Project Title: TELRI (TLTP3 no. 92)	**Date: 24-Jun-99**

Factors affecting changes in the use of educational technology within HE establishments : Working document

Development of a TELRI Change Management Framework

Dr S P M Warburton

The aim of this document is to explore the ways in which educational technology methodologies are designed, implemented and embedded and how to facilitate the changes required.

Section A of the document provides a collection of factors, primarily categorised as promoting or inhibiting, which may influence the changing use of educational technology within an institution. These factors have been distilled from a wide range of sources and case studies (*see references*) as well as exploratory interview data from the TELRI project. Some of the factors are repeated within the secondary categorisation of societal (external) through to software related issues. For example, teaching and learning policies can exist at the course (academic staff), departmental, institutional and governmental (societal) levels. These factors have not been prioritised. In other words, the extent to which individual factors have an effect has not yet been determined. Other factors are likely to be identified through the course of the TELRI project.

The analysis of these promoting and inhibiting factors has been conducted along three axes, as discussed in section B:

- working practice as the central informative process,
- the implementation life cycle, and
- theories of change management.

These inter-related factors have a tertiary coding based on two further criteria: their *temporal nature* and their *scope of influence* in relation to working practice.

The temporal category has been split into long-term (LT), medium-term (MT) and short-term (ST) issues. The 'scope of influence' category has been split into: social aspects (Sc), polices (P), support (Sp), technological (T), teaching (Tch) and research (Res). *See section 2 for further details on the choice of these categories*.

The conclusions in section C aim to bring together these three inter-related perspectives into a coherent strategy for successful educational technology implementation.

Working Document:

'Factors affecting changes in the use of educational technology within HE institutions'

Version: 1.2
Date: 24/6/99

Contents: **Page**

1.	Introduction	3
2.	The Factors	4 – 9
3.	Preliminary analysis of the limiting and promoting factors in the uses of educational technology	9
3.1	Can change management theory be useful in an educational technology setting?	9
3.1.1	What are the most influential factors?	9
3.2	Developing an implementation cycle: addressing the long-term, medium-term and short-term issues of facilitating change	10
3.3	Viewing the implementation and integration of educational technology as a process of change	11
3.3.1	Can change management theory be useful in an educational technology setting	12
3.3.2	Identifying types of change	12
3.3.3	A cultural web	13
3.3.4	Stakeholder analysis	13
3.3.5	Attractiveness vs. implementation difficulty	13
4.	Conclusions	14
5.	Further work	15
6.	References	16

Figures:

Figure 1. Identifying departmental interactions: an overview 17
Figure 2. Departmental working practice as the central issue 18
Figure 3. Implementation and integration cycle 19
Figure 4. A cultural web, descriptive of an academic department 20
Figure 5. Targeting change: analysing the stakeholders 21
Figure 6. Attractiveness vs. implementation difficulty: an analysis of four TELRI projects 22
Figure 7. Framework for a flexible 'implementation toolkit' 23

Factors affecting changes in the use of educational technology within HE institutions

1. Introduction

This document explores the ways in which educational technology solutions are designed, implemented and embedded and how the changes required for successful integration may be facilitated. The study is situated in a climate where, despite much persuasion as to its multiple benefits, the wider impact of educational technology has remained relatively low. This is a central issue for the TELRI project as it seeks to deploy technological solutions to develop the research capabilities of undergraduate students

The starting point for this exploration is a collection of factors which have been identified as barriers or drivers to the use of educational technology. These factors have been distilled from a number of documents which include exploratory interview data from the TELRI project and previously reported case studies (*see references*). The analysis of these factors has initially been conducted along three axes: how studying working practice is central to gaining information about cultural practices; implementation/integration life-cycles; and theories of change management. The conclusion of this document brings together these three inter-related perspectives to form a framework aimed at successful long-term educational technology implementation.

2. The Factors

The following list highlights the factors which may have an influence on the changing use of educational technology within an institution.

The factors have been categorised in three different ways to provide the maximum analytic sensitivity. Firstly they have been distinguished as either promoting or inhibiting. Secondly, they have been split into seven groupings according to societal, institutional, departmental, staff, student, technology and software related issues. Finally, each factor has been assigned a tertiary coding based on two further criteria: the temporal nature of the factor and its' sphere of influence in relation to working practice. The temporal category, under the column 'time', has been split into long-term (LT), medium-term (MT) and short-term (ST) issues. The sphere of influence category, under the column labelled 'sphere', has been split into social (Sc), policy (P), support (Sp), technology (T), teaching (Tch) and research (Res). *See page 8 for further details on these categories*. Where applicable, the factors have been numbered according to their source document/s. These are listed in the references section (page 15) of this document.

The factors have not been prioritised. In other words, they are not ordered according to their importance. This will be variable and depend on the specific scenario in which the educational technology is situated. Other factors are likely to be identified through the course of the TELRI project.

1. Limiting Factors	Time	Sphere
Societal (external):		
• Slow infiltration of the latest technologies into educational establishments	*LT*	*T*
• Lack of accreditation for teaching – career profile as an academic synonymous with research	*LT*	*P,Sc*
• Pay scales for university staff: • Prioritisation of effort towards research to improve prospects of promotion	*MT-LT*	*Res*
• Unattractiveness of education for top quality developers and programmers	*LT*	*P,T*
• Societal demands and expectations of the education system	*LT*	*P,Sc*
• Rapid turnover of technology standards and software, difficult for an institution to keep pace	*LT*	*T*
Institutional issues:		

• Institutional commitment:
  • Lack of an overall teaching and learning strategy providing clear and coherent direction[6]
  • Secondary impact of other university policies e.g. indirect effect of polices regarding space management may effect housing and access to student workstations
	ST-LT	*Tch,P*

• Low level of commitment of central resources such as IT services and other support staff[2]	*MT*	*Sp*
• Lack of investment in infrastructure and resources[2]	*MT-LT*	*T*
• Insufficient or poor distribution of funding[2]	*MT-LT*	*Sp*

• Institutional culture:
  • Assessment of product (outcomes) not process, assessment methods not reflecting changes in pedagogical approaches
  • Research vs. teaching driven agenda[2,6]
  • Lack of reward e.g. promotion for teaching innovation or expertise in educational technology[2,4,6]
	MT	*Res,Sc*

• Institutional working practice:
  • Reliance on paper based working methods
  • Low level of competence in technology usage
	LT	*T*

• Strictures of probation – introducing teaching innovation perceived as a 'risky strategy'	*MT*	*Tch*
• Slow rate of change, poor change management strategy[2]	*MT-LT*	*P*
• Autonomy of the institution/academic freedom – difficulty in achieving concensus	*LT*	*Sc*
• Degree structures - modularisation may make it difficult to put together a coherent educational technology strategy for a whole degree course[4]	*LT*	*P,Tch*
• Low investment in staff development[2,5]	*MT-LT*	*Sp*
Departmental issues:		

