Understanding IT Management in Higher Education

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Abstract

A meeting of academics concluded that the management of IT resources in education is sub-optimal and under-researched. The extent of IT-related changes indicates a need for strategic management, proper attention to the expectations of stakeholders, and careful management of the implementation of new systems. Representative role players provided both open and structured input to a study that contrasted open coding of transcribed text and structured analysis of repertory grid data. The results of the open coding were limited but the repertory grid data provided useful insight into the management of information technology and information systems in higher education. The principal findings were that the management of the scope of information systems, services and projects must be managed well, and when coupled with risk management this provides the best possibility of successful working. The controlled management of cost, value, and innovation, are revealed to be distinct areas of strategic importance.

Keywords: IT management, strategy, higher education, open coding, repertory grid

Introduction

Research in South Africa and elsewhere has found that the management of information technology in educational institutions is often ineffective and, as a discipline, it is also under-researched (Keats, 2003; Luftman, 2003; McClea & Yen, 2005; Grant, 2011; Bytheway, Cox, et al., 2012; Bytheway, Bladergroen, et al., 2012; SAICTED, 2013; Bytheway & Venter, 2014). One interesting indicator is that the International Federation for Information Processing (IFIP) established a working group dealing with "Information Technology in Educational Management" in 1996 (IFIP, n.d.), but there has been no apparent activity in that group since a planned meeting in Botswana in 2010.

Of course, managing technology is not easy. The monthly and weekly cycles of technology advancement are far faster than the annual cycles of academic planning and delivery. For example, in the Western Cape of South Africa, after more than ten year's hard work, all 1500 schools were finally provided with laboratories kitted out with desktop PCs about four years ago (Khanya Project Team, 2011), but technology had moved on far beyond the PC: this happened just at the time when there was a surge of interest in using tablet computers in teaching and learning. These difficult timescales mean that technology-driven change needs to be managed strategically. Technology opportunities must be assessed against the needs of different people, but different people see technology differently, and so strategic management becomes somewhat complex.

Take mobile devices: to a student, a smart phone is something that serves multiple functions, but to a traditional (senior?) academic it might seem to be an unnecessarily complex telephone. Take academic staff: university lecturers are pressed to deliver ever more teaching and learning to ever more students, and at the same time they are expected to undertake research and publish papers. Take academic publications: some publishers are struggling to escape a hopelessly traditional business model, while others have eliminated much of the cost of publication and achieved far more rapid cycles of review and publication. There are difficult and different issues wherever we look.

In summary, the *contexts* within which education operates are multifarious and different, the *people* are different, the *technical resources* are different (and constantly changing), and the *expectations* of key stakeholders are different. Understanding the different expectations and needs of different educational stakeholders is important in achieving successful management of information technology and systems.

A meeting of experts

As a first step in initiating research into the management of information technology and information systems in education, senior academics from each of the four universities in or near Cape Town met for two days and achieved a fair consensus about the key issues (Bytheway & Bladergroen, 2013). Agreements that came out of the meeting include:

- *IT is an investment*. However, investments in information technology and information systems in education are not delivering the expected benefits, and there has been little research that deals with this at the managerial level.
- *It's all about delivering timely value*. Information technology and information systems allow that research can be more immediate, publication can be instantaneous, learning can be driven more by learners than teachers, and the assessment of learning can be better managed – these are valuable outcomes but they engender significant change.
- *Managed change is possible*. Change can be achieved progressively, by recognising that early benefits are concerned with *efficiency* and later benefits are concerned with the more challenging issue of *effectiveness*, adding to the need for change management capability.

It was also agreed that people often "give up", but some individuals do not, and manage ideas on their own, without any support and with few resources to encourage innovation. When individuals do succeed and are able to demonstrate the legitimacy of their personally-developed ideas, there need to be processes that help them to promote and institutionalise those ideas for the benefit of all. The people issues are possibly the most challenging. What must we do to make sure that people are engaged positively, that they don't give up, and that they don't turn negative in the face of difficulty?

An easy response is to dismiss this as a problem for management, but then, how shall managers manage? Those managers who habitually concern themselves mostly with budgets and tinker with organisational structures need to understand the human factors involved.

So, what can we learn from people's real experiences with information technology-driven projects in education, and what are the things that they consider need managing?

The study

When different kinds of people work or live in different contexts, it is important to understand the differences and to manage them appropriately. This study therefore set out to investigate experiences and expectations relating to the use of information technology and information systems in universities near Cape Town. Selected partner organisations were included.

At the same time, because it was concerned with understanding a relatively new area of research, as well as qualitative analysis of interviews the study adopted two analytical techniques not often used in information systems research: Repertory Grid Analysis and Bertin Data Visualisation. A short exploratory study such as this needs a suitably fluid and adaptable approach to the analysis of people's experiences, and these two analytical techniques allowed the collection of primary data without any bias from the researcher, and useful analysis of what was a relatively small dataset.

Repertory Grid analysis has a long history (Kelly, 1955; Kelly, 1970) but has found only limited application in information systems research (Tan & Hunter, 2002). It has the important characteristic that it allows data elicitation completely independently of the researcher, and without any need for *a priori* ontologies. Jacques Bertin's ideas about data visualisation also have a long history and stand as a method of avoiding the pitfalls of doggedly quantitative or qualitative research, especially with small datasets (Bertin, 1973; Bertin et al., 1977; de Falguerolles et al., 1997; Bertin, 2000).

Prior work

A previous study (SAICTED, 2013) has thoroughly investigated the international literature concerning education, technology and management. A brief summary of the results of that study provides insight into prior work and useful background relating to the work that is reported here.

The need for policies and strategies

Local research in South Africa has made very clear the need for adequate management of information technology and information systems in education. Often the focus is on "e-learning" although, as we will see, there are many other facets of education where technology has potential. In their extensive studies of e-learning, Czerniewicz and Brown have identified different philosophies of institutional management of e-learning (Czerniewicz & Brown, 2009, p.130). The essence of their argument is that there are different strategies available with which to organise educational use of technology, and policy makers and senior education managers need to understand and decide which way to go, otherwise there will be contention and confusion between players with different beliefs and expectations. Hence there is a need for managerial leadership that is informed by those beliefs and expectations.

