTIETHNIC AND MULTICULTURAL SCHOOL[1]

## INTRODUCTION

Globalization processes and international migration modifies society and education from the bottom and sets a number of crucial challenges for the redefinition of social life in Western contexts (Bauman, 2000; Castles, 2002; Beck, 2003). "New generations" have grown in Western societies, they are "acculturated" to the lifestyle of the receiving country and they show increasingly mixed cultural traits and plural identities (Portes, 2004; Rubén & Rumbaut, 2004). This "new" youth leads to questions on the equality of treatment and opportunities for social promotion (Besozzi et al., 2009).

The challenge that a multiethnic society has to face rests in its ability to build new forms of social bond and "flexible belonging", and to create new forms of integration at both a juridical and social-economic level.

School is central to the quality of our lives in a pluralist society, because it has a strategic role in forming the citizens of tomorrow and it is a key institution for the acquisition of the necessary competences that help promote the social integration of new generations.

The study of "new generations" and their scholastic experience becomes an important area of discussion and includes: the future of contemporary societies; the possibility of economic and cultural enrichment; new forms of social cohesion; the formation of mixed cultural identities (Kymlicka, 1995; Ambrosini & Molina, 2004; Sassen, 2007).

## DIVERSITY MANAGEMENT: ISSUES AND STRATEGIES

### Approaches to the Management of Cultural Diversity

In the current debate, multiple strategies to create an inclusive school capable of integrating new generations of immigrants are recognized and these include: the assimilationist paradigm; multiculturalist approaches; and the intercultural model.

In the ambit of the assimilationist approaches, assimilation is conceived as a univocal and linear process: immigrants that assimilate to a new social context are similar to natives taking on mental habits and lifestyles (Park & Burgess, 1924). In such a context cultural assimilation is the assumption for social and economic

integration and, therefore, for social stability. Therefore assimilation is an obligation for immigrants and not a commitment for the hosting society.

The assimilationist perspective favours the development of the idea of a "common belonging" of all the individuals to the human race. Furthermore there have been critiques of both the ethnocentric assumptions and the regulative implications. This kind of critique starts from the multiculturalist thesis, and sees integration in the assimilationist concept as ethically unjustifiable and politically incorrect. Multiculturalist approaches tend to stiffen and naturalize the differences and they conceive of a socially divided universe in distinct cultures each with a strong internal homogeneity. In such a vision every individual is absorbed into one culture and has a unique cultural identity.

In the north-American literature also neo-assimilationist theories have developed (Alba & Nee, 1997; Brubacker, 2001) that re-propose the concept of assimilationist abandoning the normative components of the traditional assimilationist approach. Portes and Rumbaut (2006) problematize the linearity of the relationship between cultural assimilation and socioeconomic integration and distinguish different integration paths: upward, selective and downward assimilation. Such modalities of assimilation depend on social and individual factors, among which are the socio-cultural capital of the family and ethnic networks. Portes and Rumbaut orient their research on modalities towards finding new forms of composition between acquired elements from the hosting society and elements taken from the cultural patrimony of the country of origin (Esser, 2010).

Within current sociological debate, there is an affirmation of the intercultural perspective, that tries to overcome the limits of old approaches to the management of cultural diversity, assimilationism and multiculturalism (Cesareo, 2004). It is a new approach to the evolution of inclusive societies and suggests recognising and respecting differences within a common reference framework of values, rules and rights (Commission of European Communities, 2008). Such a vision of integration

> is understood as a two-sided process and as the capacity of people to live together with full respect for the dignity of each individual, the common good, pluralism and diversity, non-violence and solidarity, as well as their ability to participate in social, cultural, economic and political life. It encompasses all aspects of social development and policies. […]. Effective integration policies are needed to allow immigrants to participate fully in the life of the host country. Immigrants should, as everybody else, abide by the laws and respect the basic values of European societies and their cultural heritage. Strategies for integration must necessarily cover all areas of society, and include social, political and cultural aspects. They should respect immigrants' dignity and distinct identity and to take them into account when elaborating policy (Council of Europe, 2008, p. 11).

*Areas of School Policies*

The literature on migrations sets as central the role of scholastic institutions in the social and working integration of new generations. The importance of school

before migration is also evident when considering the increase of foreign students in European scholastic systems. The scholastic population has significantly changed with time and today it is highly heterogeneous in relation to social, cultural provenience, motivation, expectations and requisites for learning. Schools are at the centre of the interaction between different cultures because they welcome, in a universal way, all the children of immigrants on the basis of the inalienable right to education and development that crosses borders, states and nations.

The transformation of the demographic basis of the scholastic population sets a real educational challenge that must be considered in a wider context of social cohesion. A good scholastic experience follows the objectives of equity and is at the basis of social and economic integration. In the current debate there are three ambits of scholastic policies. The school as a space for:

– cognitive learning;
– social construction;
– construction of citizenship.

As regards the first dimension (school as a place of cognitive learning), research shows how scholastic education is fundamental to the acquisition of knowledge, abilities and competences that allow access to public space and social resources (Nesse Network, 2008; European Commission, 2010). Good scholastic success allows the accumulation of advantages for the future and efficient interaction with the rules of scholastic social contexts. In other words, scholastic success is a factor able to significantly influence the educational and working path and, in the case of immigrant children, the integration process. Human capital (acquired during the scholastic formative path) social capital and material resources are the basis for breaking the vicious circle of disadvantage and can help the processes of social mobility among new generations (Bourdieu, 1980; Coleman, 1988; Portes & Rumbaut, 2006).

Referring to the dimension of school as a place of social construction, the scholastic institution plays (for all students, and particularly for the foreign ones) a mediating, socializing and capital production function within the group of peers. Research carried out on scholastic integration of foreign students underlines the complexity and multidimensionality of the scholastic integration process, including not only the acquisition of knowledge and abilities, but also relations, richness and the intensity of the relations with peers and with adults, at school and outside. In their research on private religious and public schools in the United States, Coleman et al. (1966) noticed the importance of social capital in favouring good scholastic achievement.

In relation to the third ambit (school as a space for the construction of citizenship), the literature remarks how citizenship has always been at the core of education and the development of educational systems, both as a social mandate that society pours on to the school (to form the citizen with rights and duties), and as a concept that summarises the central dimension of equal opportunities before education (Marshall, 1950). In sociological terms it is well known that schools are

born as an organized answer to the deep changing processes of traditional societies. In today's pluralist societies the concept of citizenship undergoes deep transformations.

It is evident that there is a pluralisation of citizenship forms both in terms of structure (coexistence of different citizenships within the same territory) and as multiple expressions in the individual and social experience. This implies the need to reconsider citizenship according to both universal and cosmopolitan dimensions, with an articulation of universal instances of human rights with particular ones of single national realities and single groups of people (Kymlicka, 1995; Withol de Wenden, 2001). In such a vision, the importance that education to citizenship has is evident and, therefore, educational policies that allow the development of each are fundamental. Dealing with citizenship today in relation to educational policies means: re-discuss the right to education and its full implementation; reconsider the interventions in order to conjugate the exercise of individual liberties and active participation in civil society. Citizenship emerges as a wide program to realize new forms of inclusion, belonging, and integration at a political-juridical, economic and social level.

## MATHEMATICAL MODELS FOR DATA ANALYSIS AND DECISIONS

In this chapter the OR approach is applied to the analysis of deep transformation that our scholastic institutions are undergoing following the growth of the multi-ethnic and pluricultural character of western societies and to find strategies to manage diversity in education. The mathematical tools used are:

– the Analytic Hierarchy Process (AHP) (Saaty, 1980, 2008);
– fuzzy algebra and fuzzy logic (Zadeh, 1975);
– multivariate statistics (Benzécri, 1980);
– cooperative games (Luce & Raiffa, 1957).

### *The Analytic Hierarchy Process*

Let us recall (Knuth, 1973) that a *directed graph* or *digraph* is a pair $G = (V, A)$, where V is the set of *vertices*, and A is the set of *arcs*. The vertices will be indicated with Latin letters. A pair $(u, v)$ of vertices denotes an arc with initial vertex u and final vertex v; an n-tuple of vertices $(v_1, v_2, ..., v_n)$ denotes a *path* of length n-1, formed by the arcs $(v_i, v_{i+1})$, $i = 1, 2, ..., n-1$.

The AHP is based on the representation of a decision problem with a directed graph $G = (V, A)$ with the following five properties:

– vertices are distributed in a given number $n > 2$ of levels, numbered from 1 to n;
– there is only one vertex with level 1, called the root;
– for every vertex v different from the root there is a path passing through v and having the root as initial vertex;
– each vertex of level $i < n$ is the initial vertex of at least one arc and there are no outgoing arcs from vertices of level n;
– if an arc has the initial vertex of the level i then its final vertex has level i+1.

Let us call AHP-*graph* every digraph satisfying the five properties. From the semantic point of view, referring to the decision problem, the vertex of level 1 of an AHP-*graph* is the *overall goal*, the vertices of level 2 are the *specific objectives*, or, in simpler notation, the *objectives*, the vertices of level n are the *alternatives* or *strategies* of the decision problem. For n > 3 the vertices of level 3 are said to be the *sub-objectives* and the vertices of level n-1 are the *criteria*.

There are three steps in the AHP.

### Step 1

Construction of the AHP-graph that best summarizes the decision problem. The final vertices of the arcs leading out from a vertex v are meant to specify in more detail the meaning of the objective v.

### Step 2

A decision maker or a committee assigns a score to each arc following the AHP procedure proposed in (Saaty, 1980, 2008). The score given to an arc (u, v) indicates the extent to which the vertex v satisfies the objective denoted by u. Scores are non-negative real numbers and the sum of the scores of the outgoing arcs from one vertex must be equal to 1. For each path, the path score is the product of the scores of the arcs contained in the path.

### Step 3

Calculating the overall score associated with each vertex. For every vertex v different from the overall goal, the score of v is the sum of the scores of all the paths that connect the overall goal with v.

Let us recall the procedure proposed by Saaty (1980; 2008) mentioned in Step 2. Let $x_1$, $x_2$, ..., $x_p$ be the final vertices of the arcs leading out from a vertex v. If a decision maker, D, considers $x_r$ to be preferred to (or is indifferent to) $x_s$, then he/she is requested to estimate the importance of $x_r$ with respect to $x_s$ using one of the following judgments: *indifference*, *weak preference*, *preference*, *strong preference*, *absolute preference*. The judgment chosen is said to be the *linguistic value* associate to the pair ($x_r$, $x_s$).

The linguistic values are expressed as numerical values following the Saaty fundamental scale:

– indifference = 1,
– weak preference = 3,
– preference = 5,
– strong preference = 7,
– absolute preference = 9.

The scores 2, 4, 6, 8 are used for intermediate valuations.

If the object $x_r$ has one of the above numbers assigned to it when compared with object $x_s$, then $x_s$ has the reciprocal value when compared with $x_r$. A pairwise comparisons matrix $A = (a_{rs})$ with p rows and p columns is associated to the p-tuple $(x_1, x_2, ..., x_p)$, where $a_{rs}$ is the number assigned to $x_r$ when compared with $x_s$.

Then one calculates the principal eigenvalue $\lambda_1$ of the matrix A and, among the eigenvectors associated with $\lambda_1$, select the one with all components $w_1$, $w_2$, ..., $w_p$ nonnegative and sum $w_1+w_2+ ...+w_p$ equal to 1. The real number $w_r$ is the score given to the arc $(v, x_r)$ by the AHP.

The evaluations of the decision maker D may not be consistent, in that there may be problems in the allocation of the values of matrix A in terms of the transitivity of preference relations between the elements of the set $\{x_1, x_2, ..., x_p\}$. Saaty suggests checking the consistency by calculating the number

$$\mu = (\lambda_1 - p)/(p-1) \tag{1}$$

If this number is less than 0.1 then consistency is considered acceptable, otherwise the decision maker is asked to revise the judgments.

## *Group Decision Making: A Representation with Fuzzy Numbers*

We propose below an algorithm that uses fuzzy numbers to aggregate the opinions of a committee of experts. Let $D = \{D^1, D^2, ..., D^h\}$ be the set of decision makers, usually experts in the decision field. Let $\{x_1, x_2, ..., x_p\}$ be the set of objects to compare (i.e. the final vertices of the arcs leading out from a vertex v). The expert $D^t$ associates to the n-tuple $(x_1, x_2, ..., x_p)$ a matrix $A^t = (a_{rs}^t)$ with p rows and p columns, where $a_{rs}^t$ is the number assigned to $x_r$ when compared with $x_s$.

In order to have a unique matrix that summarizes the views of all the experts we propose to calculate the matrix A* as the geometric mean of the matrices given. The generic element $a_{rs}$ of the matrix A* is then given by:

$$a_{rs} = (a_{rs}^1 \cdot a_{rs}^2 \cdot ... \, a_{rs}^p)^{1/p} \tag{2}$$

It is important to note that the matrix A* thus obtained retains the main properties of the matrix A of a single decision-maker: every element belongs to the interval $[1/9, 9]$ and $a_{sr} = 1/ a_{rs}$. This allows us to calculate the scores of the arcs $(v, x_r)$ with the same procedure as in the previous section, i.e. by calculating the principal eigenvalue of A* and the eigenvector associated with all components $w_1$, $w_2$, ..., $w_p$ nonnegative and sum $w_1+w_2+ ...+w_p$ equal to 1.