• Culture:
  • Research agenda i.e. lecturers are employed and want to be employed for research not teaching ability[1,6]
  • Subject discipline – science versus humanities subjects (e.g. bioinformatics course naturally suited to web based delivery)[1]
  • Academic individualism – resulting in small scale personal projects[1]
  • Peer pressure – an academics standing in relation to his/her peers, marginalisation of academics pursuing educational technology solutions[1,6]
  • HoD perspective – departmental focus on research[1]		

• Lack of acknowledgement of effort of those involved in teaching		

innovation[4,6]
- Lack of teaching and learning policy[6]
- Poor communication and social cohesion within the department or within the teaching staff of a particular subject discipline[1]
- Working practice:
  - Lecturers day to day working practice
- IT infrastructure[1]
- ESR and RAE creates tension between teaching and research
- Investment profile – teaching or research orientated[1]
- Lack of technical support within the department[1,4]
- Level of commitment to integration[1]
- Technical expertise or preparedness to innovate residing with a single staff member[1]
- Willingness to seek out advice on teaching[1]

Academic staff issues:
- Need to commit time (tension between research and teaching)[1,5,6]
- Academic profile:
  - Strong research motivation i.e. developing research profile[1]
- A strong research community exists but no real teaching community exists i.e. academic community is built on its research links (conferences, communication, socialising, support)
- Low availability of information and guidelines
- Previous successes and failures – perceived risk of failure (exposure to criticism e.g. feedback from student evaluation)[2,6]
- Ease with technology
- Commitment – short term, novelty factors
- Lack of teaching expertise (pedagogic knowledge) [5]:
  - Educational background – previous experiences of being a student dominating current teaching practice[1]
  - Stifled willingness and commitment to be innovated
  - Adopting technology driven approaches[1]
- Commitment to change[2]
- Staff know less about the technology than students[2]
- Difficulties in adapting to the different range of IT skills in new students[2]

Student issues:
- Poor access to IT facilities[1]
- Expectation of students to be self-motivated[1]
- Requirement for student training
- Desire to get a degree as painlessly as possible[4]:
  - course may be taught differently compared to others e.g. may decentre the lecturer – students may be resistant to change
  - technophobia, resistance to the heavy use of technology
  - workload and commitment may be heavier
  - novelty factor may soon wear off

Technology issues:
- Lack of standardisation e.g. different hardware across institution[1]
- Access to computers and bandwidth of network[1,2,6]
- Upgrade costs of software and platforms (and replacing of stolen items)[2]
- Lack of coherent IT polices which support educational needs
- Rapid rate of change in technology and standards
- Technology driven approach over-riding educational needs
- Incompatibility of communication systems[2]
- Out of date media being used e.g. CD-ROM

Software related issues:

- Lack of tools and applicable software (which includes productivity tools and CAL packages)[1,2,5]
- Inappropriate technologies being advocated e.g. particular software packages such as Lotus Learning Space[1]
- Short shelf-life of software, need support for upgrading
- Inability to provide tailor-made solutions
- Lack of ownership[2]
- Inability to reuse or re-author material
- Poorly constructed CAL materials
    - Poor interface design
    - Unintuitive to use
    - Slow
    - 'Feels old'
    - Visually unattractive
- Lack of transparency
- Cost effectiveness e.g. cost of in-house development
- Lack of standardisation, different software versions
- Lack of flexibility[1]
- Demand for kite-marking of software products[2]

2. Promoting Factors	**Time**	**Sphere**
Societal (external): • Increasing government focus on education e.g. open and life-long learning, transferable skills • Increasing focus on, and expectation of the uses of technology to support new cohorts of learners • Technological advances infiltrating everyday life as well the educational establishment • Changing apprehension of the uses of technology especially ideas around 'interconnectivity' (e.g. WWW, e-commerce and e-mail) • Increasing digitisation of media/information, electronic documents as a standard format • Increasing comfort with new technologies • Employer demands for technologically proficient employees • National accreditation schemes for teaching • Availability of funding from HEFCE and other bodies (TLTP, FDTL etc.)[2] • Globalisation - resulting in the opening up of new educational markets and increasing consumer/student choice • Positive results from properly conducted, analysed, evaluated studies of educational technology usage[3] • Claims of studies endorsed by respected academics[3]		

Institutional issues:
• Institutional commitment
  • Commitment from head of institution and from middle and senior managers[2]
  • Coherent teaching and learning strategy[2]
• Securing of grants to support investigations into the uses of technology in education (FDTL, TLTP, local grants etc.)
• Existing educational technology projects[2]
• Existence of expertise in the areas of education and technology e.g. a proactive central teaching and learning unit[2,5]
• Commitment to development and delivery of distance learning programs
• Institutional culture:
  • Reward for teaching innovation e.g. promotion[2]
  • Increased flexibility of roles available within an institution
• Institutional working practice:
  • Increasing competence in technology usage
• Strictures of probation – encouraging innovation during probationary years
• Examples set by other institutions – effect of competition[6]
• Investment in infrastructure and resources[2]
• Investment in IT training[2]
• Raising staff awareness of possibilities (staff development issues)[2]
• Income generation from educational technology materials etc.[2]
• Changes in the ways that support staff are deployed and used[2]
• Staff development programmes that address technology usage[2]
• Technology seen as a solution to other institutional problems e.g. communicating between departments on multiple sites[2]		

Departmental issues: • Changes in the student profile and student numbers • ESR process forcing reflection on teaching and support practice – more open minded attitudes[6]		

- Positive reactions from QA assessors
- Solid IT infrastructure[1]
- IT support and expertise[1]
- Good communication and social cohesion of the department
- Access to examples of good practice:
    - Guidelines to good practice
    - Positive case studies and examples from other departments and institutions[2]
- Presence of departmental support staff with expertise in educational technology[2]
- Presence of enthusiasts or champions[2,5]
- Self-assessment exercises to reflect on departmental teaching practices e.g. peer observation of teaching etc.
- Spreading burden of change to more than one member of staff
- Level and types of assessment may suggest CAA as option[1]
- QAA – subject benchmarking resulting in reflection on departmental teaching, opening the possibilities for the uses of educational technology

Academic staff issues:

- Promoting issues of efficiency – saving time, making best use of time
- Addressing the needs of the academic
- Personal interest in technology[1]
- Staff research area closely related to educational issues[1]
- At ease with technology/technological expertise[1]
- Novelty factor
- Learning from own trials using educational technology[3]
- Staff involved in or has been part of an accredited teaching scheme[1]
- Personal desire to be innovative
- Personal satisfaction gained from teaching[1]
- Enthusiast or champion well positioned within the department i.e. has influence[1]
- Peer acceptance, favourable reactions from academic colleagues[3]
- Theory of IT use fits an ideology, or strong beliefs about education[3]