Understanding stakeholders

Engaging with stakeholders is useful only if information can flow both ways. Research has made it clear that successful change management depends crucially on managers hearing and understanding the messages that come from below (Braganza, 2000). In an interesting (and authoritative) analysis of technology in learning in the USA, Evan Straub reminds us that this is not all about "e-learning", there may be a future where systems become integrated across stakeholder groups (Straub, 2009, p.645). Parker identifies, just for the classroom, five different types of information system: "*tutorial, drill and practice, simulation/game, information, and management and assessment*" (Parker, 2010, p.259). Hence, strategies must take on an holistic vision and work to integrate diverse information systems in education (and the information that they use).

Stakeholder interests are important to successful leadership and effective management. It is not just about "e-learning", or "student registration", it is about the need for integrated information management in educational institutions that properly supports all the processes and activities that an institution chooses to undertake.

Implementation can be difficult

Of course, new systems have to be appealing to users and, as we have noted, it is not just about e-learning. Parker argues that the scope of educational systems is actually expanding continuingly, and he alludes to the widespread adoption of "Enterprise Systems" (ES) that can embrace almost all of what a typical business might want to do (Parker, 2010, p.259). We must expect that this trend will continue in education and, as Parker points out, we must have reliable ways to manage the confusion and work performance issues that such systems can cause during implementation. Elsewhere we can find some answers: enterprise systems are seen as creating "*organisational change events [that are] are both common and stressful. One method of coping with the new information needs from an ES implementation is through the auspices of different types of employee advice networks*" (Sykes et al., 2014, p.67). This sounds rather like one example of what Stoltenkamp and Kasuto have reported: following ten or more difficult years with a home-grown learning management system, they won over support for the implementation of a new open source system in a variety of ways, including lunch-time seminars, departmental visits, training and consultation sessions, blogs. This lead to successful, voluntary and productive engagement with academics. (Stoltenkamp & Kasuto, 2009, pp.46–49)

Implementation takes time, and the problem of the rate of change of technology presents itself yet again. However, other problems become evident: at the top of the list is the problem that people do not always react with enthusiasm when faced with changes to the ways that they work.

Lessons from "real" businesses

Finally, it is worth noting that there may be messages for education managers from the wider realm of business. As one example, it is argued that businesses succeed by the appointment of a "chief information officer" (CIO), but there are two types: *"CIOs who focus on IT initiatives for differentiation and CIOs who use IT for efficiency*" (Banker et al., 2011, p.501). This allusion to efficiency and differentiation echoes what came out of the meeting of experts. There may be many more such lessons to be learned.

Summary

A reading of the literature concerning education, management and information technology suggests strongly that there are many managerial issues to be dealt with, and that there is inadequate research that informs us about them. Education managers need to see that there is more at hand than just teaching and learning. For example, research is a key feature of the education landscape and needs good information technology support. Further, administration at all levels needs good systems, but the administration of *postgraduate* students is not the same as that required for *undergraduate* students – an issue that is not always fully appreciated by administrators. There is strong evidence of the importance of dealing properly with different kinds of people. Understanding the needs and expectations of *all* education stakeholders will be critical to success. As one example, managers (the core stakeholder group) need reliable management information for good decision making.

This justifies an investigation of the experiences of representative role players in order to reveal how people in education are involved with information technology and information systems, and how they characterise that involvement. If we understand what they expect as stakeholders, and how their experiences inform their involvement, we can manage their expectations better. In practical terms, depending on their role, they might be involved with *systems*, *services*, or the *projects* that develop systems and services (Whyte & Bytheway, 1996, p.75); the text that follows will simply refer to "*systems"* as a short form of reference to "*systems*, *services*, and *projects"*.

Research design

Two research questions provided foundations for the design of the study, recognising that opinions and experiences of *stakeholders* would provide a rich source of evidence with which to achieve an understanding of information technology and information systems management in higher education:

- What are the dominant experiences of stakeholders in the development, adoption, implementation and use of systems in higher education?
- How do stakeholders characterise those experiences, so as to guide the more effective management of systems investments in higher education?

Because there is little reported work in this area the project needed an exploratory, interpretive approach that would gather data about individual role players' specific experiences, and a proper understanding of the means whereby they make judgments about those experiences. The study therefore proceeded in two stages: *conversations* that yielded qualitative data for open coding, and a *repertory grid analysis* that yielded data with more structure.

Conversations yielding open-coded data

Eight selected academics, users and technical managers were invited to discuss their views of systems based on their experiences. Transcriptions of the conversations were then coded by means of open coding (as described by Strauss and Corbin 1998).

The open coding is summarised here by means of overall frequency analysis (of codes), identification of open coding themes (based on the identification of co-occurring pairs of category codes) and illustration of those themes by means of selected quotations.

Repertory Grid analysis yielding structured quantitative data

Five of the respondents were subsequently involved in additional data collection for repertory grid analysis (see Tan & Hunter, 2002 for an interesting discussion of the use of RepGrid in information systems research). They were asked to identify and characterise significant moments in their recent experiences, so as to identify between five and eight events. The success of these identified events was assessed on a simple five-point scale; there was no attempt made to *define* success in this context, it was left to respondents to make a simple choice on the scale. Events were then characterised using the triadic method that is typically (but not always) used with the repertory grid. With each respondent, the resulting characteristics were then assessed for their applicability to *all* events that emerged from that respondent (not just the event or events from which they were derived) the matrix of events and characteristics stands as the "repertory grid", and examples follow below tabulating events and characteristics with three measures:

- *counts* of the instances within each combination (of an event and a characteristic),
- a calculation of the average *applicability* of each characteristic to each event, and
- a summary of *success* of events within each group that was associated with each characteristic.

