

Information Technology Online: A Knowledge Framework for Curriculum Externalisation

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Abstract

Faced with increasing competition for students and funds, Australian universities hope that innovative technologies will provide the capability to offer flexible learning pathways that meet the needs of current and future students. However, the application of such technologies to develop an IT (information technology) degree for online external delivery is a difficult and complex process with both technological and human dimensions. Adopting a knowledge framework and a systems thinking approach can help IT educators to better appreciate the significance of their efforts to date, and give direction to future initiatives. This framework and approach is presented in this study as a stakeholder analysis that identifies the key actors, together with their viewpoints and perceptions that influence the outcome of curriculum externalisation projects.

Keywords: Online learning, flexible course delivery, knowledge management, soft systems methodology, stakeholder analysis.

1 Introduction

The drive for externalisation and the development of online learning resources is a major challenge faced by many Australian universities. Of particular interest are efforts to incorporate innovative technologies for delivery of online IT (information technology) courses.

In this investigation of the externalisation of an IT degree program, a qualitative research based approach – Soft Systems Methodology – is used to undertake a stakeholder analysis. This analysis of the viewpoint and perceptions of key actors is undertaken as part of a knowledge framework that assists in understanding the rationale for decision-making, and the nature of feedback and control within a project. A particular advantage of this approach is that it helps to create a learning organisation based upon the ability to access knowledge to redirect, facilitate and encourage innovative

approaches in development projects. Identifying how peoples' worldviews and organisational culture can be managed to ensure that they do not become barrier to learning and other knowledge management processes is a key outcome of this study.

2 Using IT to Study IT

Using the latest innovations in IT to develop and deliver an IT degree program is an attractive and persuasive proposition. Online learning technology can make study accessible to a wider range of potential students, provide students with greater flexibility in their study options, allow for new and different pedagogical approaches and has the potential for significant institutional cost savings (Morris, Zuluaga, and Atkinson. 2004; Pollacia and Simpson, 2000; Phipps and Merisotis 1999).

Significantly, there are a number of challenges associated with developing online resources and providing flexible delivery. The potential for interactivity is a major benefit offered by the online environment but successfully designing for it is one of the major challenges faced by designers of online learning resources (Sims, 1999). Schelin and Smarte (2002) warn that developers must assess the needs of the student population and clearly target skills and knowledge gaps before developing online courses. As a number of projects (e.g. Cooper, 2000; Gibson, 1997; MacKinlay, 1999; Warner & Christie, 1999) can testify, mismatches in computer skills between course requirements and students can totally overwhelm any learning. Similarly while rich media content can substantially enhance the learning experience it is essential to ensure students have sufficient bandwidth and network access if the experience is not going to become both frustrating and expensive.

A number of IT online courses have been developed and delivered successfully both in Australia and overseas. Not surprisingly, courses with high practical components or needing access to specialised equipment are more problematical and challenging to develop and deliver. The online environment as discussed in the previous paragraph offers some advantages but it is not the solution for all learners and courses (Morris, Zuluaga, and Atkinson. 2004; Pollacia and Simpson, 2000).

Finally, online learning projects typically exist in complex and poorly structured socio-technological environments, with many different issues, influences and agendas. In particular, the worldview of the learner is a key factor in better understanding how users navigate the teaching and learning interface. Therefore this study

adopts a knowledge framework and systems thinking approach in the form of a stakeholder analysis that helps to better understand the complex situations where the worldview and the transformations at the learner interface are important.

3 Adopting a Knowledge Framework

Where an organisation is beset by complex situations, Courtney (2001) suggests that the organisation should consider the nature of knowledge and knowledge management, and its relationship with decision-making. Focusing upon decision-support, Tiwana and Ramesh (2001) suggest that the models associated with knowledge management provide a suitable framework to respond to complex problems.

On the other hand, knowledge work and knowledge management can present complex problems. First there is the issue, raised by Malholtra (1998) and Kidd (2001), that knowledge management may just be a management fad. Bawden (2001) suggests that the concept of knowledge management is 'much-hyped' and subject to confusion stemming from divergent viewpoints. Also, the conflicting interests of multiple stakeholders in knowledge management are an indication of the presence of organisational complexity (Buckingham Shum 1997; McHenry 2002; Bryson et al. 2002). Furthermore, meaningful knowledge cannot be simply retrieved from some database but must be actively reconstituted in the moment, in the context of who the community is, and what the particular needs are. So, knowledge work is dominated by communication – specifically discussion, deliberation, argumentation, debate and negotiation (Lang 2001b).