Student issues:

- Increased motivation to study through more control over time and place of study
- Improved student work spaces/meeting places
- Demand for variety in teaching methods (student as consumer)[2]
- Demand for openness and explicit information regarding aims, objectives and learning outcomes
- Positive attitudes of students towards the use, and ease of use of IT[1,3]
- Positive attitudes/feedback/evaluation from students in relation to educational technology, innovative teaching methods[1]
- Increased student ownership of computers
- Increased awareness of different ways of studying and learning
- Good student preparation/training[5]
- Evidence of improved learning[3]

Technology issues:

- Technology solutions which all staff have access to or can easily become involved with[1]
- Wiring up of student accomodation[2]
- Commitment to supporting newer technologies i.e. moving beyond the current support of 'worldware' such as word-processing, e-mail and Web access (the only ‘guaranteed’ tools)

• Dial-in access to university from home		
Software issues: • Sound pedagogical drivers for the integration and embedding of educational technology[1,5] • Not relying on CAL packages to be intrinsically motivating[5] • Ease of use[1] • Demonstrations of software in action on suitable hardware[3]		

3. Preliminary analysis of the limiting and promoting factors in the use of educational technology

3.1 Working practice as central in providing insights into cultural practices

The institution can be viewed as a social entity, constructed from the social interactions and practices of those within it. Currently, the TELRI project is predominantly focussed at the departmental, subject discipline level (*see Figure 1*). At this level, one of the central issues is educational culture, or more specifically working practice. It is here, in the everyday, that the effects of policy, social cohesion, support structures, access to technology, commitment to teaching, pressures of research are reflected. The working practice of a department, teaching team or academic represents a site where the complex interplay of the many factors listed above is made visible.

An analysis of working practice suggests that it can be broken down into six major areas, or categories *(see Figure 2*). Returning to the documented list of factors, each factor has been individually examined to see if a clear link can be made to these identified areas of working practice. In other words, each of the factors has been given a coding according to its' 'sphere of influence'. For example, the inhibiting factor of access to computers was coded under the category of technology/infrastructure.

Six areas of working practice:

- **commitment to teaching**
- **commitment to research**
- **social issues**
- **support issues**
- **policies and strategies**
- **technology/infrastructure**

These are the tertiary coding categories indicated under the column labelled "sphere"

3.1.1 What are the most influential factors?

The close fit of the data to the areas identified suggests that studying working practice, for example through investigations of everyday talk and action (an ethnomethodological approach), is one method of uncovering those factors which are most influential in terms of promoting or inhibiting the use of educational technology. Here, it is important to bear in mind that just talking to academics does not provide a deep insight into these complex issues surrounding the 'success' or 'failure' of educational technology. It is dangerous to assume

that a lecturer's account of their experience represents some form of authenticity. Anecdotal evidence, experiential narratives and common-sense statements need to be treated with caution. (At present we have mainly had contact with educational technology enthusiasts which represents a small and skewed percentage of the total academic population (15-20 out of the 738 staff at Warwick)).

One factor, which appears fundamental, is the tension between research time and teaching commitment. Both Warwick and Oxford are research-led institutions where a high level of research capability is a requirement for academic appointment. In research-led institutions one might argue that an academic's career path and peer standing is principally based on the development of a research profile. There is a possibility that this may result, for some, in a non-engagement with teaching related issues beyond moral duty, short-term personal satisfaction and pressure to be seen as maintaining quality.

Despite this slightly depressing analysis, a gap for intervention clearly rests on the fact that academics, whether strongly research orientated or not, are generally required to engage in some form of teaching and therefore have some investment in teaching practices. Identifying these 'spaces' as opportunities for mobilising change, for example adopting new pedagogical approaches, is crucial. Exploiting these 'spaces' is one of the ways that links between teaching and research may be created.

The successes and failures of educational technology are clearly derived from a complex interplay between many of the factors listed above. As already stated, how much and to what level these have an effect requires further study. It is highly probable that a number of these factors exert a much greater influence than others. Careful analysis may well reveal that some factors are more myth than reality, for example, failure due to the perceived learning curve of new technology or improved success through credit for teaching innovation.

3.2 Developing an implementation cycle: addressing the long-term, medium-term and short-term issues of facilitating change

It seems apparent that for high-impact, sustainable educational technology solutions to succeed, commitment through all levels of the institution is required. Otherwise there is the danger that we will continue recycling the small-scale local interventions which currently dominate. One of the major drivers of successful educational technology implementation has been identified as a high level of integration into the degree structure[7]. Integration therefore becomes a process not just limited to a course or module but one that spreads across the institution through policies, strategies and support structures (*see Figure 3*).

Analysing the promoting and inhibiting factors in terms of their temporal nature can help inform the process of developing a successful implementation cycle:

Stage:	**Requirements:**	**Support issues:**
Short-term	• engender enthusiasm • develop a life-cycle plan • simplicity/transparency • analyse and facilitate changes in working practice • educational vs. technology driven	• pedagogical • technical • integration

Medium-term	• evaluation • feedback • networks of users • self-support	• evaluation • dissemination • case studies • publications
Long-term issues	• acknowledgement/reward • generation of polices to support innovators and innovation • educational effectiveness • cost effectiveness • good practice • flexibility	• advisory/consultancy • guidelines and documentation • recommendations

3.3 Viewing the implementation and integration of educational technology as a process of change

Introducing educational technology into a course, department or institution can be seen as a process that involves change. Doughty[3] offers an overview of the inter-related factors which need to be identified, understood and be in a 'beneficial state' for satisfactory technological change to take place.

Table 1: Doughty's list of factors relating to technological change

Category:	***Identified areas:***
Issues	e.g. quality, access, accountability, efficiency, economy, government policy, uncertainty, stress, conflict, strengths, weaknesses, opportunities, threats or failures - a perception that identifies dissatisfaction or a problem to be solved
Tasks	mission, aims, objectives, and nature of specific tasks associated with the problem
Systems and subsystems	inputs, outputs, processes, assessment, evaluation, feedback, control, culture, organisational structure, hierarchies, networks, power, resource allocation, room to move, training, staff development and support
Know-how	of technology, pedagogy, organisational and project management; ability to learn
People	attitudes, values, beliefs, personalities; subversives, mediators, leaders, sponsors
Interpretations	of all these factors, by people in all parts of the identified system
Concepts	comparison of activities considered necessary with the perceptions of reality
Action	agents of change to create a climate for change, and carry out a project to solve "the problem", modify goals, or reach a better understanding that leads to less dissatisfaction in the lives of those in the system.
Methodology	analysis/planning, action, evaluation/appraisal, reflection and revision, proceeding in a spiral fashion over extended periods of time, as in the critically reflexive action research form of social inquiry and in the systems based approach to solving human activity problems.
Resources	time, resources, co-operation, support, goodwill and priority to carry out a project