Finally, a Bertin Matrix provides a simple overview of the clustering of events and characteristics, using *success* as the combinatorial measure.

Summary

Seven respondents provided a total of 11,635 words of textual material for analysis; five of them also provided repertory grid analysis data. Overall this provided:

- Transcribed textual material based on an open discussion of projects, services or systems with which respondents had been involved.
- A list of five to eight events drawn from those involvements.
- A list of five to eight characteristics, each of which differentiated one event from two or more other events in the view of the respondent.
- A matrix showing the applicability of characteristics across all events – i.e. a matrix of up to eight rows and eight columns (up to 64 cells), each of which gauges the applicability of one characteristic to one event.

Table 1: Sources and Word Counts		
Source	**# Words**	**RepGrid**
Senior IT manager	1787	
Implementation manager	1462	
E-Learning Centre Director	1275	Yes
Implementation Partner	1880	Yes
Research Scientist	1419	Yes
Mature student	1126	Yes
Software house CEO	2686	Yes

Open coding

Frequency

The open coding of this material led to 552 denotata (instances of codes), in 25 "discovered" categories, 18 of which scored more than 5 instances as shown in Figure 1:

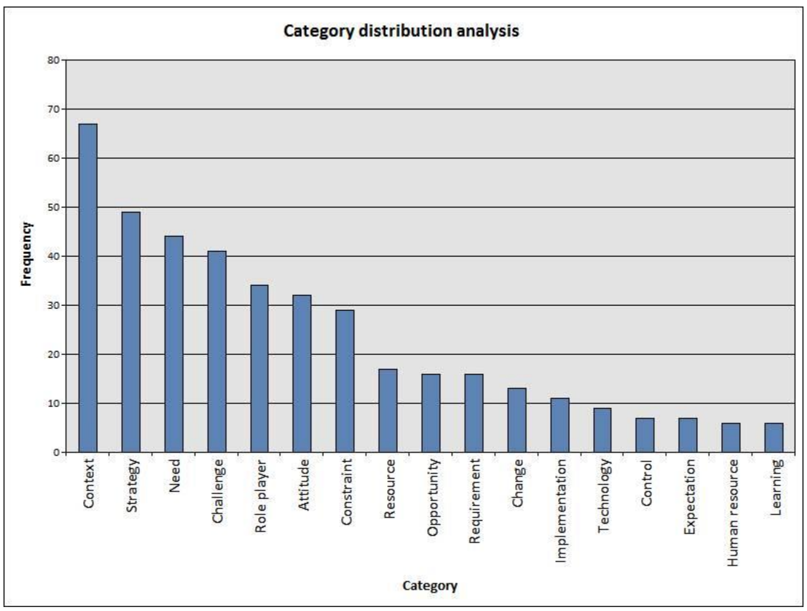

Figure 1: Frequency of occurrence of the principal categories with more than 5 instances

As can be seen, respondents were principally concerned to discuss broader issues such as the *context* within which they work, the *needs* and *challenges* of their organisations, *strategy*, and so on. A detailed analysis is beyond the scope of this paper and it will be argued shortly that the repertory grid analysis produced a more useful result. Nevertheless, the open coding gives a backdrop for the more detailed work and this early evidence from respondents will be referred to again in concluding the present narrative.

Some examples help to paint a more interesting picture of the context for the study and give some insight into the educational activity that was the subject of this research. The extracts from the interview transcripts that follow evidence the origin of some of the principal coding categories, organised according to *context* and *strategy* (having the highest frequencies) and some *other* examples from the remaining categories.

Context

The frequency analysis shows that the *context* within which respondents are working is foremost in their minds. Through detailed content analysis it is found that *context* relates strongly to *challenges*, *attitudes*, *constraints* and *needs*. Two examples of clear contextual constraint illustrate this …

> *They just say to you, go to Ikamva, you'll find it there! That's how you get treated at University! Just go there! They don't tell you how to find it, or what to do ... [Mature student]*

> *Open source of course is challenging, in the sense that we don't own the software, you can't really sell the software and make money with licensing, so you have to find your way around how you make money by other means [Implementation Partner]*

There is one case where independence from the university and a determination to stay close to the real world led to research success:

> *I think one of the reasons we are successful and getting the money, we are just following what industry wants. We are not constrained by anything. But that means that you have to build new systems every year. [Research Scientist]*

It is found that dealing with the boundaries within which people work is a recurring theme in the data. Decisions are made without regard to the people responsible for systems implementation; early support for students does not provide guidance in the use of the learning management system; using open source software gets complicated and sets different boundaries for core and for add-on components; the search for research funding only succeeds by keeping a safe distance from university administration constraints and maintaining strong external contacts.

Strategy

A full and proper strategy would take cognisance of all stakeholder needs and the variation in their demands, as explained by the commercial partner assisting one of the universities (talking about the nature of their relationships with their academic partners):

> *I think one should understand that they like to have control ... It makes it easier for [us] not to be too prescriptive, but to value their input and work with them around what they require ... it's more of a collaborative approach but of course if people don't know what they are doing we will have to prescribe! [Implementation partner]*

This businesswoman has very clear ideas about strategic issues and is willing and able to respond to different client situations. In other conversations, with academics, strategy generally did *not* emerge strongly, but the research scientist had an encouraging instinct for the "bigger picture": in discussing the need to achieve registration for quality management under the ISO 9000 standard, he explained that ...

> *We are not there yet. At the university we are one step away, we are trying to get to the stage where we can commercialise. We are trying to get to the stage where we can hand over [something that could stand as a product], not that we have yet been successful [Research Scientist]*

Whilst *strategy* was primarily seen as a factor relating to *constraint*, it actually touched on more than ten of the other categories in the analysis, for example *control*, *change, expectation*, *learning*, *opportunity* and *risk*. This helps to make clear the importance of strategic management in gaining the best value from investments in information technology and systems. Rather than being something that touches on everything else, in the background, it needs to be at the centre of management thinking.