Moreover we propose to measure the *degree of uncertainty* (or *disagreement within the committee*) using the following formula:

$$u_{rs} = \exp \sqrt{\frac{\sum_{t=1}^{p} \left[ \ln \frac{a_{rs}^t}{a_{rs}} \right]^2}{p}} \tag{3}$$

We can show that $u_{rs}$ is greater than or equal to 1 and equality holds if and only if the scores of the experts are all the same. Moreover $u_{rs} = u_{sr}$. Then we can define the uncertainty of $x_r$ with respect to v, that is the uncertainty of the arc $(v, x_r)$ as the geometric mean of the elements of r-th row of the matrix $U = (u_{rs})$, or, interchangeably, as the geometric mean of the elements of the $r^{th}$ column. That is, the uncertainty of $(v, x_r)$ is given by:

$$u_r = (u_{r1} \, u_{r2} ... \, u_{rp})^{1/p} \tag{4}$$

It seems plausible to use the above formulas to introduce the *fuzzy score* of the arc $(v, x_r)$ defined as the triangular fuzzy number:

$$w_r^* = (w_r \, / \, u_r, \, w_r, \, w_r \cdot u_r) \tag{5}$$

The number $w_r$ is the core of $w_r^*$, i.e. the most important numeric value, $w_r \, / \, u_r$ and $w_r \cdot u_r$ are the extremes and the differences $w_r - w_r/u_r$ and $w_r \cdot u_r - w_r$ are the left and right spreads of $w_r^*$, respectively (Maturo, 2009).

Moreover, for every path $p = (x_1, x_2, ..., x_k)$ we define the fuzzy score of p as the product of the fuzzy scores of the arcs that form the path. In order to obtain triangular fuzzy numbers the fuzzy product defined by Zadeh using the principle of extension (Zadeh, 1975; Yager, 1986; Klir & Yuan, 1995) is replaced by the approximate fuzzy product defined as the triangular fuzzy number with the same core and the same extremes of the Zadeh fuzzy product (Maturo, 2009).

Finally, for every vertex x different from the overall goal, the fuzzy score of x is the sum of the fuzzy scores of all the paths joining the overall goal with x.

## CASE STUDY

The purpose of this case study is to identify the most effective strategies for promoting the integration of new generations of immigrants and natives in scholastic contexts characterized by the presence of students with different cultural backgrounds.

The general objective (GO) is defined as "Diversity management in the multicultural school" and is divided into three specific objectives as described earlier:

– $O_1$ = cognitive learning;
– $O_2$ = social construction;
– $O_3$ = construction of citizenship.

With the AHP, to each one of these objectives is associated a score with respect to the general objective.

In addition, each of the objectives is specified by the following criteria:

– $C_1$ = regular scholastic attendance;
– $C_2$ = scholastic performance;

–  $C_3$ = formative aspirations;
–  $C_4$ = socializing places;
–  $C_5$ = friendship associating;
–  $C_6$ = interethnic relations;
–  $C_7$ = intercultural relations;
–  $C_8$ = idea of citizenship;
–  $C_9$ = plurality of belonging.

With the AHP, the decision maker for each objective $O_i$ and for each criterion $C_j$, assigns a score that measures the degree to which the criterion $C_j$ meets the objective $O_i$.

Good scholastic integration is an important prerequisite for social integration, development of social bonds and, therefore, for cohesion in multi-ethnic and culturally diverse societies. To this end, with reference to the scientific literature, we identified four possible strategies:

–  A1 = Promote assimilation;
–  A2 = Promote multiculturalism;
–  A3 = Promote interculturalism;
–  A4 = Not to change anything.

The procedure was to interview a group of 12 teachers from a primary school in Pescara, situated in a suburb quarter and attended by students of different ethnic backgrounds. The teachers interviewed were well versed in the problem of interculture and highly motivated in this research. For each of them matrices of pairwise comparisons were elaborated. Applying the methods described above and in the previous section, the following triangular fuzzy numbers expressing the scores of the alternatives were obtained:

–  s(A1) = (0.109, 0.144, 0.190),
–  s(A2) = (0.125, 0.164, 0.214),
–  s(A3) = (0.451, 0.586, 0.761),
–  s(A4) = (0.083, 0.107, 0.139).

In other words:

–  the alternative A1 has a triangular fuzzy score with core 0.144 and left and right spreads 0.144 – 0.109 = 0.035 and 0.190 – 0.144 = 0.046, respectively;
–  the alternative A2 has a score with core 0.164 and left and right spreads 0.039 and 0.050, respectively;
–  the alternative A3 has a score with core 0.586 and left and right spreads 0.135 and 0.175, respectively;
–  the alternative A4 has a score with core 0.107 and left and right spreads 0.024 and 0.032, respectively.

In order to establish a ranking between the alternatives it is necessary to choose an order relation between the triangular fuzzy numbers, or at least a preorder relation.

If (a, b, c) and (a', b', c') are two fuzzy triangular numbers, let us put (a, b, c) $\leq_t$ (a', b', c') if and only if (a $\leq$ a', b $\leq$ b', c $\leq$ c'). The relation $\leq_t$ is a partial order

relation (Maturo, 2009), let's call it *triangular relation*. A weaker relation, not of order but of preorder, is the *crisp relation* defined by (a, b, c) $\leq_c$ (a', b', c') if and only if b $\leq$ b'. Instead a stronger order relation (partial), let's call it *dominance relation,* is the relation defined by (a, b, c) $\leq_d$ (a', b', c') if and only if c $\leq$ a'.

For every order (or preorder) relation $\leq$ on a set of triangular fuzzy numbers, we write (a, b, c) < (a', b', c') if (a, b, c) $\leq$ (a', b', c') but not (a', b', c') $\leq$ (a, b, c).

As for the alternatives we can see that s(Ai) $<_d$ s(A3), for i = 1, 2, 4; therefore the alternative A3 (promotes interculturalism) dominates all the others, that is to say it is strongly preferable compared to the others. For the other three alternatives it is evident that s(A4) $<_t$ s(A1) $<_t$ s(A2), therefore A2 is preferable to A1, but without dominating it; besides A2 is preferable, without dominating it, to A4. Thus, even though the almost certain classification of preference, in a decreasing order, is (A2, A1, A4), there is a small possibility that, in particular circumstances, the order could be different.

### *Multivariate Statistics*

Completely different points of view can be obtained by using multivariate statistics (Benzécri, 1980). The approach here is to obtain information from the data without a priori hypotheses. Suppose that a phenomenon on a universal set U with n elements is represented by a set X = {$X_1$, $X_2$, ..., $X_k$} of statistical variables, with k<<n. The goal is to explain the phenomenon with a smaller number of variables Y = {$Y_1$, $Y_2$, ..., $Y_h$}, called the *explanatory variables*, linear combinations of $X_i$ and uncorrelated.

For example, in the *method of principal components*, we consider the *total variability* of X, V(X), defined as the sum of the variances of the $X_i$. The phenomenon is believed to be described in a manner acceptable by Y if the ratio V(Y)/V(X) is sufficiently close to 1. In practice they are often just 3 explanatory variables.

Some possible variables related to the immigration and diversity management objective in the multicultural school may be: age, citizenship, gender, cultural capital of the family, social capital of the family, profession of their parents. Specific variables for immigrants might be: macroarea of origin, age of immigration, migration routes, migration projects, schooling, knowledge of the Italian language, ethnic networks.

The variables are assigned a weight that measures the degree of importance. This weight can be detected using the Saaty's pairwise comparison, in relation to each specific objective. In other words, the variables take on the role of the criteria in the process of Saaty.

### *Cooperative Games and Consensus*

The instrument of cooperative games, whose applications in the social sector were introduced in the famous book (Luce & Raiffa, 1957), seems best suited to resolve situations of conflict-collaboration created by the phenomenon of immigration.

In fact, we can identify different social groups, residents or immigrants, such as school-age students, retired men, workers, university graduates, managers, each of which may decide on different behavioral strategies. Each of these strategies will have a utility, dependent on the decisions of other groups.

If strategies are coordinated in a cooperative way, overcoming any mutual mistrust, then the overall utility will be greater than the sum of the individual utilities of the group if each were acting only according to their own (apparent) interest. The only challenge then is that the allocation of overall utilities for each should be enough to overcome what is sure to be achieved by acting alone. For example, the work contribution of immigrants will allow the sustainability of the pension system, and in return will have an adequate health care and education.

A different point of view is that of *consensus*, for example, studied in (Eklund et al., 2007; Maturo & Ventre, 2009). Consider the case of a set $D = \{D^1, D^2, ..., D^h\}$ of decision makers. Every decision maker in $D^t$ belonging to D, using the Saaty procedure, gives a vector $p_t = (p_{t1}, p_{t2}, ..., p_{tn})$ of scores of alternatives A1, A2, ..., An.

The vector $p_t$ can be interpreted as a point of Euclidean space of n dimensions that represents the decision maker $D^t$. We can set a *minimum level of consensus* given by a number $\varepsilon > 0$ and assume there is *consensus* between two decision makers $D^r$ and $D^s$ if the distance between the points $p_r$ and $p_s$ is less than $2\varepsilon$.

We say that there is consensus among h decision makers if there is a point $c \in R^n$ such that all the points $p_t$ representing the h decision makers have distance from c less than $\varepsilon$. Finally we say that there is a *sufficient consensus* in the committee if there is consensus in a majority of decision makers.

If sufficient consensus was not achieved a mediator should explore the possibility to convince more dissident decision-makers (represented by more peripheral points) to change their assessment. In (Eklund *et al*., 2007), and in (Maturo & Ventre, 2009) some algorithms are designed based on an alternation of the action of a mediator and application of mathematical procedures, in order to increase consensus in a committee until a sufficient consensus is reached or it is shown that sufficient consensus cannot be achieved.

At the end of the algorithm, where h is the maximum number of people in agreement and they constitute a majority, then decisions are made taking into account only the points representing these h individuals.

## FINAL CONSIDERATIONS AND FURTHER RESEARCH LINES

From the case study it seems that the most efficient strategy to manage diversity in scholastic multiethnic and pluralist contexts is the intercultural approach.

In the ambit of scholastic policies the intercultural approach sees the school as a space of: cognitive learning, of construction of citizenship, of construction of sociality.

Adopting the intercultural perspective means not just organizing integration strategies for immigrant students. Teaching in an intercultural perspective means

considering diversity as a paradigm of the identity of the school itself (MPI, 2007; Council of Europe, 2008).

First of all it is necessary to promote strategies aimed at granting all students equality in educational paths, and to give immigrant students the resources for study and to fully participate in scholastic and non scholastic life. In particular the following practises are relevant: welcoming practices, intensive language courses for students, certifying linguistic competences, developing teachers, student orientation.

Linguistic diversity, that is spreading across European education systems, can be a precious educational resource for all the students and can contribute to European integration and intercultural dialogue (Nesse Network, 2008). The conservation of the mother tongue is an instrument for cognitive growth. It can have positive results on scholastic outcomes and on the paths of identity building; it can produce a re-valuation of the familiar cultural capital (Hakuta, 1986; Kao, 2004).

Actions for the valorisation of plurilinguism in the school require a systematic and professional approach that is integrated with resources. It is possible: to reconsider the general offer of foreign languages, that can include languages spoken in the most numerous communities; to organize course on the basis of school networks; to foresee the involvement of scholastic and territorial reality. In the document promoted by the European Commission the European Union was asked to promote the proposal of a personal adoptive language, according to which each European citizen should be encouraged to choose an adoptive language (European Commission, 2008). For the immigrants the personal adoptive language should be the one of the country where they intend to live. In fact, a deep knowledge of the national language and culture that it reflects is a necessary element for scholastic success and to full participation in economic, social, cultural and political life. In such a vision, the practise of certifying the language of the country of destination and registering a level of knowledge of the language according to standards common to all European languages, can be efficient from a perspective of valorising the linguistic competences acquired by the students.

More generally, the intercultural approach is aimed at widening the cognitive field, promoting the ability of decentralization to show the variety of points of view, and develop critical thought (Council of Europe, 2008). The relativization of the criteria and concepts does not lead to radical relativism, but to an understanding of shared criteria and the promotion of attitudes of openness towards diversity. Interculturalism is based upon a process, dynamic, situated and social concept of culture. Such a concept grasps the negotiation processes from which cultures and traditions are modeled, recognises the student with his history and identity, and avoids the labeling and rigid fixation of cultural belonging.

Intercultural education is conceived both as transversal and interdisciplinary and as a specific curricular space that takes on the form of a new education of citizenship that includes intercultural dimension and has, as objectives, equality and social cohesion.

In that sense it is necessary to invest in the intercultural curriculum. Scholastic subjects – e.g. history, literature, geography, mathematics, artistic and musical education – can be an occasion to develop intercultural competences. For example, in the ambit of teaching history and literature it is necessary to overcome the Eurocentric approach and underline the contribution and autonomous values of different cultures. Geography can widen the vision of students from the national context to a European and a worldwide one. Maths and scientific subjects can promote a critical attitude and appreciation of the comparison of ideas.