The factors identified by Doughty provide a useful entry point into thinking about change. Current work on change management strategy and change management theory may provide useful tools for identifying and facilitating the changes that occur in the move towards technology based educational solutions. Any change management strategy inherently requires that the drivers and restraints toward change are identified and resolved to ensure success. The following change equation highlights this[8]:

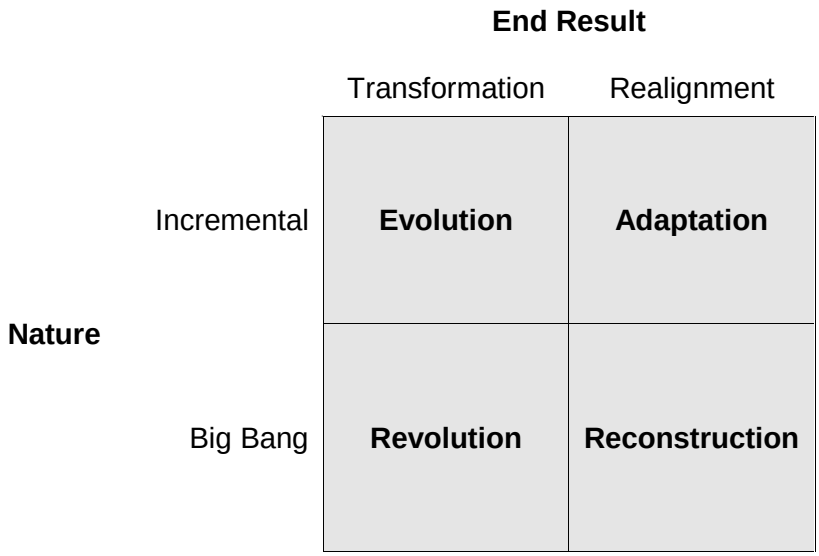
C = (A + B + D) > X

Where:
C = change
A = level of dissatisfaction with present situation
B = desirability of proposed change
D = practicality of change (ease)
X = personal cost of changing

3.3.1 Can change management theory be useful in an educational technology setting?

What follows is an overview of a series of tools and techniques used in the development of change management strategies. Where appropriate these have been modified to relate to an educational setting. Those tools and techniques which may be of long-term value is currently being investigated.

3.3.2 Identifying types of change



Eight key questions, adapted from Balogun *et al.*[8]

1. Is there a coherent strategy understood and shared throughout the institution?
2. Are supporting structures and systems under development?

3. Is there a trigger for change?
4. Are there visible 'early positive indicators' designed in to the change process?
5. Is day-to-day working practice aligned with the required outputs?
6. Are the barriers to change being removed/dealt with?
7. Are the changes supported by symbolic activity?
8. Is communication built into the change process?

3.3.3 A cultural web – (a descriptive tool informed by studies of working practice)

See Figure 4

Building a cultural web which has been informed by studies of working practice is a powerful tool which can be used to address a number of questions:

- to what extent do the existing cultural practices help or hinder the proposed changes?
- to what extent does the existing culture need to be changed for successful implementation?
- which parts of the existing culture need to remain unchanged?

Once the first cultural web has been designed a process of re-webbing can be undertaken. This second web is used to outline the desired cultural practices which are envisioned following a successful change strategy. For example, referring to Figure 4, one of the central paradigms might become innovative teaching practices. This comparison between the two webs helps to give a feel as to the extent of the change required. To effect change successfully then all aspects of the cultural web need to be addressed.

3.3.4 Stakeholder analysis

See Figure 5

The purpose of the stakeholder analysis is to identify key individuals or groups of individuals which may be able to influence the successful integration of educational technology.

3.3.5 Attractiveness vs. implementation difficulty

See Figure 6

A more direct analysis of the likely success or failure of particular projects.

Key issues regarding attractiveness vs. implementation difficulty:

- Forcing project movement: augment the drivers and reduce restraints

- Clearly the interpretation of this descriptive model does not define success or failure (i.e. as a black or white issue) but indicates a level of risk and the directions in which a project can be moved. Defining success or failure within the scope of educational technology projects is a problematic issue. What are the criteria that are used to judge this? Is success simply represented by the adoption of technology? Or is it something more subtle such as educational effectiveness or long-term sustainability? Judging success and failure will also impact on the interpretation of the major promoting or inhibiting factors. For example, if success is judged purely on uptake of technology then the biggest factor may be institutional IT policy. If the measure of success is better learning then

assessment polices may be the biggest factor. Success needs to be judged against purpose/intention/goals and revealed through a rigorous evaluation process (cost/benefit analysis).

- I believe it is important to steer away from 'scientising' socio-cultural issues such as 'motivation' and 'hassle'. Striving to fix these qualities does not make them more 'real' or 'true' (in other words, these are essentially qualitative issues not quantifiable entities).

4. Conclusions

This document has evolved from an initial examination of the promoting and inhibiting factors related to the uptake of educational technology. These promoting and inhibiting factors appear to have a strong influence on the 'success' or 'failure' of educational technology initiatives. In broader terms, these factors provide an insight into why, on the surface, educational technology appears to have had such a localised impact.

Central to exploring these issues, the first part of this ongoing study has categorised a whole series of factors ranging from the personal to the practical, the individual to the institutional. The second part of this study has started to explore the extent to which these factors might inform the production of successful implementation strategies. It has been stressed in this section that careful analysis is required to dig below the surface and question factors which at face-value seem to be of overriding importance. In other words, some seeming largely barriers may actually be relatively easy to overcome while other apparently insignificant barriers may prove long-term stumbling blocks.

These three modes of analysis all reveal that change, in terms of the implementation of educational technology is a highly complex process. A proposed method for bringing these stands together is the development of a flexible toolkit which can be utilised by departments, projects or institution to help identify the most fruitful way forward. This idea has resonance with both the Flashlight[9] program, aimed at providing tools for improving technology and learning and the ELT[10] project which aims to provide tools for evaluating the effectiveness of C&IT.

One possible framework for an 'implementation toolkit' is described below and illustrated in Figure 7.

1. Departmental analysis through studying working practice
    - Choosing a methodology
    - Data collection and analysis
2. Identifying barriers and drivers
3. Mapping out a change management strategy
4. Putting into practice an implementation cycle
5. Evaluating the strategy

What are the advantages that a toolkit could offer? Firstly, as Erhmann[9] recognises, education is local and therefore accurate information needs to be gained from studies at the local level. A carefully constructed toolkit could provide this level of sensitivity. Secondly, active participation in a self administered evaluation should help engender a sense of ownership and stimulate reflection within a department. Thirdly, the toolkit would hopefully mobilise a wide cross section of staff and create a feeling of investment in the solutions that are chosen and implemented.