Other results

Many of the comments expressed an *attitude*, particularly to the challenges and resource limitations in education. A manager responsible for e-learning support, who has been particularly successful in establishing a new learning management system, expressed clearly positive attitudes to her partners (in the implementation of the new learning management system) and her concern to manage the level of control:

> *It took about a year ... for us to start another process, so even though I don't want to get involved in the technology stuff, and I sometimes feel that I should take total control of the thing, it does not work like that. We are partners! [E-Learning Centre Director]*

At the same institution, the mature student had a surprising *attitude* to Dropbox, which was revealed to be a primary vehicle for one lecturer in sharing her learning material, and yet a *challenge* for the student:

> *I have a lecturer that uses Dropbox, but I am not comfortable with Dropbox because I have hardly used it. I now have to get [my husband] to download Dropbox stuff for me, and I don't feel comfortable about that at all. [Mature student]*

Perhaps this student has a *need* to develop self-sufficiency with modern web services such as Dropbox. Other role-players demonstrated high levels of self-sufficiency, for example by developing their own systems where needed. Financial management is a critical *need* in effectively managing research, and the research scientist had an *attitude* that he should develop what was needed, by himself, using Excel:

> *Of course the university has its own finance department - but we have ten managers here and they are all doing a lot of things … we would like to know immediately what is happening with the money. I need to know now, I want to know today, what is in my account! I can't wait two months to hear what my situation is! [Research Scientist]*

He demonstrated a quite advanced financial management system that provided for requisitions and purchasing approvals, avoiding the need to wait for scheduled meetings, and face-to-face discussions in urgent cases, by simply providing the information that is needed for a decision, where it is needed and without delay.

Summary

When one talks to a range of people involved in developing, delivering and using information technology and information systems in education it is not surprising to find such a diversity of perspectives, constraints, and attitudes. But this is the complexity that senior managers in education must deal with if investments in new systems and services are to deliver good returns.

RepGrid analysis

The second phase of the project adopted a more structured approach to data elicitation. Repertory Grid analysis is based on Kelly's Personal Construct Theory. It is not much used in information systems research but it has the merit that it allows for investigation of personal viewpoints in a way that avoids bias from the researcher (Kelly, 1955; Kelly, 1970; Tan & Hunter, 2002). It is also flexible, as Tan and Hunter have shown: it can be used in a quantitative, qualitative or mixed way. It is also pragmatic, as argued by Dick (2000):

> *The individual in its personal world is at the centre, not a supposed average organism in a controlled context. Epistemologically Kelly puts himself in the tradition of empirism and pragmatism. Following this claim, he led the theory of personal constructs to the operative stage of a diagnostic method, whose realisation he described in detail (Dick, 2000).*

At the heart of Kelly's method is the idea that a person's experiences lead to *constructs* that characterise the *elements* that are the subject of study. As an example, in social research, elements might be drawn from the set of people known to a respondent in their social group; constructs are then based on the view of the respondent as to whether contacts are (for example): *close* or *distant*, *friendly* or *unfriendly*, *clever* or *stupid*, *old* or *young*, and so on. In this way, the constructs are bi-polar, and to some degree axial, so that ratings or rankings can be developed: "this person is *extremely* friendly", or "this person is *somewhat* old". According to the nature of the construct, actual quantitative values might be attributed that assess an element on a numerical scale that is useful to the research, such as: "I enjoy being with this person, I have met her 37 times in the last year". The ranking or rating of an element on a bipolar construct scale occurs at the level of the *link*; this is no more than an *instance* of a respondent describing an event on a bipolar scale, as illustrated in the examples given here. However, for the purposes of this research it is necessary to look at *the experiences* of those involved with systems in education, and *the ways* in which they characterise them. Hence, in this study:

- elements are drawn from the *events* that a respondent deems to be interesting or significant, in the context of their involvement with technology-related systems, projects or services in education;
- constructs are developed by means of the triadic method, wherein one event is compared with two others to establish a *characteristic* that the one has that the other two do not (or *vice versa).*

Thus, for the purposes of this work, Kelly's *elements* are here referred to as ***events***, and his *constructs* are here referred to as ***characteristics***. Figure 2 below shows the relationships between events, characteristics and links:

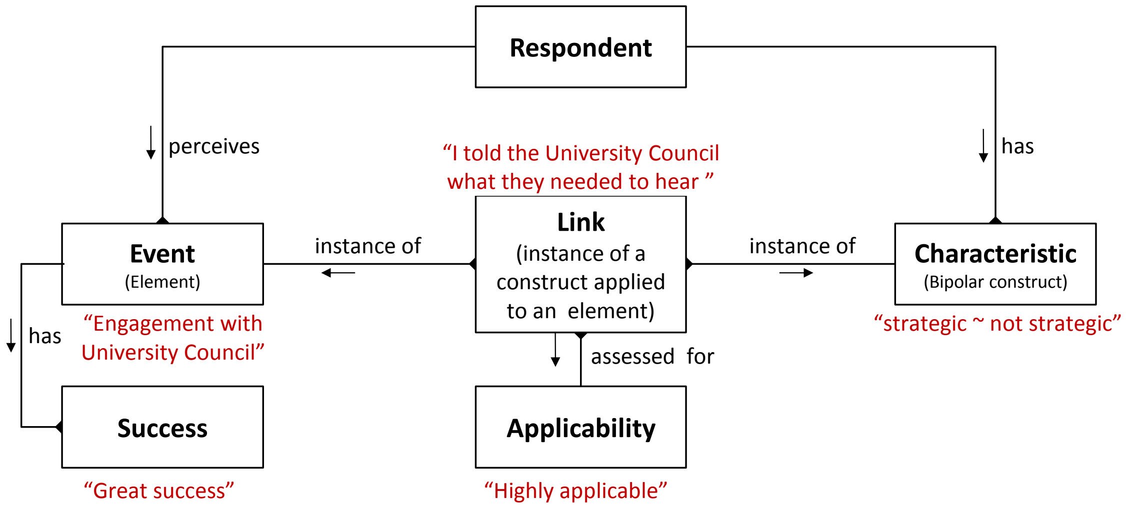

Figure 2: The organisation of the RepGrid data

While it is common when using Kelly's methods to rank or rate an instance of an element-construct pair on the bipolar construct scale, this research is concerned with understanding the *characteristics* of *events*, as perceived by those who are involved, and the degree to which those characteristics might apply to events of different kinds. It was therefore decided to rate event-characteristic pairs (the *links* in Kelly's terminology) according to the *applicability* of the characteristic to events, as well as to the *success* of the discovered events (as expressed by respondents). Figure 2 above shows the arrangement of these ideas and includes an illustration of typical data (in red, in the original): in an event that was "engagement with university council" the "strategic~not strategic" scale is considered to be "highly applicable"; the extent of success of that event was considered to be "great success".