Multi-religiosity that is evident in scholastic classes is an opportunity to gain knowledge of practices and different religious signs, and favours the development of attitudes like respect and recognition in the exploration of the self.

Actions for interculture must develop also a relational dimension. (MPI, 2007; European Commission, 2010). The relational dimension can be promoted through contact and sharing experiences. That is to say, interculturality is favoured if the class becomes a place of communication, cooperation and exchange of experiences.

Furthermore, the intercultural approach requires the construction of networks and coordination, that is to say that scholastic institutions should activate links between scholastic policies that promote closer links with parents and community. Also school networks are an efficient instrument to spread practices, organizational modalities and inter-institutional cooperation forms.

The difficult task of education in a culturally heterogeneous society is to promote the construction of a plural and shared citizenship, that is to say a citizenship that includes the sharing of universal values and the respect of individual rights.

The educational challenge is set within the wider objective of cohesion in the plural and multi-ethnic society, because the failure of education can impede the development of social bonds and feelings of belonging.

## NOTES

[1] The study was designed jointly with contributions from both authors in each part.

Contini Rina Manuela contributed the following paragraphs: Introduction; Diversity Management: Issues and Strategies; Approaches to the Management of Cultural Diversity; Areas of School Policies; Case Study, Final Considerations and Further Research Lines;

Maturo Antonio contributed the following paragraphs: Mathematical Models for Data Analysis and Decisions, The Analytic Hierarchy Process, Group Decision Making: a Representation with Fuzzy Numbers; Multivariate Statistics; Cooperative Games and Consensus.

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## AFFILIATIONS

*Antonio Maturo*
*Department of Social Sciences,*
*University of Chieti-Pescara, Italy.*

*Rina Manuela Contini*
*Department of Social Sciences,*
*University of Chieti-Pescara, Italy.*

ZEHRA KAMIŞLI ÖZTÜRK

# 15. OPERATIONS RESEARCH APPLICATIONS IN HIGHER OPEN AND DISTANCE LEARNING SYSTEMS

## INTRODUCTION

In this chapter, some decision problems faced in Higher Open and Distance Learning (ODL) systems are discussed. The terms open learning and distance education represent approaches that focus on opening access to education and training provision, freeing learners from the constraints of time and place, and offering flexible learning opportunities to individuals and groups of learners. Open and distance learning is one of the most rapidly growing fields of education, and its potential impact on all education delivery systems has been greatly accentuated through the development of internet-based information technologies, and in particular the World Wide Web (UNESCO, 2002). The management of ODL institutions often differs from the management of traditional face-to-face educational institutions, this being reflected in the structure of the institution and generating a clear differentiation between the types of learners. The management of ODL institutions has a particular character reflecting the wide area served by the education provision (Gürol & Turhan, 2005).

In this chapter, most of the case problems are selected from the Open Education Faculty of Anadolu University. Anadolu University ODL System, is very active in international collaborations, has very good technical and human resources, and an ODL model that is continuously evolving. In this context, the Anadolu University ODL System[1] is one of the largest in the world. Besides providing the resources to meet the demands of Turkish Higher Education, Anadolu University Distance Education System awards associate degrees, bachelor's degree and degree completion programs for personnel working in education, health, theology, and horticulture; the police, the Turkish Air Force, Army, Navy and Gendarme all via its distance education model. Moreover, Anadolu University provides training and development for many prestigious international organizations thus helping raise the educational levels of Turkish citizens.

In this chapter, we consider a number of the general decision problems that may be encountered in many ODL institutions, and we also discuss possible solution approaches.

## LOGISTIC ACTIVITIES

All effective distance learning programs depend upon the "three legs" of good learning materials, effective learner support, and efficient logistics

(Moore & Kearsley, 1996). One of the most important decision tasks in ODL systems is planning logistic activities because it is crucial to provide the right service at the right time and the right place. As Larson (1999) found, the lack of availability of course resource materials has a negative impact on distance learning (Valenta et al., 2001). In her study Çekerol (2011) also highlights the importance of logistic support for the sustainability of ODL systems as well as in determining the attitudes of the learners towards the distribution process of exam documents and course books.

In the distribution process of printed course materials, determination of the vehicle routes is one of the decision problems faced in ODL systems. The Vehicle Routing Problem (VRP) is a well known problem in operational research. The VRP has generated enormous interest from many researchers during the last decades because of its vital role in the planning of distribution systems and logistics in many sectors (Yeun et al., 2008). In this section, a vehicle routing model for the ODL System of Anadolu University's printed course materials is proposed.

Since 1982, textbooks – the core instructional medium – have been developed through a well-designed and precise process in a way that helps learners to work on their own. Teams that design and develop textbooks at Anadolu University are composed of experienced content experts, editors, instructional designers, TV editors, art directors, language experts, and measurement and evaluation experts. Textbooks are designed with advanced educational technologies in such a way that learners can learn by themselves. Each year, approximately 5 million books are sent to learners. In preparing the books, 605 academicians who are specialists in their fields are assigned as authors and 162 academicians as editors.

In Anadolu University course materials are printed in the university printing house. Then, before the registration period, the printed course materials have to be distributed to 91 bureaus available in 81 cities across Turkey and also in Nicosia, Azerbaijan and in some Western European countries. For instance, in the 2009–2010 academic year, 5.5 million books were printed for 382 courses. Due to the fact that the learners do not have to enrol in each academic year, the demand for the books is not deterministic. So, the numbers of learners and accordingly the demands for the books are estimated based on the past years' data. The vehicles are identical and based at a single central depot. If it's required, more than one vehicle can visit a bureau. The objective is to minimize the travelling costs.

The problem can be modelled as a Generalized Vehicle Routing Problem (GVRP) which is a generalization of the VRP. The GVRP may also be considered as a special case of the capacitated location routing problem presented by Laporte et al. (1986) where all tours start and end at the same node. Kara and Bektas (2003) handle the GVRP with minimal and maximal load restrictions and present an integer linear programming formulation (ILPF) as follows:

Let $G = (V, A)$ be a directed graph with $V = \{0, 1, 2, …, n\}$ as the set of vertices and $A = \{(i, j): i, j \in V, i \neq j\}$ as the set of arcs.

In this formulation, $V = \{0,1,2,…,n\}$ represents a set of nodes corresponding to bureau locations, where 0 represents the origin (depot).

Let $V$ be partitioned into mutually exclusive and exhaustive non-empty subsets $V_0, V_1, \ldots, V_k$, each of which represents a cluster of bureaus, where $V_0$ is the origin (depot).

*Decision Variables*

Define

$$x_{ij} = \begin{cases} 1, \text{ if arc } (i, j) \text{ is on the tour, } i \in V_{\mathrm{p}}, j \in V_{\mathrm{l}}, p \neq l, p,l = 1,2,\ldots, k \\ \\ 0, \text{ otherwise} \end{cases}$$

$y_{pl}$ = flows from cluster $p$ into cluster $l$, $\forall p \neq l$, $p,l = 1,2,\ldots, k$.
$u_p$ = unloaded amount from the vehicle just after leaving cluster $p$, $p = 1,2,\ldots, k$.

*Parameters*

Let:
– $c_{ij}$: cost of travelling from node $i$ to node $j$, $i \neq j$, $i \in V_p$, $j \in V_l$, $p \neq l$, $p,l=1,2,\ldots, k$
– $d_i$: demand of bureau $i$, $i = 1, 2, \ldots, n$
– $q_l$: demand of cluster $l$, $q_l = \sum_{i \in V_l} d_i$, $l = 1,2,\ldots,k$

– $m$: number of vehicles
– $Q$: capacity of each vehicle
– $K$: minimum starting load of a vehicle just before starting its trip
The constraints of the problem, under the heading to which they correspond to, are given below:

*Degree Constraints*

For each cluster excluding $V_0$, there can only be a single outgoing arc to any other node belonging to other clusters. This is implied by the following constraints:

$$\sum_{i \in V_l} \sum_{j \in V \setminus V_l} x_{ij} = 1, \; l = 1,2,\ldots,k \tag{1}$$

There can only be a single incoming (entering) arc to a cluster from any other node belonging to other clusters, excluding $V_0$. This is implied by the constraints (2).

$$\sum_{i \in V \setminus V_l} \sum_{j \in V_l} x_{ij} = 1, \; l = 1,2,\ldots,k \tag{2}$$

There should be $m$ leaving arcs from and $m$ entering arcs to the home city (origin), which are implied by the constraints (3) and (4).

$$\sum_{i=1}^{n} x_{0i} = m \tag{3}$$

$$\sum\nolimits_{i=1}^{n} x_{i0} = m \tag{4}$$

*Flow Constraints*

The entering and leaving nodes should be the same for each cluster, which is satisfied by;

$$\sum\nolimits_{i \in V \setminus V_l} x_{ij} = \sum\nolimits_{i \in V \setminus V_l} x_{ji} \, , j \in V_l \, , l = 1, 2, \ldots, k \tag{5}$$

Flows from cluster $p$ to cluster $l$ are defined by $y_{pl}$. Thus, $y_{pl}$ should be equal to the sum of $x_{ij}$'s from $V_p$ to $V_l$. Hence,

$$y_{pl} = \sum\nolimits_{i \in V_p} \sum\nolimits_{j \in V_l} x_{ij} \, , p \neq l, p, l = 0, 1, 2, \ldots, k \tag{6}$$

Note that $y_{pl}$ will automatically be 0 or 1 by the degree constraints given by (1), (2), (3) and (4).

*Side and Subtour Elimination Constraints*

The maximum load of a vehicle will be satisfied by the following constraints:

$$u_p + \left(Q - \bar{q}_p - q_p\right) y_{0p} - \bar{q}_p y_{p0} \leq Q - \bar{q}_p \, , p = 1, 2, \ldots, k \tag{7}$$

$$u_p + \bar{q}_p y_{0p} + \left(q_p + \bar{q}_p - K\right) y_{p0} \geq q_p + \bar{q}_p \, , p = 1, 2, \ldots, k \tag{8}$$

where $\bar{q}_p = min_{l, l \neq p} \{q_l\}$ and $Q \geq K \geq q_p + \bar{q}_p, \forall p$.

Connectivity between clusters on a route will be satisfied by the constraint (9), where $Q \geq q_p + q_l, \forall l \neq p$.

$$u_p - u_l + Q y_{pl} + \left(Q - q_p - q_l\right) y_{lp} \leq Q - q_l \, , p \neq l, p, l = 1, 2, \ldots, k \tag{9}$$

*Nonnegativity Constraints*

$$x_{ij} = 0 \ or \ 1, \quad \forall (i, j) \tag{10}$$

$$u_p \geq 0, \quad \forall p \tag{11}$$

$$y_{pl} \geq 0, \quad \forall (p, l) \tag{12}$$

The integer linear programming formulation of the GVRP is given by:

$$M : minimize \sum\nolimits_i \sum\nolimits_j c_{ij} x_{ij} : subject \ to \ (1) - (12)$$

This section has presented an integer linear programming formulation of the GVRP for the distribution of printed course materials. According to the managerial requirements of the system, the delivery model can be changed, therefore, the formulation can sometimes be reduced to special cases of GVRP.

## LEARNER-PRACTICE COURSE ASSIGNMENT PROBLEM

This section is concerned with an assignment system proposal for two programs in the Open Education Faculty that have practice courses. There are two teaching programs in the Open Education Faculty: *Program in English Language Teaching* and *Program in Pre-school Education*. These programs began to admit learners to meet the demand for teachers with a protocol assigned by the Ministry of National Education (MNE). The English language teaching program is a blended program whereby the first two years are face-to-face learning and the last two years are through distance education. In addition, there are different practice courses in these programs' senior years along with theoretical courses. We now discuss the frequently encountered decision problem of a multi-objective learner-practice course assignment problem in these ODL teaching programs.

The practice courses are done in schools within the structure of the MNE. These practice courses are undertaken within the schools regular schedule of courses, in different time slots and with different teachers. In fact, each ODL learner is assigned to one of the local schools to take these courses, and so this is also an assignment problem to be solved. However, here we just deal with the problem of which learner is to be assigned to which course's timeslot and teacher. Based on the time and place freedom property of ODL systems, the ODL learners can also be in employment. So, the precise timeslots of the practice courses are important for the learners. Also, timeslots may not have the same importance for everyone. For instance, the morning courses may be more important than afternoon courses for some learners. Under the condition that the course program is known, the problem's constraints are defined as follows:

− no learner can be assigned to more than one practice course in the same timeslot;
− each learner must take only related practice courses.

As in most real life decision problems, here it is important to meet the individuals' preferences. So, the objectives of the problem are defined as follows:

− the learners' time slot preferences should be considered;
− the daily loads of the learners should be balanced.

A general timetabling problem involves scheduling a number of tuples, each consisting of a class of learners, a teacher, a subject and a room, to a fixed number of timeslots. This problem has been well studied in the past. An exhaustive search is impractical because there are too many alternatives. Modelling the problem as an integer programming problem has not been particularly successful because there are too many variables and constraints (Abramson, 1991). Here the dimensionality

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of the learner-course assignment supports Abramson, and so we consider heuristic methods that are capable of avoiding local optima and are frequently used to solve these types of problem.