Gao et al. (2002) observe that great difficulty is faced in managing the human aspects of knowledge processes, especially those associated with ethical values, managerial philosophy, personal subjectivity, or cultural behaviour embedded in organisational contexts. This concern extends to the concept of 'sticky knowledge' - knowledge that is produced locally and does not have explicit exchange value, rather it is socially embedded (Lang 2001a). While this sticky knowledge circulates and diffuses easily within its community, flows between different communities of practice – even in the same organisation – may be problematic. Lang (2001b) also observes that knowledge work deals with complex problems; that for knowledge workers their problem space is continually shifting. Schmitz and Whitworth (2002) and Lach et al. (2003) argue that one community's solution can become another's problem.

3.1 How to address complex problems in knowledge management?

The development of successful knowledge framework requires the consideration of 'hard', technology-based and 'soft', people, culture and leadership issues (Egbu et al. 2001). Taking a learning organisation perspective of knowledge management, Brown and Brudney (2003) recommend that this soft, people-based approach is able to provide structure and a collaborative response to

complex problems. Gao et al. (2002) propose that the systems sciences, including soft systems thinking, should be used to support the different levels and phases of knowledge management. Similarly, faced with inter-related complexity and complex problems, Gustafsson (2002) recommends the adoption of a holistic open systems approach.

3.2 Why stakeholder analysis?

Knowledge creation is closely associated with different worldviews and viewpoints (Yolles, 2000). These worldviews and viewpoints change to reflect the organisational realities, and provide a cognitive space of concepts, knowledge and meaning that is closely linked to organisational culture. Given the perceived importance of viewpoints and stakeholders in knowledge management, stakeholder analysis is also recommended. Bryson et al. (2002) state that stakeholder analysis is particularly useful for turning complex problems into problems that can be solved, and are worth solving. Stakeholder analysis to deal with complex problems is also suggested by Savage et al. (1991). Such analysis needs to address the power, intentions and values of both the organisation and key stakeholders. Finegan (1994), Neal (1995) and Green (1999) emphasise the potential for using Soft Systems Methodology (SSM) in the early stages of projects, to help the various stakeholders achieve a common understanding of the problem situation.

4 Systems Thinking and Knowledge Management

Systems thinking, holistic approaches, and in particular, soft systems approaches are strongly recommended when faced with complex problems in knowledge management (Cacioppe 2000; Elliman and Orange 2000; Yeoman et al. 2000; Ballard 2002; Gao et al. 2002; Gustafsson 2002; Rose 2002; Venters et al. 2002a, 2002b). Recommending the use of Soft Systems Methodology (SSM), Barry and Fourie McIntosh (2001) describe it as incorporating systems thinking and systems concepts into an approach that offers the opportunity for incremental improvement that is essential to address complex problems. SSM provides a framework for involving all stakeholders in a continual learning cycle, and forms a theoretical foundation for thinking about and responding to difficult problems.

4.1 What is SSM?

Soft systems thinking is an interpretive approach that is strongly influenced by Vickers' (1968, p. 59, p. 176) description of the importance of appreciative systems – systems of social process and change - in dealing with human complexity. Checkland (1999), and Checkland and Scholes (1990) have attempted to transform these ideas from systems theory into a practical methodology that is called Soft Systems Methodology (SSM).

SSM is designed to allow the human element of such systems, which is typically unstructured and poorly defined, to be incorporated into problem solving work. It

may be used to analyse any problem or situation, but it is most appropriate where the problem “cannot be formulated as a search for an efficient means of achieving a defined end; a problem in which ends, goals, purposes are themselves problematic” (Checkland 1999, p. 316). SSM in its idealised form is described as a logical sequence of seven steps (Checkland 1999, pp. 162-183). These are:

- Stages 1 and 2 - Expression of the problem and formulation of the Rich Picture.
- Stage 3 - Selection of a Root Definition.
- Stage 4 - Model Building - the Conceptual Model.
- Stage 5 – Comparison.
- Stage 6 and 7 - Recommendations for Change, and Taking Action.

In the practical sense, these stages are activities that can be undertaken in any order, and with considerable iteration. In many cases, back-tracking and reworking are essential parts of SSM.

4.2 Applying SSM within a Knowledge Framework

A significant feature of SSM is that it can be used as an approach to stimulate debate and capture the perceived visions of participants. In this context, Elliman and Orange (2000) recommend the use of SSM to facilitate effective change and improved work practice by allowing the exploitation of individual and socially constructed knowledge and experience. Rose (2002) supports the use of SSM as an appropriate iterative approach for the collection of socially constructed knowledge and sense making. It provides a data collection technique based upon semi-structured interviews and includes participant and non-participant observation, document study and researcher-led workshops.