Overall, respondents talked about 17 systems (or services, or projects) of many different kinds. The research scientist talked of his work with a "battery management" system that is critical to the operation of new battery technologies; for the mature student "WhatsApp" had become a key means of communication; the outsource partner was, naturally, very involved with the specific "open source learning management system" that they supported. Their experiences in those 17 systems, projects and services identified 38 events, that led to 55 bipolar characteristics, each assessed for applicability to all events in 226 instances.

Consolidation of characteristics and events

As would be expected, respondents used different terms to refer to what are essentially the same concepts or the same kinds of events. A peer-reviewed consolidation of all 55 characteristics and all 38 events was undertaken. This accommodated them within nine higher-level bipolar groups, and eight higher-level event groups. For example, for the present purpose "prototyping" is just another form of "determining requirements", and both can be accommodated in a higher-level group that can be called "DESIGN" (upper case is used here to denote the high level groups that emerged from the consolidation). The high-level groups, and the number (#) of low-level items that are accommodated in each, are presented in the table that follows. Details of all the original data, and a record of how events and characteristics were consolidated, are provided in the Appendix at the end of this paper.

The consolidation of *events* fell quite easily into a sequence that represents the initiation, design, development, testing, implementation and operation of systems; management can be seen as over-arching and might touch on all stages of the lifecycle (as well as on other things). The consolidation of *characteristics* cannot be seen in the same way, and is open to some interpretation. The table shows the characteristics' names in short form and in bipolar form. In the narrative that follows the short form of characteristic groups are shown in SMALL CAPS; event groups are shown in *SMALL CAPS IN ITALICS*.

Table 2: Consolidation of characteristics and events

Characteristic (simple form)	Consolidated characteristic groups (bipolar form)	#	Consolidated event groups	#
INNOVATION	INNOVATIVE : CONVENTIONAL	5	*INITIATE*	6
SCOPE	INSIDE : OUTSIDE	16	*DESIGN*	4
RISK	CERTAINTY : UNCERTAINTY	5	*BUILD*	2
DIFFICULTY	DIFFICULT : EASY	4	*OUTSOURCE*	4
CHANGE	CHANGE : CONSTANCY	4	*TEST*	1
CONTROL	CONTROLLED : UNCONTROLLED	6	*IMPLEMENT*	6
COST	LOW COST : HIGH COST	2	*OPERATE*	7
VALUE	VALUE : COST	5	*MANAGE*	8
SUCCESS	SUCCESS : FAILURE	8		

Using these consolidated views of the data, three analyses were undertaken of the measure available therein:

1. How many *instances* of the nine characteristics are to be found in each of the event groups?
2. How *applicable* do respondents consider that these characteristics are, across all event groups?
3. How does the *success* of the events relate to the characteristics in the different event groups?

The three tables that follow summarise the results of this analysis. Missing data (indicated by a blank cell) results from some combinations of event and characteristic not being represented in the source data. This is not a shortcoming of the dataset, it is indicative of areas of work where some characteristics have limited or no applicability in the view of respondents, and so it is actually a useful research result.

1: Frequencies

Table 3 below preserves the sequence of events, according to the lifecycle and management, but the rows are organised according to the number of total instances in each row, highest at the top.

It is seen that SCOPE had almost twice as many instances (61) as any other. Then there is evidence of SUCCESS (34), VALUE (30), and CERTAINTY (20). The other characteristics trail, and COST (11) and CHANGE (9) are the least frequent – this is surprising in light of the widely-held belief that education is being driven by technology-induced change.

Table 3: Frequency of occurrence of Links

	INITIATE	DESIGN	BUILD	OUTSOURCE	TEST	IMPLEMENT	OPERATE	MANAGE	Totals:
INSIDE : OUTSIDE	9	3	2	8		12	13	14	61
SUCCESS : FAILURE	4			2	2	7	15	4	34
VALUE : COST	3	1	1	3	1	6	11	4	30
CONTROLLED : UNCONTROLLED	5	3	3	4		5	1	6	27
CERTAINTY : UNCERTAINTY	2			4		4	2	8	20
DIFFICULT : EASY	4	3	3	2	1	4		2	19
INNOVATIVE : CONVENTIONAL	4	2	2		2	3		2	15
LOW COST : HIGH COST	2	2	2	2		2		1	11
CHANGE : CONSTANCY	1				1	2	5		9
Totals:	34	14	13	25	7	45	47	41	

Hence we find that understanding the importance of the SCOPE of a system (or project, or service) and managing it effectively are clearly important, especially during *INITIATION*, *IMPLEMENTATION* and *OPERATION*. SUCCESS and VALUE are seen when systems or services go operational. There is also evidence that the SCOPE of *MANAGEMENT* activity is an issue. Respondents are also more concerned with project *INITIATION*, *IMPLEMENTATION*, *OPERATION* and *MANAGEMENT* than with the work of development.

2: Applicability

Table 4 also preserves the sequence of events as before, and the rows are now sorted according to the average of all applicabilities of the characteristics across the different kinds of event.