One of the next aims of this ongoing investigation will be to decide whether the production of such a framework is viable, and its' real value to target projects, departments and institutions.

In summary:

1. The success and failure of educational technology is often described in terms of factors which either promote or inhibit its' uptake
2. Studying working practice is a valuable method for analysing and identifying these promoting and inhibiting factors
3. This data can be used to inform the use of tools to manage change
4. Managing change is central to the integration and long-term sustainability of educational technology solutions
5. Integrating these approaches into a flexible ' implementation toolkit' offers a potentially beneficial solution for institutions, departments and projects to adopt
6. Being able to offer a sound implementation strategy is vital to the TELRI project if it is to achieve success in its' second phase of embedding solutions to improve student research capabilities

5. Further work

1. Add a case study example e.g. Warwick Languages department
2. Add-in material relating to 'resistance to change' i.e. in terms of: perception, personality, habit, threats to power and influence, fear of unknown, economic reasons, organisational design, organisational culture, resource limitations, fixed investments, inter-organisational agreements.
3. Possibly reframe the analyses in terms of:
   - WHY = finding out/analysing a department = studying working practice/culture = methodology = gathering data
   - WHAT = tools for change = change management
   - HOW = strategy for implementation/integration
   - WHERE = building in an evaluation cycle
4. Examine the work of the Flashlight program and how it may inform some of the issues raised (http://www.tltgroup.org/). Also see Oliver, M. and Conole, G. (1998).
5. Should implementation be split into two processes (which may be further sub-divided)?
   - Offer framework for educational change = educational approach = commitment to integration
   - Offer transparent technology solutions = applicability = working practice
   - Evaluated against 'educational effectiveness'/cost-benefit analysis?
6. Consider the factors as a network of issues as opposed to a linear set of hierarchical issues that need to be tackled
7. Levels of interaction – examining interaction at a single level e.g. the level of policy and how polices, strategies and directives interact.
8. Address the issue of educational effectiveness
9. Reframe some of the issues in terms of organisational networks and organisational studies
10. Address the changing nature of many projects which are now cross-departmental and cross-institutional - redefining and reconfiguring of the institution and cultural boundaries requiring greater flexibility in the types of analyses and strategies that are bought to bear.

6. References

1. TELRI project meeting notes - preliminary conclusions drawn from exploratory interviews with the following Warwick departments: Languages, History, Maths, Computer Science, Law and Biological Sciences.

2. HEFCE report – 'Factors which have helped or limited the effective adoption of technology and learning materials'.

3. Doughty, D. (1996) 'IT in Education and Education in IT.' URL: http://www.elec.gla.ac.uk/TILT/ITEDEDIT.html (visited 9/6/99), *see also TILT project outcomes*

4. Lousberg, M. and Soler, J. (1998) 'Action research and the evaluation of IT projects.' Active Learning: 8, 36-40.

5. Scott, B. *et. al*. (1998) 'Embedding TLTP and other resource based learning materials into the curriculum.' Active Learning: 8, 41-44.

6. Maier, P., White, S. and Barnett, L. (1997) 'Using educational development strategies to integrate learning technologies.' Active Learning 6, 10-14.

7. Gunn, C. and Brussino, G. 'An evolutionary approach to CAL.' Active Learning 6, 20-22

8. Balogun, J. and Hope Hailey, V. with Johnson, G. and Scholes, K. (1999) 'Exploring Strategic change.' Europe: Prentice Hall

9. Ehrmann, S. C., (1998) 'Studying teaching, learning and technology.' Active Learning 9: 36-39.

10. Oliver, M. and Conole, G. (1998) 'Evaluating communication and information technologies: a toolkit for practitioners' Active Learning 8, CTISS Publications, http://www.cti.ac.uk/publ/actlea/al8pdf/oliver.pdf

11. Johnson, G. and Scholes, K. (1999) 'Exploring corporate strategy.' Hemel Hempstead: Prentice Hall

Figure 1. Identifying departmental interactions: an overview

The following diagram identifies three major components that are central to the notion of an academic department and its' educational culture. The diagram is useful in forming an initial picture of the interrelated processes that constitute the educational context of a department. For example, the symbolic nature of the department is defined by: the subject discipline; the building, rooms and resources that are available; the technological infrastructure; the administrative processes that exist and the department's position within the wider context of the institution.

