The availability, applicability and utility of Information Systems Engineering standards in South African higher education

(Appendices)

Contents:

This volume contains the Appendices that support the thesis, submitted separately

Appendix 1 **ISO-IEC/JTC1/SC7 Published Standards**

The current scope of work in SC7 is currently indicated to be:

IT Service Management
IT Enabled Services and Business Process Outsourcing
IS Governance
Software system products
Enterprise architecture
Software engineering environment
Software engineering body of knowledge
Management of software assets

The following are the published standards that are publically available at the time of writing, sorted into date order:

Standard	Date	Title and notes
ISO 3535	1977	Forms design sheet and layout chart
ISO 5806	1984	Information processing -- Specification of single-hit decision tables
ISO 5807	1985	Information processing -- Documentation symbols and conventions for data, program and system flowcharts, program network charts and system resources charts
ISO 8790	1987	Information processing systems -- Computer system configuration diagram symbols and conventions
ISO 9127	1988	Information processing systems -- User documentation and cover information for consumer software packages
ISO 8807	1989	Information processing systems -- Open Systems Interconnection -- LOTOS -- A formal description technique based on the temporal ordering of observational behaviour
ISO/IEC 8631	1989	Information technology -- Program constructs and conventions for their representation
ISO/IEC 11411	1995	Information technology -- Representation for human communication of state transition of software
ISO/IEC 14568	1997	Information technology -- DXL (Diagram eXchange Language for tree-structured charts)
ISO/IEC TR 12182	1998	Information technology -- Categorization of software
ISO/IEC 10746-1	1998	Information technology -- Open Distributed Processing -- Reference model (Overview)
ISO/IEC 10746-4	1998	Information technology -- Open Distributed Processing -- Reference Model (Architectural semantics)
ISO/IEC 13235-1	1998	Information technology -- Open Distributed Processing -- Trading function (Specification)
ISO/IEC 13235-3	1998	Information technology -- Open Distributed Processing -- Trading Function -- Part 3 (Provision of Trading Function using OSI Directory service)
ISO/IEC 14598-5	1998	Information technology -- Software product evaluation -- Part 5 (Process for evaluators)
ISO/IEC 14598-5	1998	Software engineering -- Product evaluation -- Part 5 (Process for evaluators)
ISO/IEC 14598-1	1999	Information technology -- Software product evaluation -- Part 1 (General overview)
ISO/IEC 14756	1999	Information technology -- Measurement and rating of performance of computer-based software systems