The figures in the table are derived from an assessment, within the data from each respondent, of the applicability of every low level characteristic (55 in total) to every event (38 in total), leading to a total of 226 instances of applicability, on a five-point scale. The averages presented below are calculated selectively from the original low-level data within each intersection of event group with characteristic; the overall averages were also calculated based on the original low-level data, so as to preserve the integrity of the results, they are *not* averages of the figures that can be seen in the body of the table.

SCOPE is again high on the list: yet again we find that understanding what happens inside and outside the organisation is important. RISK and INNOVATION have risen to the top, however, and SUCCESS has fallen; CHANGE and COST remain at the bottom of the list, implying that they are not only infrequently see as issues, but they have the lowest applicability. On the other hand, *INITIATION*, *IMPLEMENTATION* and *MANAGEMENT* show generally high levels of applicability of characteristics (refer to the bottom line).

Table 4: Applicability of characteristics

	INITIATE	DESIGN	BUILD	OUTSOURCE	TEST	IMPLEMENT	OPERATE	MANAGE	Averages:
CERTAINTY : UNCERTAINTY	5.00			3.50		5.00	3.50	4.13	4.20
INNOVATIVE : CONVENTIONAL	4.50	4.50	3.00		4.50	2.00		4.50	3.80
INSIDE : OUTSIDE	3.78	2.33	4.50	4.00		3.83	3.38	4.07	3.75
SUCCESS : FAILURE	4.75			2.50	3.50	4.57	3.40	3.00	3.71
CONTROLLED : UNCONTROLLED	3.40	3.67	4.00	3.00		3.00	4.00	4.17	3.56
DIFFICULT : EASY	2.75	4.67	3.67	3.50	2.00	3.25		4.50	3.53
VALUE : COST	4.33	5.00	5.00	2.33	1.00	2.67	3.09	5.00	3.37
LOW COST : HIGH COST	3.50	3.50	2.00	3.50		5.00		2.00	3.36
CHANGE : CONSTANCY	2.00				4.00	3.50	3.20		3.22
Averages:	3.85	3.79	3.62	3.36	3.29	3.67	3.32	4.07	

[Note that the averages given here at the right hand side are calculated as the averages of the original low-level data, not of the aggregated data that is presented in the body of this table]

Hence we find that respondents are very concerned that they should have certainty and a degree of CONTROL in working with information technology and systems, and they are concerned to understand the degree of INNOVATION that they are dealing with as well as the scope – as already mentioned. Although the differences are small across the event groups, *MANAGEMENT* is more informed by the characteristics than any other event group.

3: Success

Respondents were asked to rate the outcome of events, as "successful" or not, on a five point scale. The averages across the bottom line of the Table 5 give an indication of how much success was achieved, across all systems and all respondents, suggesting that successful *DESIGN*, *OUTSOURCING* and *OPERATION* are the most likely kinds of event to succeed, according to respondents' experiences. On the other hand, successful *INITIATION* and *IMPLEMENTATION* are more difficult to achieve.

Table 5: Success of events

	INITIATE	DESIGN	BUILD	OUTSOURCE	TEST	IMPLEMENT	OPERATE	MANAGE	Averages:
CERTAINTY : UNCERTAINTY	3.00			3.50		3.00	4.00	3.25	3.30
INSIDE : OUTSIDE	2.56	3.67	3.00	3.25		3.00	3.38	3.07	3.10
VALUE : COST	2.33	3.00	3.00	3.33	3.00	2.83	3.27	3.25	3.07
SUCCESS : FAILURE	2.25			3.50	3.00	2.71	3.33	3.25	3.06
CONTROLLED : UNCONTROLLED	2.60	3.67	3.00	3.00		3.00	4.00	2.83	3.00
CHANGE : CONSTANCY	2.00				3.00	2.50	3.20		2.89
LOW COST : HIGH COST	2.50	3.50	3.00	2.50		3.00		2.00	2.82
INNOVATIVE : CONVENTIONAL	2.50	4.00	3.00		3.00	2.67		2.00	2.80
DIFFICULT : EASY	2.50	3.67	3.00	2.50	3.00	2.75		2.00	2.79
Averages:	2.50	3.64	3.00	3.16	3.00	2.87	3.36	2.98	

[Note that the averages given here at the right hand side are calculated as the averages of the original low-level data, not of the aggregated data that is presented in the body of this table]

This analysis suggests that the success of systems-related events in the general mêlée of academic life is not *strongly* related to the constructs that we would use to characterise them; the spread of the results in this table (across events and characteristics, as shown in averages) is not so wide, and therefore the result is not particularly interesting unless we can attribute high significance to the small differences. This is partly because the measure of success derives from only 31 events out of the 38 that were recorded (principally because of the random nature of the triadic process, whereas the tabulation of applicabilities was derived from 226 applicabilities – every characteristic was tested for application to every event, within each of the individual datasets provided by respondents).

It is because the size of the "success" dataset is quite limited that an appropriate vehicle is needed for the analysis.

The Bertin Matrix

The Bertin Matrix is a way to visualise small datasets. It avoids obscuring the significance of the data in complex statistical or qualitative procedures that might be unreliable with small sample sizes (Bertin, 1973; Bertin, 2000). As Antoine de Falguerolles explains:

> *Bertin introduced a display and analysis strategy for multivariate data with low or medium sample size. Bertin tries to make the information in a dataset understandable. He does not fit models: he tries to provide simple tools to interrogate data (de Falguerolles et al., 1997, p.1).*

Figure 3 shows a Bertin Matrix that has been derived from the "event success" data gathered in this study – it uses the same "success" data as already given in Table 5. In each of the cells in the matrix, the number indicates the extent to which event success was found in those events in the event group (column) where the characteristic group (row) was seen by respondents to have application. Bertin uses visualisation of different kinds in his writings about graphical displays; here colour has been used to show areas of considerable success (the increasingly dark shades of green) and areas of more limited success (yellow). The coloured "flags" are a further aid to assessing the data. There were very few instances of outright failure in the data and so this result can be interpreted thus: the range 2.00 -> 2.60 indicates "limited success" (red flags), 2.60 -> 3.50 indicates "some success" (yellow flags) and 3.50-4.00 indicates "great success" (green flags). A blank cell occurs where no respondent nominated a characteristic in that group (the row) that would apply to an event in that event group (the column). As already noted, this is not a shortcoming of the dataset, it is indicative of areas of work where some characteristics have limited or no applicability, and a blank cell is therefore a research result.