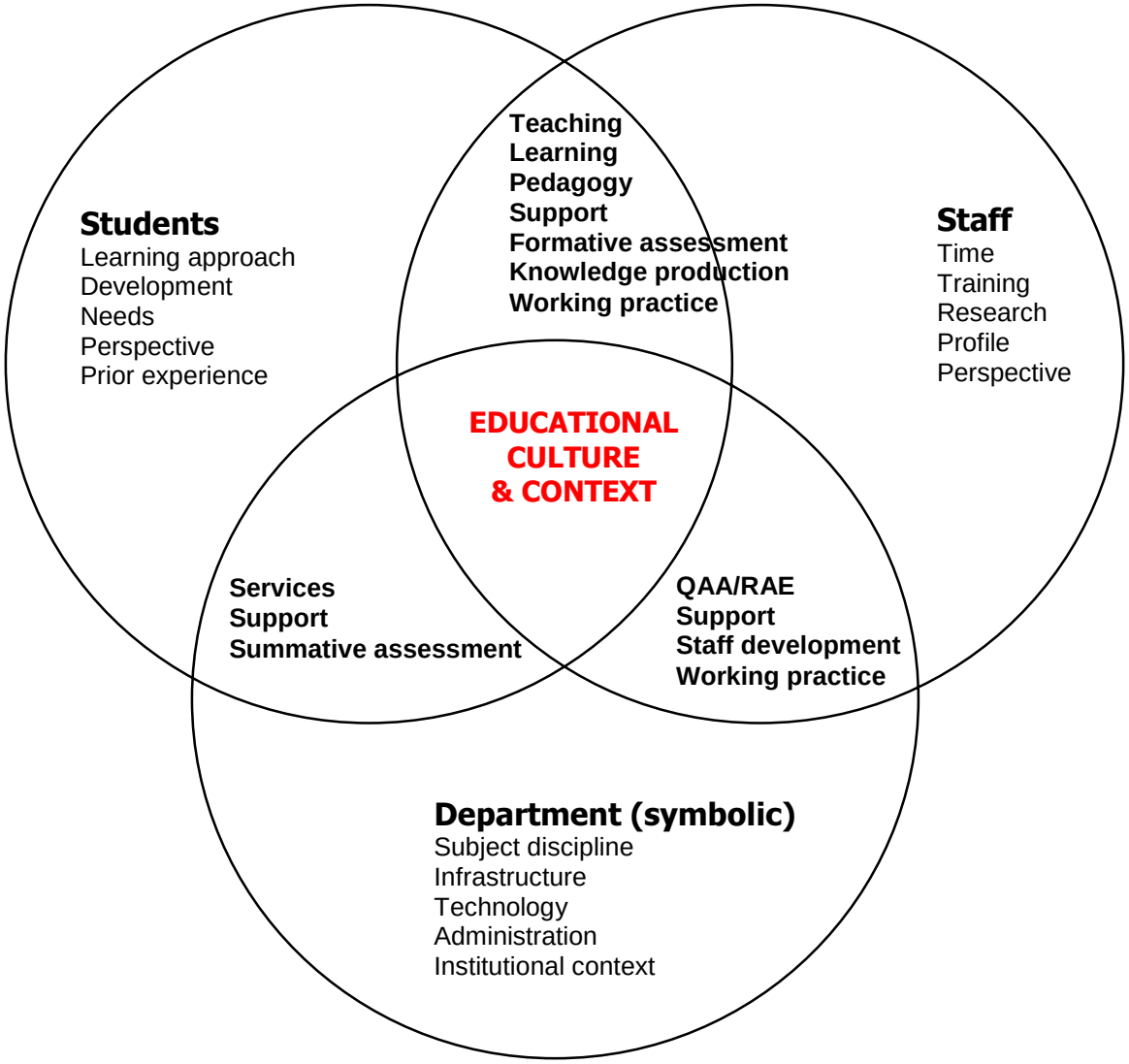


Figure 2. Departmental working practice as the central issue

The following diagram illustrates how an analysis of working practice reveals six major components. These components form the basis for the tertiary coding of the promoting and inhibiting factors that may have an effect on the use of educational technology.

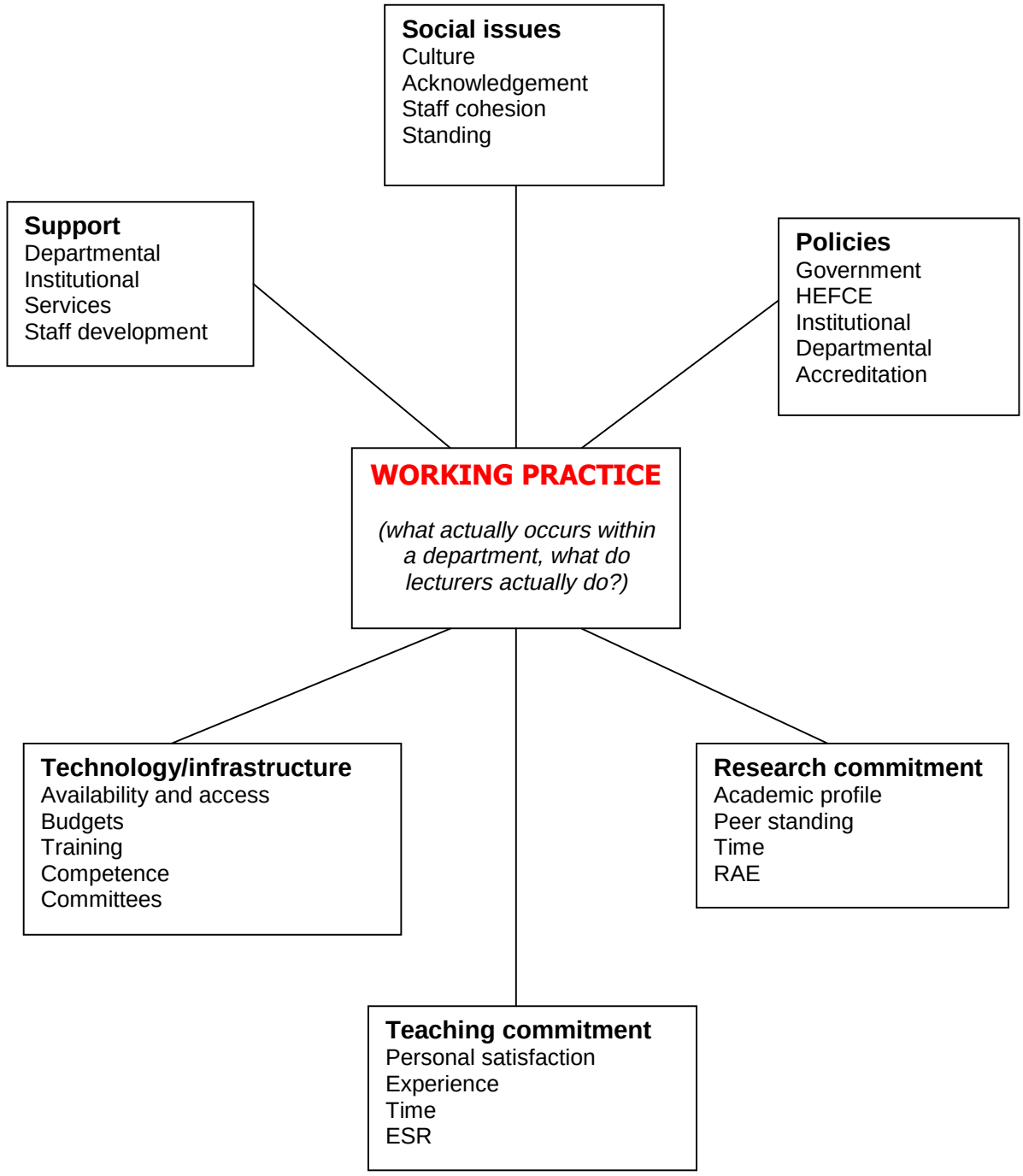


Figure 3. Implementation and integration cycle

The diagram below shows the required flow of information and 'process' (from individuals, through the department, institution and vice-versa) for successful change to occur i.e. to achieve sustainable educational technology implementation and integration. This type of overview would be consistent with an incremental transformation approach via 'pockets of good practice'