This is supported by Neal’s (1995) recommendation that SSM is a valuable approach to requirements definition, especially in the provision of a stakeholder analysis that can identify the key viewpoint and important stakeholders. Savage et al. (1991) and Schmitz and Whitworth (2002) also emphasises that stakeholder analysis, particularly focused upon the stakeholders’ power, intentions and values, is a key response to difficult problems.

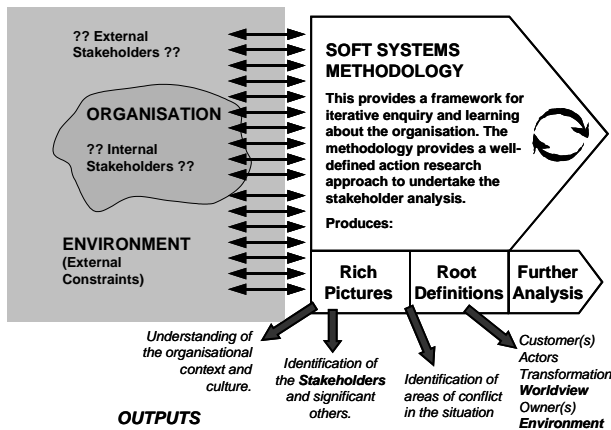


Figure 1: Using SSM for Stakeholder Analysis

A key feature of SSM is the support of learning about the successfulness of past interventions. Staker (2000) proposes that a knowledge repository can be built that contains the outputs from each iteration of SSM. The repository would contain Rich Pictures and Conceptual Models as graphical images, and Root Definitions as objects representing human activity systems. These images and objects provide the artifacts upon which a knowledge management framework can be built.

The approach illustrated in Figure 1 has been previously applied in a research project investigating knowledge management practices in the Australian construction industry (Walker, Finegan and Maqsood 2003). In that project SSM was used for stakeholder analysis, resulting in three types of output – artifacts - that are particularly useful:

1. The Rich Pictures provide an opportunity to identify specific stakeholders, and significant others, within the context of the area being investigated.
2. The Root Definitions include a statement of the significant worldviews.
3. The Root Definition also defines the environment of the organisation and the stakeholders.

5 Case Study – Externalisation of an IT Degree

The following case study, based upon the externalization of an IT degree program, provides an example of a complex and messy situation. As this project was critical to the mission of the School of IT, it is important to analyse the lessons learnt, and in particular to document whom the stakeholders were, and what issues were important to them.

The project team involved in the initial implementation of the project conducted this case study. Commencing in 2004, this analysis has undergone several iterations of refinement, both in the formulation of the rich picture and conceptual model. It is a continuing case study, with further cycles of analysis being planned as the externalization project moves into the second stage of implementation.

The case study is summarized and illustrated in the Rich Picture (Figure 2). It shows the structure, processes and especially the beliefs and concerns of the key players.

This Rich Picture portrays the complexity and conflict associated with different priorities, expectations, knowledge and skills, reporting relationships, and service delivery. The “storm clouds” describe a number of problematic issues and sources of conflict associated with this case study. For example the School of IT has difficulties in providing the resources to delivery the degree program in Alice Springs. The Rich Picture also shows that there is considerable pressure for change being applied on the School of IT by key stakeholders.

<p>Root Definition</p> <p>Developing Pathways is a system to enable IT lecturers, supported by senior management, money, and educational design expertise, to develop flexible learning pathways for students. This involves transforming existing traditional print based delivery materials into online teaching resources. It is undertaken to achieve multipurpose resources that expand readily into new areas, offering new business development opportunities, better quality in teaching and learning, transparency and consistency in teaching resources, and a shared understanding of curriculum issues.</p> <p>The system must be able to work within the economic constraints from the university and government, while meeting the changing demands of industry and employers for skills and knowledge in a format that enables students the flexibility to undertake study and meet work and family commitments.</p>
<p>Customer: Students, university, employers.</p> <p>Actors: Lecturers, senior management.</p> <p>Transformation: To use senior management support, money, and educational design expertise, to develop flexible learning pathways for students through a process of adapting existing traditional delivery materials into online teaching resources.</p> <p>Weltanschauung (why Bother?): To achieve multipurpose resources that expand readily into new areas, offering:</p> <ul style="list-style-type: none"> • new business development opportunities, • better quality in teaching and learning, • consistency in teaching resources, • shared understanding of curriculum issues. <p>Owner: School of Information Technology</p> <p>Environment: Economic, university, government, workplace and family.</p>

Table 1: Root Definition and CATWOE

The rich picture is followed by the development of the root definition and CATWOE (Table 1). The mnemonic CATWOE is used to check that all the components are in this definition.