	OPERATE	OUTSOURCE	MANAGE	IMPLEMENT	INITIATE	DESIGN	BUILD	TEST
CERTAINTY : UNCERTAINTY	4.00	3.50	3.25	3.00	3.00			
INSIDE : OUTSIDE	3.38	3.25	3.07	3.00	2.56	3.67	3.00	
VALUE : COST	3.27	3.33	3.25	2.83	2.33	3.00	3.00	3.00
CONTROLLED : UNCONTROLLED	4.00	3.00	2.83	3.00	2.60	3.67	3.00 4	
SUCCESS : FAILURE	3.33	3.50	3.25 2	2.71	2.25			3.00
CHANGE : CONSTANCY	3.20 1			2.50	2.00			3.00
LOW COST : HIGH COST		2.50	2.00	3.00	2.50	3.50	3.00	
DIFFICULT : EASY		2.50	2.00	2.75	2.50	3.67	3.00	3.00
INNOVATIVE : CONVENTIONAL			2.00	2.67	2.50 3	4.00	3.00 5	3.00 6

Figure 3: A Bertin Matrix

In this case the rows and columns of the matrix are sorted, in the manner described by Bertin, so as to bring together domains that seem to share the same levels of success. There was some statistical experimentation with correlation and principal component analysis, but the results were affected by the "missing values" and it could be argued that such statistical methods are contrary to the approach that Bertin espoused: his intention was – to put it simply – to "let the data speak for itself".

Event groups showing higher levels of success include *OPERATION*, *OUTSOURCING* and *DESIGN*; *BUILD*, *IMPLEMENTATION* and *MANAGEMENT* show moderate success although *MANAGEMENT* struggles to show success where COST, DIFFICULTY and INNOVATION are applicable. *Initiation* also struggles to show success, perhaps because it is at a very early stage in the life cycle. *TEST* has so few data points that it would be reckless to draw conclusions there.

The characteristic groups re-inforce the consistent importance across the life cycle of SCOPE and CERTAINTY, especially in *MANAGEMENT*, *OUTSOURCING* and *OPERATION* – not so much in the core activities of *DESIGNING*, *BUILDING* and *TESTING*. Where COST, DIFFICULTY and INNOVATION are applicable there are mixed relations with success, especially with *MANAGEMENT* (as already noted).

Some brief notes on the enumerated domains marked out in Figure 3 in red follow.

1. Success is largely seen in the *OPERATION* of systems and services. There is a particular concern for the management of CERTAINTY, SCOPE and CONTROL.
2. *OUTSOURCING* and *MANAGEMENT* share an apparent dependency on five of the nine characteristic groups but not on change. *OUTSOURCING* is something of a special case as here clearly SCOPE will be of prominent importance, and it is more to do with management than with operational activities.
3. *INITIATION* and *IMPLEMENTATION* share a dependency on all the characteristics but success is seen more obviously during the latter stage – that is to be expected of course.
4. *DESIGN* and *BUILD* are both concerned with the nitty-gritty of development and the data suggests dependency on SCOPE, VALUE and CONTROL …
5. … also on COST, DIFFICULTY and the level of INNOVATION.
6. As noted, *TESTING* has few data points, indicating that it did not feature much in the engagement with respondents. This itself is a matter for concern. Although educational systems and services are not generally safety critical, an untested system that fails will undermine stakeholder confidence.

It is surprising that the operational event groups, *DESIGN BUILD* and *TEST*, provided few or no instances of dependency on SUCCESS and CERTAINTY as these event groups contribute very directly to success in practice. Generally, this study reveals a relatively low level of interest in, or attention to, the practical matters of design, build, test and operation, but that might be because respondents were non-technical, or technical only at a managerial level.

Summary of findings

The repertory grid has delivered a more interesting and nuanced result than the open coding. The multifarious low-level events and characteristic scales were able to be usefully accommodated in two sets of higher level groups: the event groups reflected the classical systems lifecycle (from initiation to operation) and added management but the characteristic groups had no particular pattern.

The Bertin Matrix shows the correlation of events and characteristics by an informal process, and it does so with some success. Issues of managing the SCOPE of systems (and services, and projects) are pre-eminent and especially important for successful *INITIATION*, system *BUILDING*, *MANAGEMENT*, and decisions about *OUTSOURCING*. Change was seen as axiomatic at the start of this narrative (from the meeting of experts) but it is the least-frequently mentioned characteristic. *IMPLEMENTATION* and *OPERATION* are the stages of the lifecycle where CHANGE becomes visible and real, especially to those who will use the system or service. But an understanding of the degree of change that will emerge is important from the start.

An attempt to analyse the way that success depends on the applicability of characteristics produced limited results. Most success is seen in *INITIATION* and *IMPLEMENTATION* and least in *DESIGN*.

Conclusion

This project set out to answer two questions that would inform us about understanding information technology and information systems management in higher education. They are re-stated with a final commentary here.

What are the dominant experiences of stakeholders in the development, adoption, implementation and use of systems in higher education?

The dominant experiences of stakeholders in higher education, as represented by this small sample, are mixed. Many respondent experiences revolved around activities depending on scope, and for this writer the most important result is that, as we seek to integrate systems and as the reach of our systems and services increases, then managing the *scope* of our systems and understanding the *boundaries* of what we do becomes essential. Within the work that is done, initiation and implementation activities also came up repeatedly and deserve our fullest attention in the future, because they are the activities that bring scope to the fore. Systems and service development projects that are *not* properly focused on the needs of defined users, in defined educational processes, are at serious risk of failure.