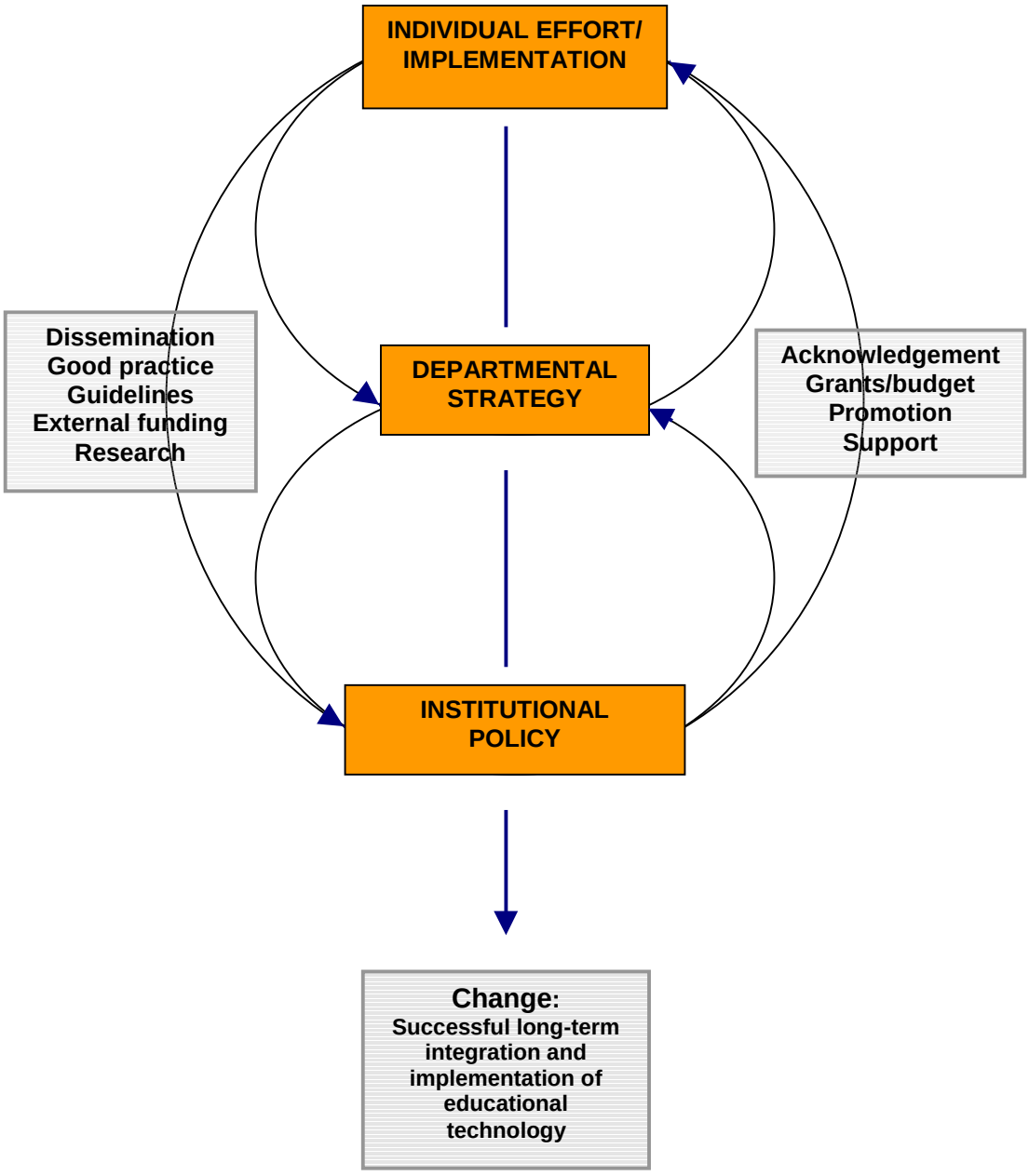
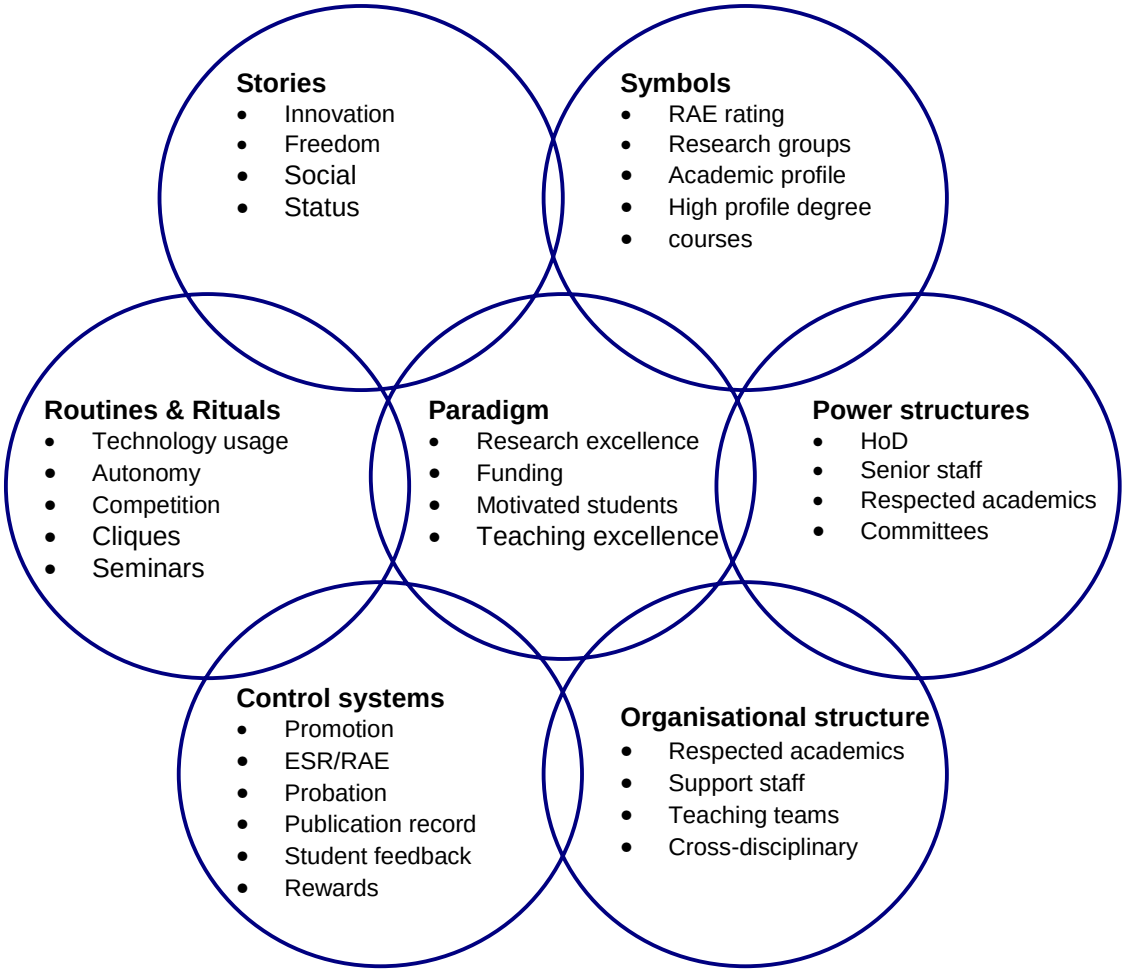


Figure 4. A cultural web, descriptive of an academic department

Building a cultural web is a method which can be used to audit an organisation's present culture, in this case that of an academic department. It provides a tool for highlighting the barriers to change presented by the existing culture.



Adapted from: Johnson and Scholes[11]

Figure 5. Targeting change: analysing the stakeholders

A simple analysis of the stakeholders according to attitude and influence can help identify where weaknesses lie in the support for change. In the example below, various factors are identified which may help shift a department's students, support staff and academics into more positive, active roles.