- C** Clients, customers (or victims) of the system.
- A** Actors who carry out activity in the system.
- T** Transformation - being the conversion of the inputs into a changed form.
- W** Weltanschauung (or constraining worldview) that makes this definition meaningful.
- O** Owner, the person with the power to start or stop the system.
- E** Environment - world surrounding the system, that provides the external constraints.

The CATWOE is only a component checklist, and the appropriateness of a root definition can only be evaluated through the dialectic process of examination, debate and argument and modification. However, it also provides the central transformation of the “ideal” system to develop new learning pathways. In this case study the transformation is defined as: ‘To use senior management support, money, and educational design expertise, to develop flexible learning pathways for students through a process of adapting existing traditional delivery materials into online teaching resources’.

6 The Stakeholder Analysis

Examining the Rich Picture (Figure 2) identifies six discrete groups of stakeholders in this case. They are:

1. Government agencies including the Australian University Quality Agency (AUQA) and funding sources.
2. Professional and industry associations, including Australian Computer Society (ACS) and Australian Information Industry Association.
3. Current and prospective IT employers.
4. Current and prospective students located in Darwin and other remote locations (including Alice Springs)
5. University Chancellery and support groups.
6. The staff of the School of IT (including the Head of School, and remotely located staff).

From the root definition and CATWOE the **customers** of curriculum development project are the students, the University (represented by the Chancellery) and current and future employers. The **key actors** that will make this project happen are the lecturers from within the School of IT, with the support of senior managers from the University Chancellery. Of great interest is the **ownership** of this project, which against all expectation is firmly held by the staff of the School of IT. Simply put, without the willpower, direction, interest and effort of the staff within the School of IT, this externalisation project would never have started or continued. Finally the root definition describes the **environment** in which IT curriculum development exists. It is a complex fusion of economic constraints from the university and government, together with changing demands from employers and industry, and a need for flexibility in meeting students’ requirements.

The Rich Picture further illustrates important relationships between the various stakeholder groups. From the environment, the Government, industry associations and employers are scrutinising the School’s performance, especially where industry funding is supporting externalisation.

The “storm cloud” between the workplace employers and the School of IT represents the continuing unfulfilled demand for IT skills in the business community. There is

also clearly a mismatch in the expectations of industry for job-ready graduates, and the desire of IT staff to future-proof the IT graduates to cope with inevitable changes and development in technology and the business environment.

Within the University, the Chancellery is applying extreme pressure for change (going online in particular) upon the staff, and especially upon the Head of School. Also from within the wider University, strong support is provided by the Learning and Resource Units, in the form of the provision of instructional design and standards for online teaching and learning, and for discipline specific learning.

Furthermore, the predominately mature age and part-time student cohort is continuously lobbying for more flexible delivery of the IT program, as they try to balance family, work and study commitments.

Focusing upon staff, important dynamics are illustrated within the School of IT. The attitude of staff members is changing as the opponents of externalisation leave the School to be replaced by new staff members with the skills and enthusiasm to develop online learning resources. A “storm cloud” exists between the metropolitan campus and the much smaller Alice Springs campus, where staff feel they are under-resourced, and a small number of students are demanding access to the IT degree program.

The value of this stakeholder analysis is that it provides an opportunity to reflect upon the experience of undertaking a complex and demanding project within the context of a real university. By using SSM to generate a set of artefacts – the Rich Picture and Root Definition – knowledge about this project has been formalised and can be reused in the future. Furthermore, the reflective practice involved in undertaking the analysis has assisted the participants – three members of the externalisation project – to better understand their roles in the project. The externalisation project is now continuing into the next stage with the benefit of this analysis and especially the reflective learning achieved by the participants.

7 Conclusion

This study has utilized a systems thinking approach that is ideally suited for the analysis of the complex issues and perspectives of the stakeholders associated with an online learning project. Using this approach a number of implementation and broader issues were identified.

The ownership of the project by the staff of the School of IT is a key insight that helps to explain the dynamics of the project, and is an important factor in the continued success of externalisation efforts. On a warning note, the project is very dependent upon the attitude and skills of current staff, and is therefore vulnerable to future staffing changes.

There is a tension between the industry’s demand for “job ready” graduates competent in a particular technology against the School’s responsibility to produce graduates able to adapt to the emerging and constantly changing requirements of the field. The study shows that it is

important to appreciate needs of the customers – the students, wider University, and the employers – who are part of the environment of this development work.