> *We got to the end, user testing still wasn't being done properly, and then production was moved out one month … we actually had like two and a half months to finish that project, which was crazy! So we did our best, but then their testing was a bit lacking … things [went] a bit bonkers! [Implementation Partner]*

Much of what was discussed with respondents could easily be accommodated in what we call "strategy". This is a word that is often used but rarely fully explicated and not much evident in practice …

> *That's our problem - someone's made a decision, they're pushing it on and you are going to have to conform to whatever is decided! [Implementation Manager]*

… and this is from a senior technical manager who has seen more water flow under the bridges of education than virtually anyone around him.

The people issues came through in the attitudes that respondents revealed in the open coding. Success in an e-learning centre is clearly derived from the attention the director has paid to the people issues. She had a strong concern to work closely and constructively with all around her. When asked whether people were looking to her you to take responsibility she replied:

> *I think I played a major part … they looked at me as the leader and what I did for the university was I worked closely with [the IT people], because they are a partner. [E-Learning Centre Director]*

How do stakeholders characterise those experiences, so as to guide the more effective management of systems investments in higher education?

This project has revealed and ranked nine groups of characteristics that warrant further study. Of over-riding concern, based on the data, is the matter of *scope*: exactly what is within the scope of a developing or operating system, or service? Unless scope is understood difficulty seems to be assured, even for students:

> *This here is "university" … the scope over there is much broader - Yes! I like that! [Mature student]*

Secondarily, respondents see the management of control, cost, value, risk and innovation as distinct strategic areas of importance.

The e-learning centre director provides a focus for our final thoughts about scope and people, in her reflections on her vision:

> *The vision I have is that all lecturers, all support centres, no matter who they are, we all have an online presence. When students come here, they are already living in a space where they think 'I will have an online pseudonym'. So my vision is still that these things are ubiquitous … The vision I have is that it's everybody's business - I think that we are living that out. [E-Learning Centre Director]*

This work has provided insight into the way that information technology and systems are used in higher education, and it has demonstrated the differences between open and structured analysis of research data and the efficacy of related analytical techniques. It provides a stimulus and some structure for further work that will, hopefully, help to improve the return that is gained from investments in educational information technology and information system.

Appendix

These two figures provide the detail of the original expression of events and characteristics (in the words used by the respondents, in lower case) and the higher level groupings that were adopted for the RepGrid and Bertin analysis.

- INITIATE
  - Initiating strategic research
  - Startup meeting with champion
  - "Go" decision
  - Discovery of PLECO Chinese-English translator for smart phone
  - Realisation the potential of a 'dashboard'
  - Realisation that database design improvements were needed
- DESIGN
  - Determine requirements
  - Realisation that a maximum of '5 clicks' must lead to useful answers
  - Prototyping
  - Complete specification
- BUILD
  - Build new system
  - Discovering that web development tools are not mature
- OUTSOURCE
  - Draft engineering drawings and fabrication
  - Outsource LabView
  - Decision to host new LMS outside the University
  - Partnership
- TEST
  - User testing
- IMPLEMENT
  - Change business model
  - Bare instruction to "go there" (to iKamva)
  - Adopt financial management system
  - Rollout complexity
  - E-Tools course embedded in induction programme
  - Design of training programme
- OPERATION
  - Discoverying iKamva
  - Getting messages
  - Getting marks
  - Social update
  - Prof Fink
  - Realisation of risks of isolation
  - Sakai 'WOW' moment(s)
- MANAGE
  - Decision to start research
  - Feedback meetings
  - Quotation dilemma
  - Mind change
  - High costs
  - Summarising the history of LMSs in Higher Education
  - Documentation of the decision to go ahead
  - Engagement with University Council

Figure 4: Consolidation of events

- INNOVATIVE : CONVENTIONAL
  - Agility/Scrum : Structure/Conventional
  - Motivated : Not motivated
  - Novelty : Familiarity
  - New technology : Legacy technology
  - Novelty : Familiarity
- INSIDE : OUTSIDE
  - In scope : Out of scope
  - Many-ness : One-ness
  - In-University : Out-of-University
  - In-process : Out-of-process
  - Research : Management
  - Within discretion : Outside discretion
  - In project : Out of project (management)
  - Internal : External
  - Engaged : Not engaged
  - Development management : Client management
  - Might write their own standard : Can use published standard
  - Outside organisation : Inside organisation
  - Additional people involved : Can use existing team
  - External : Contained
  - Embedding : Isolating
  - Outsource : Insource
- CERTAINTY : UNCERTAINTY
  - On plan : Off plan
  - In control and responsible : Out of control despite effort
  - Reliable : Unreliable
  - Feedback : No Feedback
  - Preparation : Confusion
- DIFFICULT : EASY
  - Repeatable : One-off
  - Changing requirements : Fixed requirements
  - Challenging : Easy
  - Easy delivery : Problematic delivery
- CHANGE : CONSTANCY
  - Managed change : Loosely managed change
  - Lobbying : Capitulating
  - Anxiety (creating) : Anxiety (reducinig)
  - Behaviour change : No behaviour change
- CONTROLLED : UNCONTROLLED
  - All projects : One project
  - Visuality : Obscurity (paper reports)
  - Measureable : Not measureable
  - Own standards : Brought-in standards
  - Need for standards : Need for agility, liberal thinking
  - Owned : Not owned
- LOW COST : HIGH COST
  - Expensive : Economical
  - Low rollout cost : High rollout cost
- VALUE : COST
  - Input : Output
  - IP Development : IP Exploitation
  - Commercial : Non-commercial
  - Excitement : Tedium
  - Strategic : Not strategic
- SUCCESS : FAILURE
  - Liberation : Constrainment
  - Power-giving : Disabling
  - Championed : Not championed
  - Snr Management commitment : Lack of commitment
  - Connectedness : Disconnectedness
  - Research benefit : No research benefit
  - Giving : Receiving
  - Making reputation : Losing reputation

Figure 5: Consolidation of characteristics

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