We now consider a solution to the problem with a Genetic Algorithm (GA). GAs are powerful general purpose optimization tools which model the principles of evolution. They are often capable of finding globally optimal solutions even in the most complex of search spaces. They operate on a population of coded solutions which are selected according to their quality and then used as the basis for a new generation of solutions found by combining (crossover) or altering (mutating) current solutions (Burke et al., 1994).

In our case, the solution is an assignment of learners to related courses. For this purpose, an entry page is prepared as given in figure 1. The steps of the solution process can be explained as follows:

– in part "a", the courses that the learners can take as the practice courses are given in a table. A learner can take the practice courses from different teachers. In this case, each course is treated as different and the data entry is accomplished by entering the value "1" for an appropriate course (considering course conflicts and timeslots) and "0" otherwise;
– in part "b", learners can give the values "0", "1", and "2" according to their timeslot preferences so that the value "0" is given to most preferred timeslot. In addition, to balance the learner total loads, the course schedule and the weights of each timeslot are given in this part;
– the genetic parameters like population size, iteration number, crossover and mutation ratios are entered in part "c". When the "solve" button is clicked the algorithm begins to solve the problem. First of all, the related problem and GA parameters are read. Then a population is generated randomly. Each individual (chromosome) is a binary string. The individuals in the population are then evaluated according to the objectives of the problem. This means measuring each individual's deviation from the average load and, for each individual, the total unmet timeslot preferences. Two individuals are then selected based on their fitness, the lower the fitness, the higher the chance of being selected. These individuals then "reproduce" to create one or more offspring, after which the offspring are mutated randomly. This continues until a certain number of generations have passed;
– finally, the assignment results are given in part "d".

Assignment results can be read as follows: For example, on Monday the 5th learner takes the courses 1 and 2 at timeslots 11 and 12 respectively. Similarly, on Tuesday, the 10th learner takes the courses 2 and 5 at timeslots 22 and 24 respectively.

The learner-course assignment problem is a large size problem. For instance, in the 2008–2010 education term for the practice course *Community Service*, 2633 learners were assigned to 268 teachers in all cities. The existing assignment system has disadvantages – two examples would be the human resources needed in constructing the assignments and the difficulty in considering learner preferences.

Also it is hard to obtain an optimum assignment by solving the problem manually. As a future study, a web based assignment system will be developed based on the developed GA. This will also make it easier to collect learner preferences.
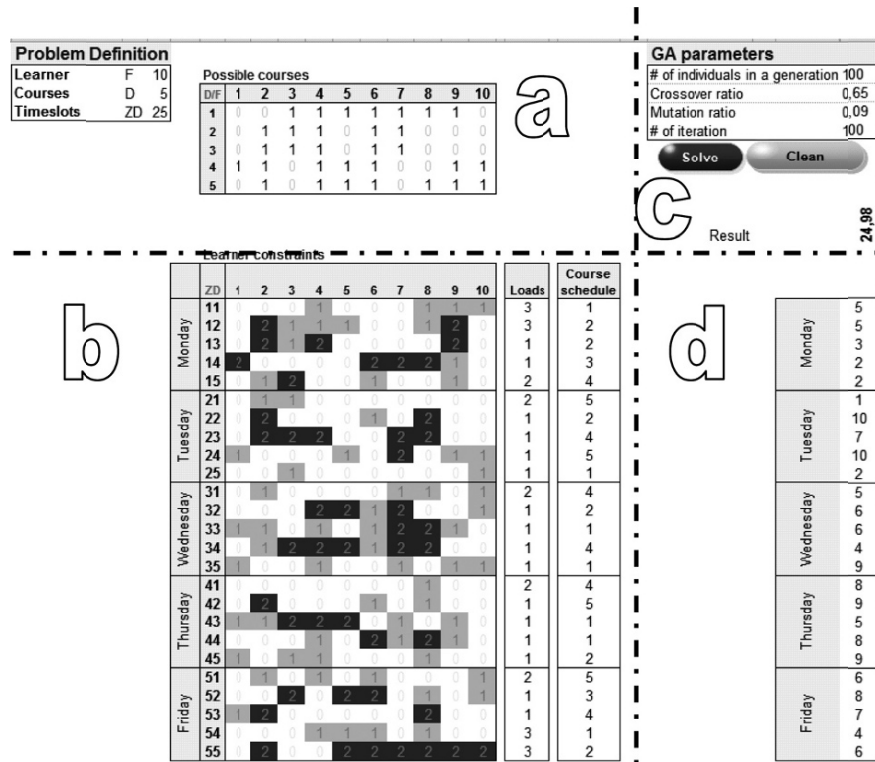


*Figure 1. User interface of the GA for a learner-course assignment problem.*

APPLICATION MODEL SELECTION

Based on developments in information technology, determination of the weight assigned to different academic delivery modes within ODL is an important decision area. Therefore, it is important for institutions to develop a decision model that determines these ratios in the planning processes. In designing ODL programs (and depending on the study areas and the target population) different requirements under varying criteria create a multi-criteria decision making environment. Therefore, decision makers are faced with the problem of evaluating different implementation models.

According to Ertugrul and Karakasoglu (2007), multi-criteria methods like the Analytic Hierarchy Process (AHP) can be applied to multi-criteria decision problems in universities. The AHP is a powerful multi-criteria method that

considers both tangible and intangible criteria, and by applying group decision making, the different opinions of various experts can be integrated.

Decision makers are often faced with several conflicting alternatives. Özkul et al. (2007) evaluate ODL implementation models by an AHP model, for the Program in English Language Teaching (ELTT) at the Anadolu University Open Education Faculty. The decision problem is the determination of the ratios of different delivery modes in the implementation model. The hierarchical structure, which includes tangible and intangible factors, was constructed working cooperatively with the administrators and instructors of the program.

*Theoretical Background of AHP*

Decision making is the study of identifying and choosing alternatives based on the values and preferences of the decision maker. The AHP is a systematic method for comparing a list of objectives or alternatives. It is based on the well-defined mathematical structure of consistent matrices and their associated right eigenvector's ability to generate true or approximate weights (Forman & Gass, 2001).

In using the AHP to model a problem, one needs a hierarchic structure to represent that problem, as well as pairwise comparisons to establish relations within the structure. In the discrete case these comparisons lead to dominance matrices and in the continuous case to kernels of Fredholm Operators, from which ratio scales are derived in the form of principle eigenvectors, or eigen functions, as the case may be. These matrices, or kernels, are positive and reciprocal as in Equation (13) (Saaty & Vargas, 2001).

$$a_{ij} = 1/a_{ji} \tag{13}$$

Paired comparison judgements in the AHP are applied to pairs of homogeneous elements. The fundamental scales of values are between the values 1 and 9 to represent the intensities of judgements. Using these pairwise comparisons, the relative weights of attributes can be estimated. The right eigenvector of the largest eigenvalue of matrix $A$ in Equation (14) estimates the relative importance of attributes.

$$A = \begin{bmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{m1} & \cdots & a_{mn} \end{bmatrix} \tag{14}$$

where $a_{mn}$ is the pair-wise comparison rating and represents the relative degree of importance of criterion $m$ over criterion $n$. In the AHP approach, the eigenvector is scaled so the elements add to 1 to obtain the weights. Based on properties of reciprocal matrices, the consistency of pair-wise judgments can be calculated (Ananda & Herath, 2008). A Consistency Ratio (CR) measures the consistency of the pair-wise comparisons and as a rule of thumb, a CR value of 10% or less is

considered acceptable (Saaty, 1977). The pair-wise comparisons are completed for all levels. By making the comparisons, the weights of each criterion and in the final step, by hierarchical synthesis, the weights of the alternatives are obtained. Moreover, the AHP employs redundant comparisons to ensure the validity of judgments and also provides a measure of inconsistency for discarding inconsistent judgments (Saaty, 1994).

## *Numerical Example*

The proposed model for ODL implementation models in the *Program in English Language Teaching* (ELTT) at Anadolu University Open Education Faculty consists of six main criteria: *cost*, *access*, *staff*, *interaction*, *benefit* and *media of instruction*. The main and sub criteria are given in figure 2.
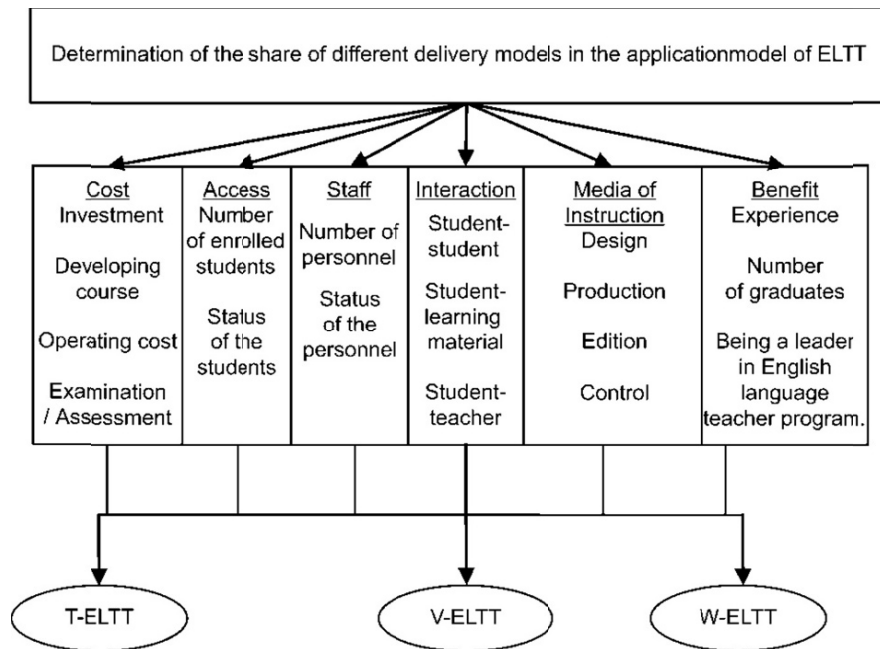


*Figure 2. The AHP model structure for the application model selection problem.*

With the proposed model, all of the criteria (including the quantitative criteria like cost, number of personnel and learners, and also the qualitative criteria like interaction, medium of instruction and benefit) are considered together and this makes the decision problem very complex.

ELTT is a blended learning model, so it is important to determine the weight and priorities of each delivery mode to execute the program successfully. The alternatives considered were videoconference based (V-ELLT), web based

(W-ELLT) and traditional (face-to-face/T-ELL) education based implementation models. The data for this study were obtained from the judgments of three specialists of ELTT. The outcomes of the model were twofold. As well as prioritizing the alternative delivery modes, the priorities of all the criteria defined for this problem are obtained. The criteria weights also help administrators to investigate their systems and policies. In this respect, institutions are assisted in making strategic decisions such as selecting which instruction media to develop or in undertaking cost/benefit analyses.

According to the results obtained from the research; a blended ODL ELTT program can be based on 41.4% face-to-face education, 30.9% W-ELLT and 27.8% V-ELLT. It is not surprising that face-to-face education has the highest weighting in a foreign language teacher training program, as certain aspects of the programme (especially the assessment of teacher applicants) needs a synchronous delivery model. Depending on the program's curriculum, the lessons can be given based on the ratios either yearly or periodically.

## LEARNING MANAGEMENT SYSTEM SELECTION

Technology is a major contributor to the dramatic transformation of open and distance learning (Potashnik & Capper, 1998). As technological developments increase there are more alternatives to choose from and one of the ODL system choices is in relation to the selection of an appropriate learning management system (LMS).

Other examples of studies that use multi-criteria decision making techniques for selection problems that occur in ODL systems include, for instance, Poonikom et al. (2004) who proposed a systematic framework using the Analytic Network Process (ANP) for the selection of universities that offer undergraduate programs in engineering, and Sadi-Nezhad et al. (2010) who evaluate three e-learning systems by using ANP and fuzzy preference programming. As well as in traditional education institutions, LMS selection is a key strategic decision in ODL systems. This managerial decision is important as it affects the success of courses. Girginer et al. (2007) have evaluated three different courseware development platforms as a multi-criteria decision problem with an ANP model.

Many decision problems cannot be structured hierarchically because they involve the interaction and dependence of higher-level elements on lower-level elements. Not only does the importance of the criteria determine the importance of the alternatives as in a hierarchy, but also the importance of the alternatives themselves determines the importance of the criteria. Hence, the Analytical Network Process is a generalization of the AHP (Saaty, 1996).

### *Theoretical Background of ANP*

A network has clusters of elements, with the elements in one cluster connected to elements in another cluster (outer dependence) or within the same cluster (inner dependence). There are two kinds of influence: outer and inner. In the first, one

compares the influence of elements in a cluster on elements in another cluster with respect to a control criterion (such as economic, political, or social influences). In the second, one compares the influence of elements in a group on each other (Sagir & Ozturk, 2010).