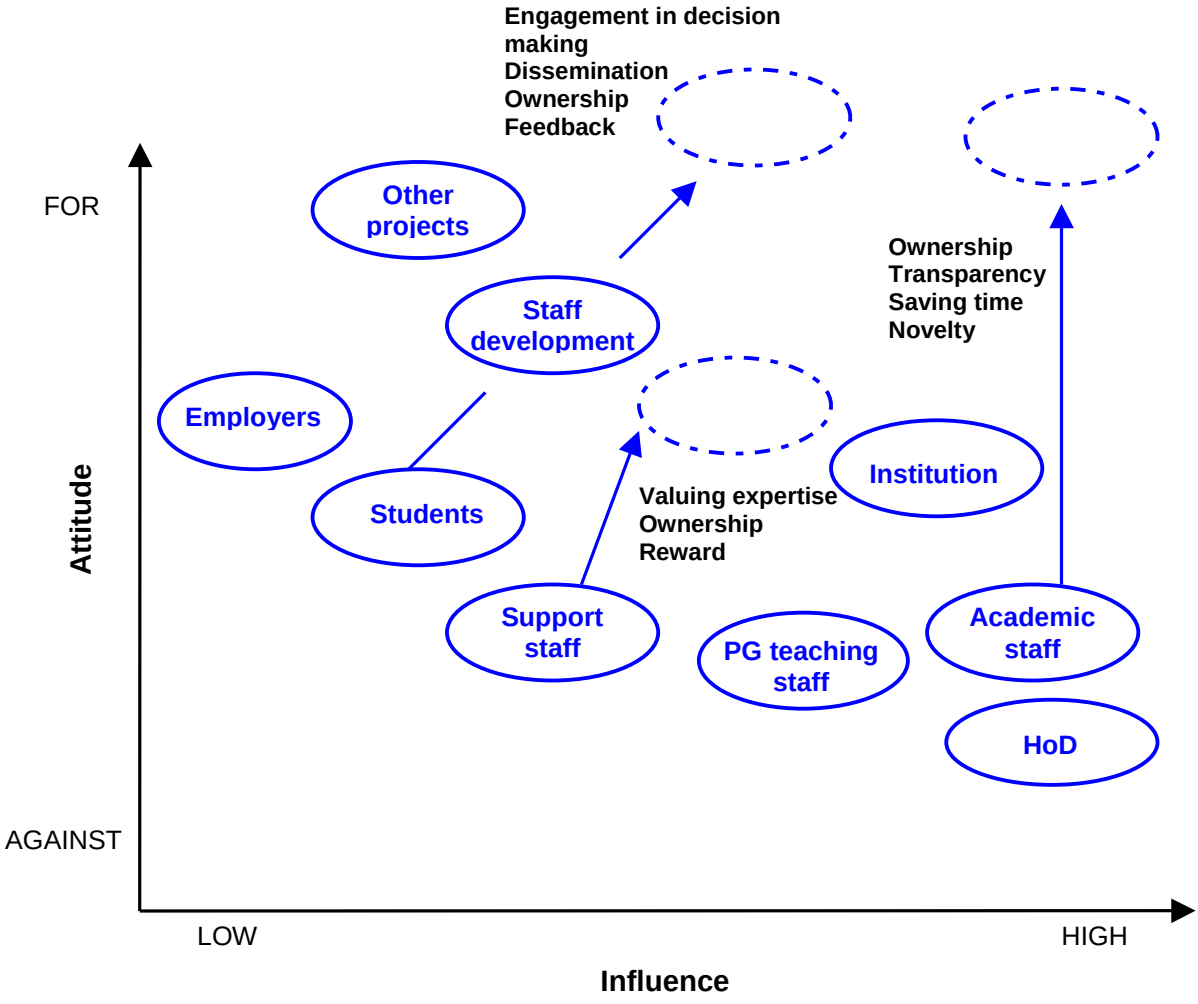
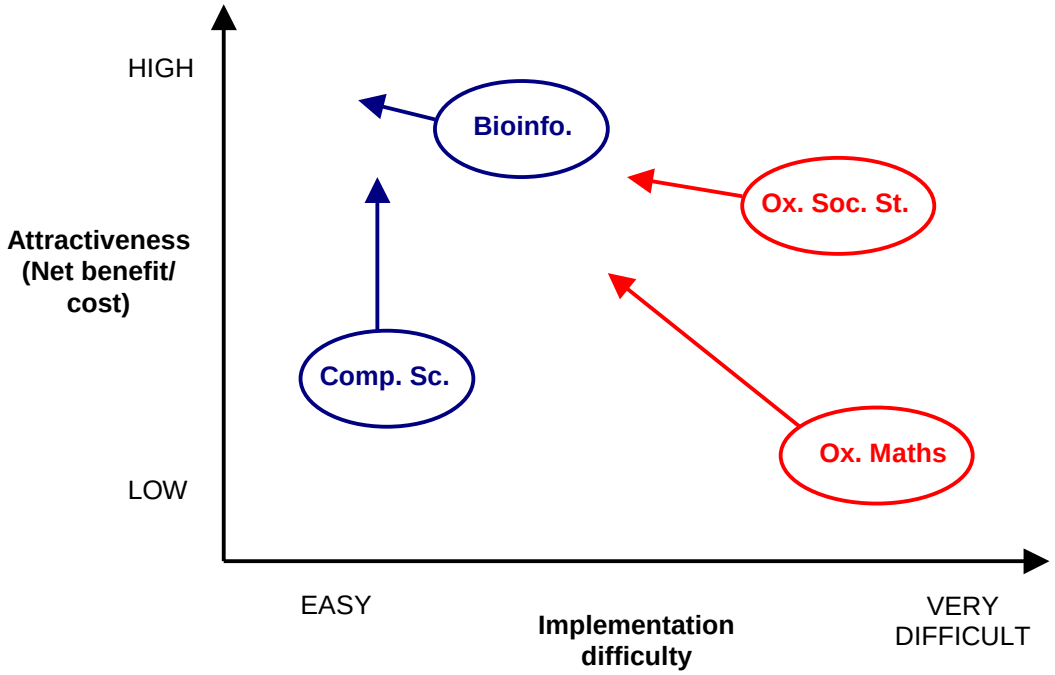


Figure 6. Attractiveness vs. implementation difficulty: an analysis of four TELRI projects



KEY:

Blue = projects likely to achieve success
Red = projects which require attention to avoid failing (or achieving only partial success)
→ indicates the likely direction in which the projects can be pushed

Projects:

Bioinfo. – Oxford/Warwick bioinformatics course
Comp. Sc. – Warwick Computer Science department
Ox. Maths – Oxford Maths department
Ox. Soc. St. – Oxford Social Studies

Figure 7. Framework for a flexible 'implementation toolkit'