This study has investigated the processes of developing external curriculum of an IT degree by identifying how peoples’ worldviews and organisational culture can be documented and better understood. Such understanding provides a better basis for decision-making and management. In particular action can be taken to ensure that beliefs and culture do not become barriers to progress.

In conclusion, by using the artefacts generated by SSM, a knowledge framework has been described that assists in understanding the rationale for decision-making, and the nature of feedback and control within a project. The advantage of this approach is that it helps to create a learning organisation that learns from experience and applies the lessons to future endeavours.

8 References

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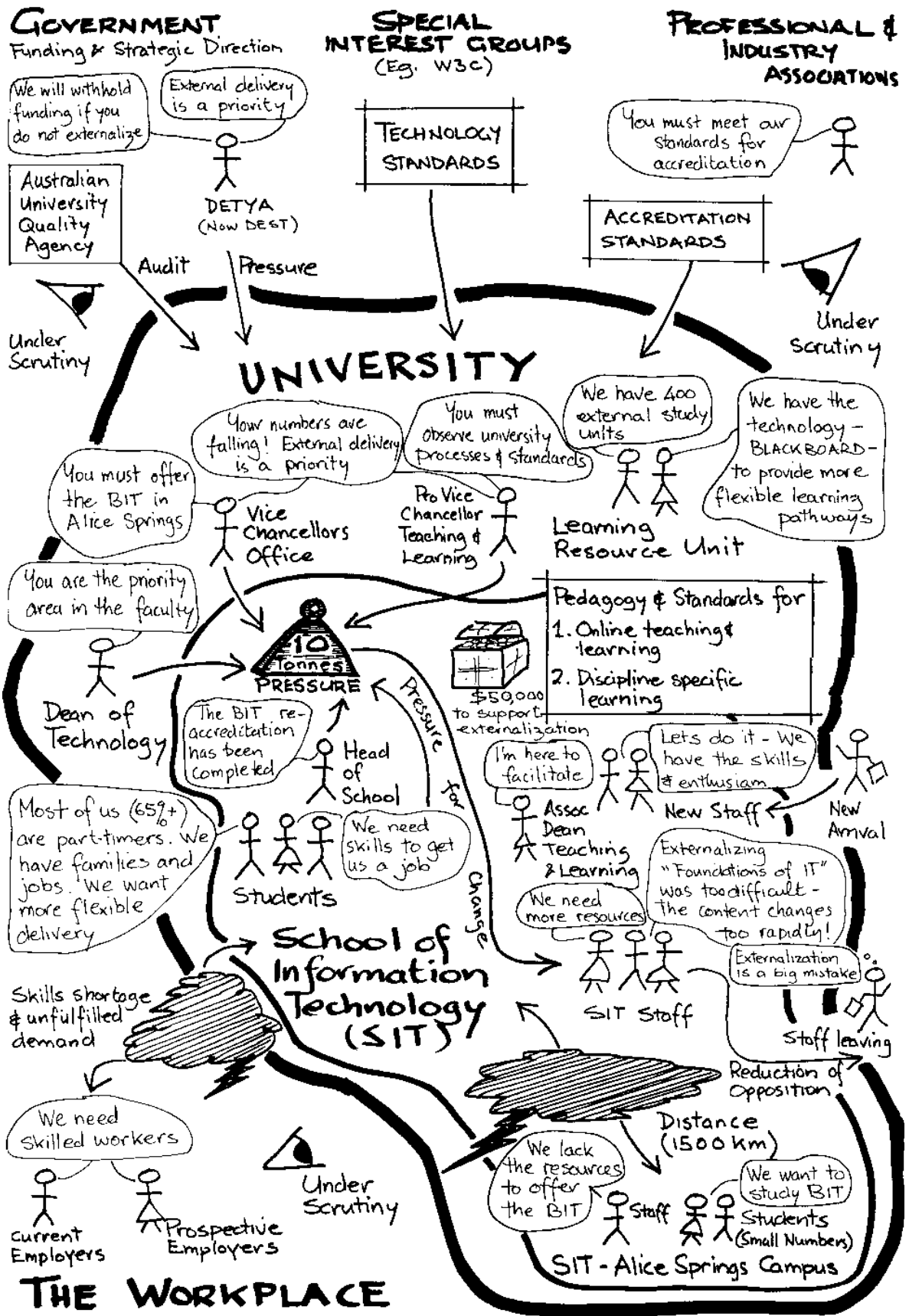


Figure 2: Rich Picture – Externalising the IT Degree