The ANP approach is capable of handling interdependence among elements by obtaining the composite weights through the development of a supermatrix. To obtain global priorities in a system with interdependent influences, the local priority vectors are entered in the appropriate columns of the supermatrix, As a result, a supermatrix is actually a partitioned matrix, where each matrix segment represents a relationship between two nodes (components or clusters) in a system. Let the components of a decision system be $C_k$; $k = 1,..,n$, and each component $k$ has $m_k$ elements, denoted by $e_{k1}$, $e_{k2}$, …, $e_{kmk}$. A supermatrix along with an example of one of its general entry matrices are shown in equation (15). For example, the component (C1) in the supermatrix includes all the priority vectors derived for nodes that are "parent" nodes of the (C1) cluster, which means the elements in (C1) influence some or all the elements that feed into (C1).



$$ (15) $$

A recommended approach by Saaty (1996) is to determine the relative importance of the clusters in the super-matrix with the column cluster (block) as the controlling component. That is, with a pair-wise comparison matrix of the row components with respect to the column component, an eigenvector can be obtained. This process gives rise to an eigenvector for each column block. For each column block, the first entry of the respective eigenvector is multiplied by all the elements in the first block of that column, the second by all the elements in the second block of that column and so on. In this way, the blocks in each column of the super-matrix are weighted, and the result is known as the weighted super-matrix, which is stochastic. Raising a matrix to powers gives the long-term relative influences of the elements on each other. To achieve a convergence on the importance weights, the weighted super-matrix is raised to the power of $2k + 1$; where $k$ is an arbitrarily large number, and this new matrix is called the limit super matrix. By normalizing each block of this supermatrix, the final priorities of all the elements in the matrix can be obtained.

*Numerical Example*

With the goal of selecting of best LMS for an ODL system, Girginer et al. (2007) developed an ANP model and determined the main and sub criteria as given in figure 3. The main criteria (clusters) were determined as *financial*, *technical*, *instructional* and *vendor support*. The group of specialists made the pairwise comparisons.
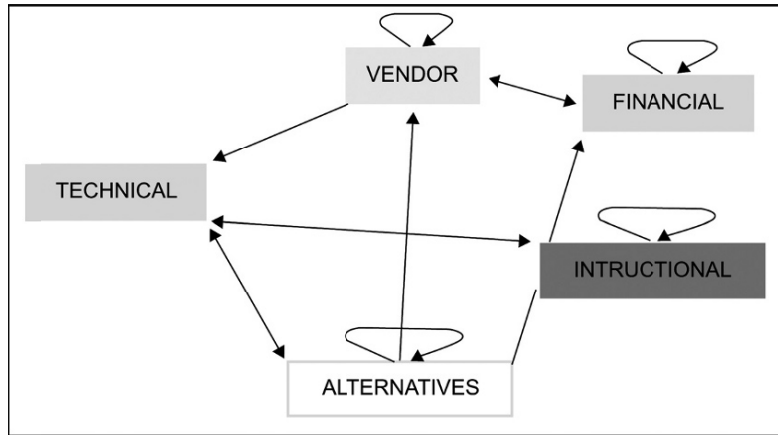


*Figure 3. The main ANP network for the LMS selection problem.*

In figure 4 the *student* sub decision network under the *instructional* cluster is given with the dependencies. Students perceive that they receive more individual attention from instructors. Studies have shown that student attitudes toward distance education can be significantly affected by facilitating some degree of interaction among students and teachers (Valenta et al., 2001).

The outcomes of the model are twofold just as in the application model selection problem. As well as prioritizing the alternatives, the priorities of all the criteria defined for this problem are obtained.

In the conclusion of the study, the priorities of the criteria and the best LMS were determined and also the applicability of the ANP for this decision problem was shown. According to the decision model, the priorities of WebCT, Breeze and Fle3 were 0.4539, 0.4034 and 0.1427 respectively. So, WebCT was determined as the most appropriate courseware development platform based on the main and sub-criteria. Through this study, a contribution to designing a new training environment for ODL institutions based on courseware development platforms is provided. It is hard to determine the dependencies between all elements, however when the dependencies are included more consistent results are obtained.

Distance education illustrates well the relationship between the use of technology and the need to reorganize to maximize the benefits. Distance education, when properly organized and structured, also illustrates the capacity to

reach new target groups and to expand the range of educational provision through the use of technology (Bates, 2005). Repetition of this study for a specific program may represent more useful information to the people in the related program. Furthermore, it is possible to apply this model for different platforms by considering the recent integration of platforms in the market. It is believed that this study provides a sound methodological model for those decision makers faced with the selection of a LMS.
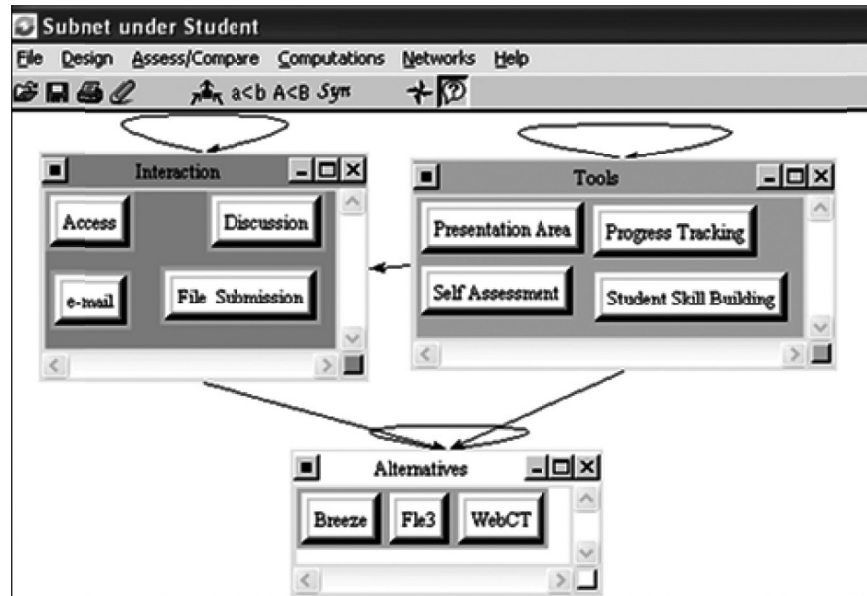


*Figure 4. Student sub network under instructional cluster.*

CONCLUSIONS

Due to the structure of ODL systems, decision makers continuously face various decision problems. Beside the problems dealt with in this chapter, there are also various other decision problems faced in the ODL systems, and these problems can be exemplified as follows:

The academic counselling service is one of the most important elements of the ODL systems. For instance, in Anadolu University distance learners have chances to collaborate with other learners and professors face-to-face to learn more deeply. The main purpose of this service is to meet professors and learners from all over the country, and to promote interaction with a view to ensure more effective learning. 861 academic personnel in 74 different centres provide academic counselling services for 10 courses in evenings and at weekends. Hence, scheduling the courses to rooms and timeslots in each centre is a large multi-objective decision making problem that includes academic personnel preferences.

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Videoconferencing is also one of the components of ODL systems. Currently, the students in ODL system of Anadolu University take 22-hours of academic counselling from over 20 academic advisors for 16 different courses in a week via videoconferences. Similar scheduling problems occur in the management of this learning environment.

A team of experts in educational technology and technical staff (with the help of technologically advanced equipment) play an important role in the production of radio and TV programs which supplement the textbooks. Here, multi-objective decision making problems based on selection of appropriate technologies occur. In addition, scheduling TV and radio programs in TV production centres is one of the main decision problems in ODL systems.

Developing, printing, and disseminating textbooks for an ODL institution is a challenging task that requires many talented and experienced experts and a strong technical infrastructure. The most crucial step in designing a textbook is analysing the target population and the needs of that group, before starting to write the content. Textbooks are an effective and efficient means of providing learners with sound information using text and various visual forms (e.g. colour, graphics or photography) and there are many important decisions to be taken here too.

As with the distribution of course materials, the examination materials are also distributed to the examination centres in each city. So the same vehicle routing problem occurs. Beside the distribution of these printed materials, another problem that occurs relates to stock planning of these materials. Also, some plant location problems occur when new printing machines are sourced.

As seen from the above examples, in open and distance higher education systems, managers have to make decision around various tasks continuously. Usually, the effort is towards minimising the operating costs of ODL systems and as technological progress continues these multi-objective decision problems will continue to occur. The presence of multiple actors, e.g. academic personnel and learners etc., brings out user satisfaction problems and issues that complicate these decision problems and, furthermore, in educational institutions most of the problems are institution-specific because of particular local constraints and parameters. Under these circumstances, in the solution processes of most problems a need for heuristics occurs. We have looked at a small subset of ODL related decision problems in this chapter, and many of the problems discussed here can be found across the spectrum of traditional higher education systems.

## NOTE

[1]   More information can be taken from www.anadolu.edu.tr

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## AFFILIATION

*Zehra Kamışlı Öztürk*
*Open Education Faculty,*
*Anadolu University*

JON WARWICK

# 16. LIBRARY OPERATIONAL RESEARCH: TIME FOR A NEW PARADIGM?[1]

## INTRODUCTION

As we move into the second decade of the 21st Century, Higher Education (HE) in the UK is facing a period of unprecedented change as restrictions on the public finances seem set to demand greater efficiencies from HE institutions. At the same time, the quality of provision must be maintained and since students are expected to be contributing more and more to the financial cost of their education, the "student experience" is becoming more central to our ideas of educational quality.

The notion of the academic library is also going through a period of unprecedented change, not only because of the library's position as a fundamental part of any university but also because of the ongoing revolution in digital technology and the effects this has had on library collections along with modes of learning activities adopted by students.

It might be thought that in such times, Operational Research (OR) would become a central pillar of library management decision making since OR has built a reputation as an analytical toolbox for optimising the use of limited resources and has been highly successful when applied in a number of organisations and industries. However the reality in the context of academic libraries (so-called Library OR) is somewhat different and, although the emergence of Library OR saw a great deal of published work from the 1960's through to the 1980's, there has, since then, been a marked decline in such work so that Library OR now seems to feature quite rarely in the published literature.

This chapter explores some of the reasons behind this rise and fall, and discusses how Library OR could be re-conceptualised so as to realise some of the benefits to the academic library that OR has offered and continues to offer in other disciplines. We shall first consider the origins of OR and then explore some of the early work conducted in connection with academic libraries. Some criticisms of this early work are then offered as well as a description of the schism in OR that provoked the development of new OR paradigms. Finally, we conclude with a personal view as to how Library OR might offer, via these new paradigms, real value and support for those involved in the management of academic libraries.

## THE ORIGINS OF OPERATIONAL RESEARCH

The UK Operational Research Society defines Operational Research as "...the discipline of applying advanced analytical methods to help make better decisions."

Furthermore, the society describes the problem context within which OR workers operate as "… messy and complex, often entailing considerable uncertainty" and that their mode of working involves the use of "… advanced quantitative methods, modelling, problem structuring, simulation and other analytical techniques to examine assumptions, facilitate an in-depth understanding and decide on practical action." (UK ORSOC, 2010). This definition encompasses the full range of activities that currently fall within the scope of OR and embraces problems that span the tactical, operational, and strategic dimensions of management and planning.

The original conceptualization of OR though was far more modest and with the discipline rooted in military projects undertaken just prior to, and during, the Second World War, the first use of the term Operational Research was in 1936 (Gass, 2002). The war itself provided an acid test for effectiveness of the mathematical methods being applied to military planning and there were some notable successes. For example, a key to the defensive successes of the Royal Air Force was the development of radar technology and it has been estimated that while the advent of new technologies had improved the likelihood of enemy aircraft detection by a factor of 10, the work of OR workers, in developing the man-machine system, had further increased this by a factor of two (Kirby 1999). Such operational successes certainly had a profound impact in establishing OR as an area of activity of importance, even though it was essentially conducted by civilian rather than military scientists. Other important areas of wartime application included the scheduling of aircraft maintenance and inspection, and enhancing the effectiveness of aircraft attack-strategies on enemy submarines (Beasley, undated).

In the immediate post-war years, restrictions on the availability of resources (manpower, time and physical resources) meant that it became imperative that maximum benefit should be derived from these resources. The transition of OR from a military discipline to one that had applications to business and management within the UK was initially rather slow, with adoption of the modeling methods developed being primarily limited to two major industries – the coal industry and iron and steel. Kirby (1999) argues that the real golden age of OR began in the 1960s and was essentially the result of a "modernisation" of British industry in which companies moved from being predominantly family owned and controlled, to having US-style multidivisional structures importing science-based managerial approaches – again originating mainly from the USA. Serious UK government interest in OR only became apparent in the later 1960s with the election of a Labour government which was committed to further industrial modernization and economic planning.

Thus interest in OR grew rapidly in both the public and private sectors and as organizations grew and international competition increased, OR practitioners could offer support to managers via new computer technologies and mathematical methods which offered a degree of detailed planning and control that earlier generations of managers could never have had.

With the UK Operational Research Society (founded in 1953) providing a focus for the development and practice of OR, the education of new generations of OR

specialists came to the fore in the mid-1960s with the creation of new universities and business and management schools. These were keen to embrace the new business approaches and methods already being offered by their American counterparts, so university courses in OR and Management Science began to appear. The expansion of OR as an academic and professional discipline continued through the late 1960's and into the 1970's.

But what was the nature of this discipline that was emerging? At that time it was certainly well rooted in scientific method and took as its core the development and analysis of mainly mathematical models with the intention of finding (in the majority of cases) optimal solutions to a range of business problems. This particular approach (we'll call this the "traditional" paradigm of operational research) constrained the type of problems that OR was capable of tackling. Rosenhead and Mingers (2001) provide an excellent discussion of the traditional OR paradigm and describe six characteristics that the paradigm exhibits:

– Problem formulation in terms of a single objective and optimization. This simplification of the problem domain only allows for multi-objective decision making if objectives can be traded against each other on a common scale so that the notion of a single best solution is still achievable;
– Overwhelming data demands. Mathematical and statistical models are at their best in data-rich environments but of course this assumes that the data are both available and accurate;
– Assumed consensus. This can be problematic as it is a view of organizational decision making that ignores the influence of the individual's politics, prejudice, bias, judgment and experience – in other words the human aspects of organizational life;
– People treated as passive objects. Reinforcing the previous characteristic, the traditional paradigm is one that focuses on logical processes and a scientific method and eschews human behavioral considerations as too complex to model;
– An assumed single decision maker and clear hierarchical organizational structure. Here we are assuming a certain organizational transparency and an ability to implement whichever solution is suggested by the modeling activity;
– The abolition of future uncertainty. Although many models will include aspects of risk with the inclusion of probability distributions and expected outcomes, genuine uncertainty about possible futures tends to be ignored with, instead, assumptions made that current trends are likely to continue into the future.

Having described the early development of operational research methods and the characteristics of this traditional operational research paradigm, it is now appropriate to consider how these early modeling developments contributed to the analysis of academic library systems during the early days of expansion in Library OR. For the purposes of this exposition, we shall consider as early those examples of Library OR that appeared in print during the first 25 years of activity, that is from 1968 (when Phillip Morse published Library Effectiveness) up to about 1993. In only citing a few examples, the range of applications of OR to libraries is by no

means fully represented but any of the review articles cited below will give a much more complete picture.

## THE EARLY APPLICATION OF OPERATIONAL RESEARCH TO LIBRARIES

When conducting even a brief review of the early published literature in Library OR it is difficult to decide how to categorise the vast amount of such literature. A number of authors have undertaken such reviews including Slamecka (1972), Kantor (1979), Rowley and Rowley (1981), Kraft and Boyce (1991), and Reisman and Xu (1994). Each adopted a different scheme for organising the literature. One of the common ways of classifying Library OR models is based on the technique adopted e.g. queuing theory, simulation, inventory control theory etc. This method is appropriate perhaps to those who are familiar with the meaning of these terms, but it would mean little to others. Some authors have been dismissive of classification schemes based just on techniques (Rivett, 1980) as these only consider the end product of the modelling process and tell us little about, for example, the nature of the problem being solved. Others have used schemes that have more of a problem focus (Hamburg et al., 1974) and consider models relating to, say, space utilisation, weeding, classification and cataloguing, while others have grouped models according to the purpose of the research (Kantor, 1979), considering such categories as system description, modelling the system, application and so forth.

In this section just a few examples of Library OR work is considered which illustrate a spectrum of model use with categories as suggested by Pidd (2010a). This scheme will be helpful in highlighting problems and issues relating to the early Library OR models. Pidd proposes a simple descriptor which relates (at the extremes) to the extent to which model use is expected to be regular and routine, as opposed to infrequent or one-off. The scheme defines four archetypes:

– Decision automation: These are models that may be used routinely and frequently with little requirement to set the model up for each use other than to enter appropriate data as the basis for the decision;
– Routine decision support: These models assist (but do not replace) those who are making routine decisions so that the model provides some, but not all of the input required for a decision to be made;
– Investigation and improvement: These models are used on an irregular basis and their usage is tailored to system design, improvement or just exploring and understanding the system better;
– Providing insights: These models are to help explore complex and messy problems that may have many stakeholders, viewpoints, interpretations etc.

This scheme was published in an attempt to categorise the variety of OR models used currently, not just in the library context but across all areas of application. It is useful to look back at the early modelling work in light of this categorisation scheme. Therefore our first task is to see the extent to which examples from the literature of early Library OR models fit each of the above categories.

### *Decision Automation*

Modelling in this category represents attempts to try and find algorithms and automatic processes that will essentially replace human decision making, insomuch as the decisions to be made are not usually complex or of fundamental importance. Thus if the model produces a poor decision, then the consequences for the organisation are not disastrous. Within the library context, it is difficult to find examples in this category since few OR models have found their way into such a day-to-day routine decision making role. Thinking might be extended, however, to models that suggest operational rules-of-thumb that can generate such routine decisions. An example would be providing one copy of a title per x users or to weed out texts which have not circulated for y years. Some researchers have conducted work aimed at these types of analyses with one such example being that of Buckland (1975) in relation to loan and duplication policy. Buckland's work suggested a number of simple relationships between the loan period, duplication policy, book popularity, and satisfaction levels (as measured by the probability of finding a required book on the shelf). This resulted in the implementation of a variable loan and duplication policy so that both of these last two parameters could be related to book demand. Results of the study were implemented in the University of Lancaster library (UK) with the outcome of an increase in the satisfaction level measured some six months later. Changes in demand patterns for books, as library performance improved, were automatically accommodated by changes to loan policy and duplication levels.

Although decision automation has now become more commonplace as computers have become more and more prevalent (automatic credit scoring being a current example), in the early days of Library OR examples of fully automated decision processes were rare. This is not surprising since it was the commonly held view around that time that no OR model (or indeed any computer-based system) should take the place of a manager's judgement in running a department or organisation (DeGennaro, 1978). Thus this category of model is sparsely populated.

### *Routine Decision Support*

In this category there might be models that provide us with some support for decision making, so the decision maker might explore relationships and better understand the interrelationships between various parameters as part of the decision making process. An example here would be the work of Leimkuhler (1966, 1971), who was interested in explaining the long-term interactions between acquisition, circulation, storage, loan period and duplication policy. The work of another early pioneer Trueswell (1965, 1966), developed the idea that, within a collection 80% of usage comes from about 20% of holdings, and he was able to identify the subset of a collection that would satisfy any given level of user requirement. Stochastic models of varying complexity have been developed by a number of researchers such as Goyal (1970) who explored the effect of the loan period on the waiting time for customers and the utilisation of library staff.

However, much pioneering work in the mathematical analysis of library systems was conducted in the 1960s by Morse who made extensive use of Markov and of queuing models to examine and predict the circulation rates of books (Morse, 1968). This was achieved by relating the average circulation of a book in any year, to the average circulation in previous years. Morse suggested a procedure for deciding when duplicate copies are necessary (perhaps an early candidate for decision automation?) based on circulation rates, and also noted other dynamic characteristics such as doubling the number of copies will not double circulation. These models provide support and guidance for those seeking to make library decisions but do not recommend decisions automatically.

A further example here makes the analogy between the network of library operations and information flows, and a system of queues. Specifically, one can undertake the analysis of customer or information flows around the various facilities that make up a library (or indeed study message and document transfers within library networks) by the application of queuing theory. The work of William Rouse is relevant here relating to, for example, the performance of library networks (Rouse, 1976), assessing the impact of technology on inter-library loan systems (Rouse & Rouse, 1977) and resource allocation within libraries (Smith & Rouse, 1979). In their 1980 paper Rouse and Rouse commented that, in relation at least to the analysis of library networks, "… we can perhaps conclude that those investigators working in the area of analysis of library networks have been successful in applying operations research methodologies to library problems." (p. 148).

Although there is far greater modelling activity that can be attributed to this category, it is still difficult to find examples of Library OR work that have been truly integrated with the routine decision making frameworks of library practitioners. Much of the work reported in the literature is in the nature of stand-alone OR projects and one-time modelling investigations, and these belong within the next category.

### Investigation and Improvement

Much of the Library OR work reported in the literature relates to the investigation and improvement of library systems and therefore belongs in this category. Perhaps the best examples of models in this area are the simulation models which have been developed to explore system behaviour and to experiment with changes to library policy and policy parameters. More than 40 years ago, Leimkuhler (1968) doubted the advisability of attempting purely analytic descriptions of complex systems involving random or semi-random processes and concluded that it might be better in such cases to develop a computer-based simulation model. Despite the fact that simulation is one of the most frequently used decision support techniques within the management science area, it remained (in the early days of Library OR) an underutilised approach to the modelling of library systems (Main, 1987). There are, however, examples of simulation use since 1970 and these have included applications by Baker and Nance (1970), Arms and Walter (1974) and

Thomas and Wight (1976). These types of investigation allowed a rather more integrated view of library systems to be explored. Baker and Nance, for example, tried to relate library activities to user needs in terms of lending books, providing service personnel and providing storage and study space. Circulation analysis was undertaken by Shaw (1976) but the most comprehensive simulation work in this area has probably been that of Buckland (1975) mentioned earlier.

## *Providing Insights*

There is some overlap between this final category of modelling and the previous ones in that any model which helps to uncover new relationships, unexpected results or enhance practitioner understanding, can be thought of as providing insights. However, in this category are models which help with the exploration of complex, "wicked" problems, that is to say problems situated rather more at the strategic level of organisational management than at the operational level. This category takes a step back and considers the act of modelling itself as a process that adds value to decision making activities, rather than the use of a final model or solution. Certainly there are examples of Library OR which have contributed to strategic decision making and Reisman and Xu (1994) provide a number of early examples of this. In these cases, it is the completed models which have been primarily used to suggest or evaluate strategic alternatives and we have not seen the modelling process itself used as an aid to exploring and learning about the complexity of the system. This is where more recent developments in the field of OR have been concentrated.

Two other authors can be cited here as having recognised this deficiency. In 1978, Michael Buckland published a paper surveying 10 years of Library OR and identifying areas of library activity where there seemed to be gaps in the literature. He identified the need to explore a number of factors: Users and user behaviour (paying particular attention to information gathering behaviours); analytical cost models (particularly in times of economic hardship); and what he terms library "goodness" in which he distinguishes between the capability of a service and the value of a service and how each might be measured (Buckland, 1978). Furthermore, he suggests that Library OR studies tended to be narrowly focussed, perhaps exploring only one part of library activity, and comments that greater value would be derived by linking the parts together.

A little later, in 1984, Edward O'Neill published an overview of Operations Research and made some interesting observations about the impact that Library OR has had on the practice of librarianship and the operation of libraries. Generally he was able to conclude that, in answer to the question of whether Library OR has changed the way we understand libraries and the way they are operated, he could respond only with a qualified "yes". What he saw as the key deficiency of Library OR he described as follows: "It is an effective methodology for determining how to do something; however, operations research cannot determine what should be done." (O'Neill, 1984, p. 518). In other words, he was

emphasising the fact that there was very little in the OR modellers toolbox which has enabled the provision of insights into complex library issues.

## THE DECLINE OF LIBRARY OR

As we have seen, the application of OR modelling techniques to the study of academic libraries produced a burst of activity, exploring a range of library problems through the use of mathematical and statistical models. Figure 1 illustrates the rise in library OR publications as listed in Slamecka's (1972) selective bibliography of library OR.
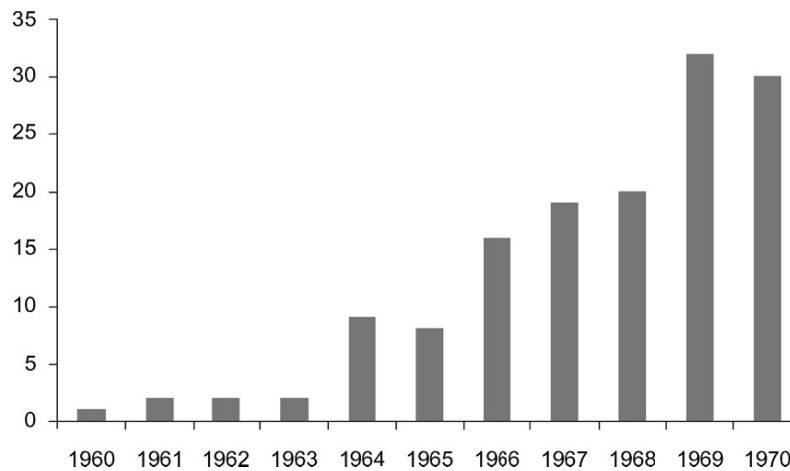


*Figure 1. Number of publications cited by year (from 1960–1970) by Slamecka (1972).*

But as we moved through the 1970s the momentum seemed to be lost so that in the early 1980s there seemed to be significantly less Library OR appearing in the literature than had hitherto been the case. In fact a simple tabulation of the work cited in the review of Library OR by Reisman and Xu (1994) indicates that approximately 20% of the work they referenced dated from the 1960s, with 54% from the 1970s and just 19% from the 1980s.

In 1975, Michael Bommer published an opinion paper in the Journal of the American Society for Information Science in which he gave a personal critical assessment of OR in libraries (Bommer, 1975). In the article Bommer discusses why he feels that OR had failed to meet the expectations of its proponents within the field of librarianship. He cites four general reasons for such impediment to achievement and these related to:

- The extent to which the OR models rely on quite complex mathematical formulations so that they are too sophisticated to be readily applicable in supporting management decision making and often make assumptions which render them unrealistic and therefore unusable;

– The lack of model implementation stemming from a failure of the modeller to recognise the non-quantifiable elements of management that, although difficult to model, must be part of the dialogue between the modeller and the manager;
– The failure to appreciate that OR is an organic process of enquiry involving more than just the development and analysis of a model; and
– The failure of OR models to make a significant contribution to some of the crucial strategic decisions faced by library managers.

Expanding this last point a little further, Leimkuhler (1977) reinforced the limitations of the traditional OR models by commenting that attempts to build analytical models of library systems, which specifically try to incorporate human and social factors, have been virtually non-existent. That these issues were being raised as early as 1975 is interesting as the real debate about the future of OR within the OR community itself did not really ignite for another five years or so. Certainly, the warning that Bommer issued, that OR was not achieving its potential in library contexts as it certainly had in other contexts, went unheeded and the decline in Library OR activity seemed to continue through the next two decades.

In other articles I have suggested reasons for this (Warwick, 2009a&b) and some of these arguments are summarised and expanded below. Whilst I agree with the observations made by Bommer, my view is that in looking for the causes of this decline in activity, we should really consider three specific clusters of issues: First, the nature and practice of OR itself and the emerging new paradigms; second, the nature of the relationship between modeller and library practitioner; and third, the changing nature of the 21st Century academic library. We now consider each of these in turn.

## NEW PARADIGMS IN OR

In the early 1980s, serious debate began within the OR community as to the future of OR and whether the narrow problem focus of traditional OR was too restrictive and prevented practitioners from having an impact in decision arenas that might be described as more strategic in nature rather than at the purely operational and tactical levels. As we have noted, similar issues were being raised within the confines of Library OR also, with the suggestion that OR models were seen as having a very narrow focus of application and were not necessarily seen as relevant to helping with any of the "bigger" problems of library management (Dahlin, 1991). Similarly, there were questions being raised relating to the utility of the published models within the library context. Rouse commented back in 1980 that it seemed as though real applications of models and their value to library practitioners was seldom reported in the literature and instead "… one reads of the derivation or development of the model and is left to wonder about how the model was actually used to aid decision making" (Rouse & Rouse, 1980, p. 145).

As a reaction to the debate on the future of OR, a growing number of OR modellers became interested in exploring ways of applying OR to the really tough, complex and messy problems that managers often face in reality. Unfortunately, these problems have characteristics which are not consistent with those listed

earlier and which define the locus of traditional OR. Murmurings of discontent were being heard from a number of quarters. Ackoff wrote that:

> Managers are not confronted with problems that are independent of each other, but with dynamic situations that consist of complex systems of changing problems that interact with each other. I call such situations messes. … Managers do not solve problems: they manage messes. (1979, p. 99).

Messes are often characterised by a lack of consensus, multiple (often conflicting) objectives to be met simultaneously, a paucity of reliable data, and politics and prejudices expressed by the people involved in defining, understanding and ultimately resolving a problem.

Two excellent discussions in this regard are those by Dando and Bennet (1981) and Habermas (1984). The former argues that although traditional OR had been largely successful within the limits defined by its scientific and depoliticised view of the world, it was time to explore new alternative paradigms for decision support so that OR might evolve and be useful in supporting decision makers right across an organisation and at all levels. They draw on the ideas of Thomas Kuhn (1962) in describing OR has having been through a period of "normal" development but that now a paradigm shift, a new way of thinking, was needed to allow OR to engage with the full range of organisational issues. In a paper published just a little later, Habermas (1984) makes a distinction between three environments within the problem space: The objective environment around us that we all observe; the social environment within which we interact with others and which helps to define behaviour; and our own internal, personal environment through which we experience everything and try to make sense of it. Habermas makes the point that each of these environments is different and argues that, while traditional OR has been successfully used to understand the objective environment (whilst largely ignoring aspects of the social and personal environments), any further broadening of the application domain of OR would require definition of an epistemology that could open up the social and personal worlds to scrutiny as well.

The expansion of OR to include paradigms which allow opening up the social and personal worlds, gave birth to what was originally termed "soft" OR. Initially, there were a number of sharp exchanges between the proponents of the traditional and soft paradigms, with the former regarding the latter as completely unscientific and lacking in rigour, and the latter regarding the former as irrelevant to the needs of modern management professionals (Mingers, 2007). The passing years have largely moderated the tone of the debate and there is now a consensus view that both sets of techniques have a place within OR, and the techniques in the new paradigms have been more accurately re-titled as problem structuring methods (PSMs). The defining characteristic of PSMs is that they are tools and techniques through which a client group can structure and learn about a complex problem, and through that learning process, arrive at a suitable course of action. In situations of high complexity, rapid change and uncertainty, the most challenging aspect of the manager's craft is in the framing and definition of the critical issues that constitute the problem and in understanding the systematic relationships between these

issues. PSMs themselves are not solution techniques. Rather, they are modelling methods that "foster dialogue, reflection and learning about the critical issues, in order to reach a shared understanding and joint agreements regarding these key issues" (Shaw, et al., 2006, p. 757). The focus of the modelling is to explore questions relating to the "why", "when" and "what" of an issue rather than the "how". Daellenbach (2001) describes this nicely by asking such questions such as: What is the nature of the issue; what are appropriate objectives; what is the appropriate definition of the system for the issue considered; and which changes are systemically desirable and culturally feasible. Only when these questions are answered can a start be made to consider how these changes are best brought about.

The modelling process now concentrates on the resolution of the problem through debate and negotiation between the stakeholders, rather than from the development of analytical models, and the role of the OR specialist changes from being one of problem analyst, to one of becoming a facilitator and resource person who relies on the technical subject expertise of the stakeholders. The process is one of mediating the exchanges between different interested parties, of making explicit what perhaps has been hidden (assumptions, politics, personal views) and enabling a learning process which will lead to the generation of agreed actions. Of course "how" type questions, when they are addressed, may generate the need for modelling activities of a more traditional nature but these would be set within the problem structuring framework.

As such, PSMs are representative of the new paradigms of OR and the extent to which PSMs have been developed and used is testament to the value that they add in the exploration of complex problems.

## THE PRACTITIONER/MODELLER INTERACTION

The traditional model-building approach to OR work has had the effect of entrusting the model building process to an OR specialist who is most likely to have some form of engineering or mathematical training. The model building process as described in a number of standard OR texts (see for example Edwards & Hamson, 2001; Lawrence & Pasternack, 2002) will usually require the modeller (usually not a specialist in the application area) to extract specifications from the problem owner so that the process of model building, testing and validation can be undertaken. Thus the locus of control of the problem solution process passes from the problem owner (problem identification and specification) to the modeller (model building, testing and validation, solution generation) and back to the problem owner (for solution implementation). The mathematical nature of much of traditional OR makes a close interaction between problem owner and modeller difficult. Within the field of Library OR this gap was quite noticeable particularly in the early days. Then library practitioners were not operating within an environment which encouraged regular debate with those undertaking research, and practitioners certainly were not trained in the art of modelling from an OR perspective. Thus the divide between practitioners (problem owners) and OR modellers (problem solvers) effectively opened a gap between researchers and practitioners.

The existence of this gap has been acknowledged for many years. In their review of Library OR literature dating from 1977, Kraft and McDonald state that "More cooperation and communication is required, however, if library operations research is to have more of a significant impact on the literature" (Kraft & McDonald, 1977, p. 4). This gap between modeller (or more generally researcher) and practitioner has been more recently studied by Haddow and Klobas (2004) and their analysis of the LIS literature identifies eleven criteria that have contributed to this gap. These include criteria relating to culture (researchers and practitioners effectively speak different languages, have differing sources of knowledge and there is a lack of mutual understanding), relevance (what constitutes problems worthy of investigation differs between the two groups and practitioners view research as not relevant or practical enough) and terminology (the terminology of each group is not necessarily understood by the other).

It is interesting to note that although the fields of librarianship and informatics have grown considerably in recent years, so that more mathematical aspects of information collection and analysis are now well represented, few of the criteria identified by Haddow and Klobas have been explicitly addressed and the gap still remains – although it may have narrowed just a little.

## THE CHANGING 21ST CENTURY ACADEMIC LIBRARY

In March 2007, the Association of College and Research Libraries, a division of the American Library Association, made public its Top Ten Assumptions for the future of academic and research libraries. The assumptions (Mullins et al., 2007) covered a range of aspects of library activity but, taken as a whole, emphasised the role that technological development and the changing attributes and expectations of the typical library customer will play in shaping future academic libraries. The assumptions listed included: That students will demand faster and greater access to materials and increasingly see themselves as customers/consumers thus expecting high quality services; that the growth in demand for technology related services would continue (and would require funding); and that higher education institutions will increasingly view themselves as businesses. These assumptions are still valid and the pace of change brought about by developments in information technology shows no sign of abating. In fact so all embracing has been the growth and influence of the internet that university students no longer regard the academic library as their key information source (Wells, 2007).

The debate about the future of the academic library in the information age has been evolving for many years. Bazillion (2001) expected that libraries would become "… a value-added component of the educational process…" (p. 54) contributing in ways which would include providing access via special facilities and equipment to a variety of electronic information sources both providing a source of expertise in evolving information systems, web surfing and electronic search method and helping to integrate technology into teaching and research programmes. This evolutionary process has not necessarily taken us in the right

direction and some have argued that what we currently have are simply digitised versions of the old-style library or, in some cases where new media and new technologies have made an impact, a kind of hybrid library (Watson, 2010). Neither of these configurations really address the changing nature of the library customer or the emerging distinctions between Place as Library or Library as Place (Davenport, 2006). Lucas (2006) summarises the literature exploring the developing notion of the library as that it:

> … reveals that long-standing hallmarks of the undergraduate library are experimentation, innovation, willingness to change service configurations, flexibility, and dealing with a large population of students with limited resources. (p. 304–305).

A relevant question to ask here is what are the characteristics of this large population of under-resourced students with whom academic libraries are expected to deal? One response is given by Law (2009) who reports on the abilities and expectations of today's digital natives (CIBER, 2007) noting that they:

– expect research to be easy and feel that they can be independent in the process;
– do not seek help from librarians and only occasionally from professors or peers;
– when they cannot find what they need, give up and assume that the information cannot be found. Student often stop after their initial searches thinking that they have completed the research process;
– have, through access to full text articles, seemed to have changed their cognitive behaviour. Instead of having to read through material at the library, they can now download material at their desks. They do not feel the need to take notes or read through them to develop themes and ideas, an activity usually considered central to a focussed research project;
– have failed to read through material, which is possible because electronic articles enable cutting and pasting. This, in turn, almost certainly leads to increased plagiarism – although the suspicion must be that this is done through ignorance more often than malice; and
– use a model of collecting information of browsing and grazing. (p. 56–57)

A slightly different view is proposed by Lucas (2006) who comments:

> We see a confident, driven achiever; a sophisticated consumer; and a demanding user of technology who is accustomed to lots of attention and being able to purchase and use the latest technology in the marketplace. (p. 316).

The literature is very clear that clinging to the status quo is not a realistic option, and that library managers need to be able to embrace change, to be able to respond to the changing environment and to the demands of learners (Walton, 2007a). Wells (2007) makes the suggestion that flexibility needs to be addressed via three central themes and these are described in table 1.

*Table 1. Library change and flexibility. Adapted from Wells (2007)*

| Locus of Change | Description |
| --- | --- |
| Flexibility and Knowing the Library User | The context here is one that represents good practice in any business situation which is to know your customer. The library should strive to establish data collection processes that allow an accurate picture of users needs and such evidence-based librarianship serves to inform managers on the services required by users and the levels of demand for those services, which services are redundant and likely developments for the future (Walton, 2007b). |
| Flexibility and Library Human Resources | Any system operating in an uncertain and rapidly changing environment places requirements on staff to be rapidly adaptable. Furthermore, the requirement for staff to develop is constant and it has been suggested that the requirement for staff flexibility is a stimulant for staff development (Johnston, 1999). |
| Flexibility and Library Management | Wells (2007) makes the point here that flexibility has to be balanced with the provision of some stability so that processes and procedures that guarantee the quality of service to customers are not eroded. The difficulty here is that the management of flexibility requires management processes that are inclusive of all levels of staff and are information rich. Note that we use the term information rather than data as the information may be in the form of perceptions, views, gut feelings, anecdotal stories or any of the rich variety of information sources on which experience and judgement is based. |

Clearly, many words have already been printed on the need for academic libraries to change and to redefine themselves within the context of education in the digital age.

The pace of change is likely to remain fast and may even get faster to the extent that the operation of the academic library as it is currently defined no longer becomes fit for the purpose. Similarly the learning behaviour of students is also changing rapidly as social technologies advance and formal learning is augmented by informal learning processes. Indeed, Watson states that "In my view, facing up to this means not just harnessing it to do what we do but rethinking our purpose. This is a new paradigm and not just 'normal' change." (2010, p. 47).

Traditional Library OR has not been able to meet these challenges and, as we have seen, from both the OR standpoint and the academic library standpoint we have had calls for a paradigm shift in the way that we conceptualise and explore these domains. We now consider what the future of Library OR might be able to offer in a world of technological and educational change.

## THE FUTURE OF LIBRARY OR: A NEW PARADIGM?

So far, the early applications of Library OR have been reviewed and some reasons have been suggested about why OR has not been able to benefit the libraries as much as it has in other areas. The arguments proposed are summarised in table 2 where they have been set against the defining characteristics of the traditional OR model as defined by Rosenhead and Mingers (2001) and described earlier.

Before beginning to explore what the future of Library OR might look like, it is perhaps worth taking a step back and considering the value that models actual add to the decision making process, since without models and modelling OR would have very little to offer in any context. I have so far been very critical of the application of OR to academic libraries, so what does OR itself say about the benefits of modelling?

Pidd (2010b) defines a model as "an external and explicit representation of part of reality as seen by the people who wish to use that model to understand, to change, to manage and to control that part of reality" (p. 10). This definition is highly relevant to the new paradigm of OR in that it does not conceptualise a model as just an abstract representation of reality, but links the model firmly with practitioners and the need to use models as part of a change and control process.

Some 20 years ago, Williams (1990) gave five reasons why he believed models are important to OR and highlighted the need to explain to non-OR practitioners the reasoning behind the use of (often mathematical) models. The reasons are cited as:

– Since models make relationships explicit, modelling often leads to a greater understanding of the situation under study;
– An understanding of the factors and parameters appearing in the model helps to distinguish between the subjective elements of decision and the objective ones. Specific techniques can then be employed to deal with the subjective elements;
– Models are flexible and allow for experimentation, far more than would be possible with a real system;
– Once constructed, models can be subjected to analysis that may yield ideas and courses of action that may not have been apparent before the modelling was undertaken;
– Many of the standard models that are regularly used in OR applications are well understood, have assumptions that have been made explicit over the years of use, and are amenable to solution by computer algorithms.

*Table 2. Critique summary of traditional OR models*

| Classic OR Model Characteristics | Commentary in relation to Library OR | Reference |
|---|---|---|
| Problem formulation in terms of a single objective and optimization | Models tend to be one-off projects and don't address broader, linked problem domains. Emphasis is on the "how" not the "what". Often quite complex mathematical techniques adopted. Real problems are complex messes. | Buckland (1978) O'Neill (1984) Bommer (1975) Ackoff (1979) |
| Overwhelming data demands | Quantitative models require data. Academic libraries are not research focussed and do not routinely collect the data that models require. Assumptions made by modellers about data are sometimes unrealistic and misunderstood by practitioners. | Bommer (1975) Haddow and Klobas, (2004) |
| Assumed consensus | OR is a process that should not assume consensus. Greater communication among modeller and library practitioner required to explore areas where consensus is lacking. There are differences in what is taken as relevant for investigation between modeller and library practitioner. | Bommer (1975) Kraft and McDonald, (1977) Haddow and Klobas, (2004) |
| People treated as passive objects | Models have tended to ignore the non-quantifiable elements of management which hinders implementation. Also the view is depoliticised and ignores the personal. OR must be inclusive of the personal and social worlds. | Bommer (1975) Dando and Bennet (1981) Habermas (1984) |
| An assumed single decision maker | OR has not contributed to strategic planning which assumes multiple views and perception in organisations. | Bommer (1975) Dahlin (1991) |
| The abolition of future uncertainty | Uncertainty in the academic library domain cannot be ignored and the future direction that libraries take will require considerable debate and engagement with learners. Libraries must be flexible and fleet of foot. | Walton, (2007) Wells (2007) Watson (2010) |

There is little doubt that the reasons cited above for the use of models are all very valid reasons why we should be undertaking modelling. What seems to be the primary issue is not the generation of models per se, but the way in which the modelling is undertaken and here I believe is the key to the future development of Library OR. I would further suggest that we need to integrate Library OR very firmly within the library management process so that it can provide a medium through which library evolutionary processes can be explored and controlled.

To explain this further, the earlier discussion of the decline in Library OR highlighted the limiting nature of traditional OR models, the modeller/practitioner gap and the changing nature of the academic library as groups of issues that have impacted negatively on Library OR. I am convinced that for Library OR to maintain its identity and the utility of its contribution to library management, it

needs to be focussed within the fourth of Pidd's modelling categories relating to the provision of insights. The new paradigms of OR have identified PSMs as tools for assisting managers in exploring problem situations, understanding and making explicit the views and assumptions of those engaged with the problem and assisting them in moving towards an agreed course of action, strategic plan and so forth.

The use of problem structuring methods immediately removes the modeller/practitioner gap since problem ownership always remains with the library practitioners. The limitations of traditional modelling techniques are removed as PSMs open a window into the social and personal worlds of those involved and yet these traditional approaches are still available if such modelling is felt to be beneficial. PSMs also allow practitioners to gain traction on the key issue of flexibility in being able to respond to the changing environment and to the demands of learners.

As examples, let us consider three areas which emerge from the literature as important to the future running, and purpose, of academic libraries. These relate to: The organisation and management of information sources and of library operations; the development of the library as an integrated part of the student learning experience; and understanding the higher education environment and defining strategic direction for an institution's library provision. In a broad sense these three views of the library are nested in that they form a hierarchical structure in which library operational management (the lowest level) is conceptualised within the context of the wider student environment (the middle level) which in turn is set within the national and international contexts of higher education so that we can move up and down the levels in a systematic way. Let us consider each of these perspectives in turn.

## ORGANISATION AND MANAGEMENT OF INFORMATION SOURCES AND LIBRARY OPERATIONS

At this level, the library is concerned with making the most efficient use of its resources and it is here that traditional OR models have seemed an attractive proposition and have, in the past, made a contribution to our understanding of resource allocation. Of course, library collections are going through a process of change as they are now a mixture of what might be termed legacy sources (traditional printed materials), materials converted into digital forms, and material which is digital at source. Law (2009) has considered how the library's role might need redefinition to accommodate the digital age and has defined an agenda that encompasses five principle, core activities which may be summarised as:

– Building e-Research collections and contributing to a virtual research environment;
– Providing a system of information assurance by means of kite-marking, trust metrics, relevance ranking etc.;
– Effective management of digital (and other) assets and ensuring appropriate access mechanisms are in place;

– Providing support and training in information literacy;
– Providing advice on policy and standards to the institution at large.

These core activities represent the academic library as both a core resource for students and staff but also as an agent for change within the institution's strategic management processes, and traditional OR modelling has so far been able to make very little impact here. Also included here is consideration of the way in which library operational procedures should attempt to remain agile and responsive. Walton (2007b) emphasises the need for flexibility in terms of library services, structure and staff. Flexibility of service and structure is governed by a requirement for evidence-based librarianship through which the needs of users can be ascertained and accommodated but balanced with some stability, so that quality of service can be assured. PSMs have a clear role to play here perhaps supported by more traditional modelling projects.

### The Library and the Student Learning Experience

For Watson (2010) the emerging role of academic libraries needs to switch from being a passive provider of resources to "…being about people and making a real contribution to the learning landscape" (p. 51). But what might this contribution be and how can OR modelling assist in making this contribution?

I feel that there are four main areas to be explored here and these are described briefly below:

– One of the major areas of growth in academic research over the last decade has been that of pedagogic research. Certainly within the UK the higher education environment, the Government has placed great weight on teaching scholarship and the student experience is taken as one of the measures in deciding whether a university is fit-for-purpose. The enormous amount of pedagogic research now conducted across virtually all universities has transformed the classroom experience of many students, yet it is unclear whether there has been much engagement with this pedagogic literature within academic libraries. OR techniques (including statistical methods) have contributed much to this research agenda and it is incumbent on those who undertake this research to ensure dissemination of results at a local (institutional) level (published papers are not frequently read) and this leads to our second consideration;
– We need to foster a better interaction between modeller, library practitioner and academic lecturer to understand more clearly the expectations of students and the expectations of lecturers. This involves processes that can facilitate dialogue between these parties but also between these staff and students so that their expectations might be better understood and, where these are thought to be unreasonable, challenged;
– Better linking of research and the academic curriculum is needed. Conventionally, the academic library has been required to respond to new course developments in so far as providing the appropriate and needed learning resources. Library practitioners can also contribute to the design of curricula,

particularly in areas related to the skills of life-long learning and the use of information as a strategic resource for students;
– The library has a role to play in personal development. Here, library practitioners can contribute to the delivery of research and information acquisition/management skills that will be part of the personal development of all students.

All of those university members engaged in defining and delivering the student experience can best serve the student by coordinating their various areas of expertise, but traditional OR provides very little modelling assistance here. PSMs on the other hand allow a structured analysis of these complex interactions so that systems can be put in place which will allow the necessary information flows and enable decision frameworks.

## *Defining a Strategic Direction*

Traditional management approaches to higher education planning have been under scrutiny for a number of years and many have argued (including this author) that higher education planning at the strategic level is not something that is amenable to traditional modelling approaches but rather what is required is a more systems-based enquiry process (Galbraith, 1998; Bell et al., 2005).

The new paradigms of OR have a direct translation to the world of the academic library. Library OR should embrace PSMs with fervour since, as has already been stated, they allow the exploration of the complex, multifaceted problems associated with strategic planning and yet do not require the locus of problem ownership to shift away from the library practitioner. Figure 2 gives an indication of the interactions that can be mediated by PSMs and I would expect that traditional modelling (where it still takes place) would be in the form of smaller scale projects aimed at supporting and informing practitioners by providing structured data, forecasts, etc. and perhaps helping to understand the possible consequences of actions.

Just as each of the three perspectives described above are interconnected, there is also a need for the library to reflect, and be able to influence, the strategic direction of the university. In many institutions this will involve engagement with the strategic planning process and also with the learning, teaching and assessment policy (or the academic strategy as some of institutions have adopted). Such engagement and discussion can also, of course, be facilitated using PSMs.

Thus Library OR can be conceptualised as a unifying process that oils the wheels of interaction between practitioner groups, between the library and its users, and the library and its host organisation, the university. Its focus is on structuring, learning, understanding and the provision of insights. Modelling is not seen as a divisive activity delineating the boundary between modeller and practitioner but instead is a way of asking questions relating to the "what", "when" and "why" of issues rather than just "how". After all, how we achieve an outcome is only relevant after we have decided what outcome is to be achieved, by when, and for what reason.
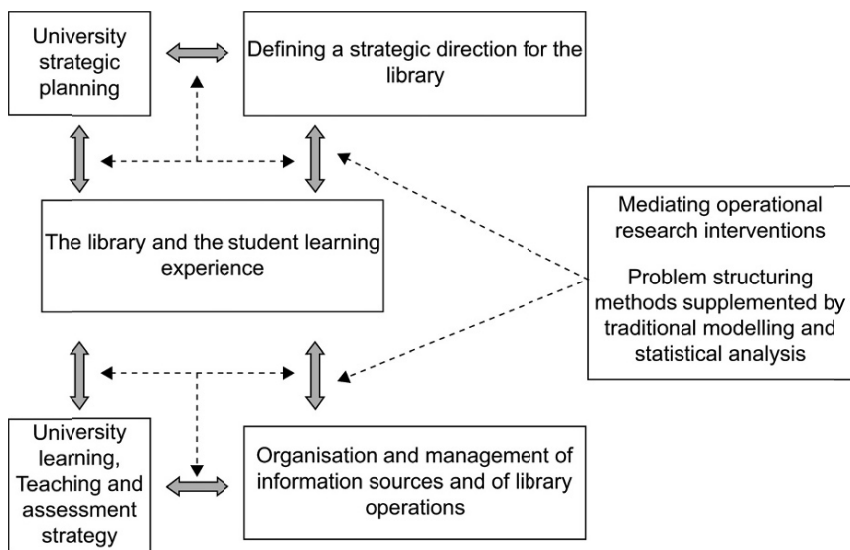
*Figure 2. A new locus of Library OR in mediating change interactions.*

## CONCLUSIONS

Academic libraries are going through a process of unprecedented change as they respond to technological change and the changing needs of learners while adapting to operate in a world of limited resources. Lucas (2006) testifies to the durability of the academic library:

The persistence of the undergraduate library indicates that it provides a unique environment for the incubation and implementation of new services, programs, and functions to meet challenges posed by advances in technology, changing undergraduate student learning preferences, and evolving faculty teaching methods. (p. 318).

Traditional Library OR has historically failed to establish itself as a routine part of library management and these new conditions are generating managerial problems with which the traditional tools of the OR modeller are not able to assist. If Library OR is to make a contribution then it must adopt the new paradigms of OR and use them to help library practitioners explore possible future directions and manage the change processes that are inevitably taking place.

## NOTE

[1]   This chapter was first published in Advances in Librarianship (volume 33) and is reproduced here with permission from Emerald Group Publishing Ltd.

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## AFFILIATION

*Professor Jon Warwick*
*Faculty of Business*
*London South Bank University*