ISO/IEC 14750	1999	Information technology -- Open Distributed Processing -- Interface Definition Language
ISO/IEC 14753	1999	Information technology -- Open Distributed Processing -- Interface references and binding
ISO/IEC 14771	1999	Information technology -- Open Distributed Processing -- Naming framework
ISO/IEC TR 14759	1999	Software engineering -- Mock up and prototype -- A categorization of software mock up and prototype models and their use
ISO/IEC 14598-4	1999	Software engineering -- Product evaluation -- Part 4 (Process for acquirers)
ISO/IEC 14752	2000	Information technology -- Open Distributed Processing -- Protocol support for computational interactions
ISO/IEC 14598-2	2000	Software engineering -- Product evaluation -- Part 2 (Planning and management)
ISO/IEC 14598-3	2000	Software engineering -- Product evaluation -- Part 3 (Process for developers)
ISO/IEC 15437	2001	Information technology -- Enhancements to LOTOS (E-LOTOS)
ISO/IEC 14769	2001	Information technology -- Open Distributed Processing -- Type Repository Function
ISO/IEC 14598-6	2001	Software engineering -- Product evaluation -- Part 6 (Documentation of evaluation modules)
ISO/IEC 9126-1	2001	Software engineering -- Product quality -- Part 1 (Quality model)
ISO/IEC 15474-1	2002	Information technology -- CDIF framework -- Part 1 (Overview)
ISO/IEC 15474-2	2002	Information technology -- CDIF framework -- Part 2 (Modelling and extensibility)
ISO/IEC 15476-1	2002	Information technology -- CDIF semantic metamodel -- Part 1 (Foundation)
ISO/IEC 15476-2	2002	Information technology -- CDIF semantic metamodel -- Part 2 (Common)
ISO/IEC 15475-1	2002	Information technology -- CDIF transfer format -- Part 1 (General rules for syntaxes and encodings)
ISO/IEC 15475-2	2002	Information technology -- CDIF transfer format -- Part 2 (Syntax SYNTAX.1)
ISO/IEC 15475-3	2002	Information technology -- CDIF transfer format -- Part 3 (Encoding ENCODING.1)
ISO/IEC TR 14143-4	2002	Information technology -- Software measurement -- Functional size measurement -- Part 4 (Reference model)
ISO/IEC 20968	2002	Software engineering -- Mk II Function Point Analysis -- Counting Practices Manual
ISO/IEC 15504-2	2003	Information technology -- Process assessment -- Part 2 (Performing an assessment)
ISO/IEC TR 14143-3	2003	Information technology -- Software measurement -- Functional size measurement -- Part 3 (Verification of functional size measurement methods)
ISO/IEC TR 9126-2	2003	Software engineering -- Product quality -- Part 2 (External metrics)
ISO/IEC TR 9126-3	2003	Software engineering -- Product quality -- Part 3 (Internal metrics)
ISO/IEC 15504-1	2004	Information technology -- Process assessment -- Part 1 (Concepts and vocabulary)
ISO/IEC 15504-3	2004	Information technology -- Process assessment -- Part 3 (Guidance on performing an assessment)
ISO/IEC 15504-4	2004	Information technology -- Process assessment -- Part 4 (Guidance on use for process improvement and process capability determination)
ISO/IEC TR 14143-5	2004	Information technology -- Software measurement -- Functional size measurement -- Part 5 (Determination of functional domains for use with functional size measurement)
ISO/IEC 90003	2004	Software engineering -- Guidelines for the application of ISO 9001 (2000 to computer software)
ISO/IEC TR 9126-4	2004	Software engineering -- Product quality -- Part 4 (Quality in use metrics)

ISO/IEC 15909-1	2004	Systems and software engineering -- High-level Petri nets -- Part 1 (Concepts, definitions and graphical notation)
ISO/IEC 25000	2005	Software Engineering -- Software product Quality Requirements and Evaluation (SQuaRE) -- Guide to SQuaRE
ISO/IEC 15476-4	2005	Information technology -- CDIF semantic metamodel -- Part 4 (Data models)
ISO/IEC 19501	2005	Information technology -- Open Distributed Processing -- Unified Modeling Language (UML) Version 1.4.2
ISO/IEC TR 19759	2005	Software Engineering -- Guide to the Software Engineering Body of Knowledge (SWEBOK)
ISO/IEC 24570	2005	Software engineering -- NESMA functional size measurement method version 2.1 -- Definitions and counting guidelines for the application of Function Point Analysis
ISO/IEC 19770-1	2006	Information technology -- Software asset management -- Part 1 (Processes)
ISO/IEC 16085	2006	Systems and software engineering -- Life cycle processes -- Risk management
ISO/IEC 15476-3	2006	Information technology -- CDIF semantic metamodel -- Part 3 (Data definitions)
ISO/IEC 15476-6	2006	Information technology -- CDIF semantic metamodel -- Part 6 (State/event models)
ISO/IEC 15414	2006	Information technology -- Open distributed processing -- Reference model (Enterprise language)
ISO/IEC 15940	2006	Information Technology -- Software Engineering Environment Services
ISO/IEC 14143-6	2006	Information technology -- Software measurement -- Functional size measurement -- Part 6 (Guide for use of ISO/IEC 14143 series and related International Standards)
ISO/IEC 23026	2006	Software Engineering -- Recommended Practice for the Internet -- Web Site Engineering, Web Site Management, and Web Site Life Cycle
ISO/IEC 14764	2006	Software Engineering -- Software Life Cycle Processes -- Maintenance
ISO/IEC 25062	2006	Software engineering -- Software product Quality Requirements and Evaluation (SQuaRE) -- Common Industry Format (CIF) for usability test reports
ISO/IEC 25051	2006	Software engineering -- Software product Quality Requirements and Evaluation (SQuaRE) -- Requirements for quality of Commercial Off-The-Shelf (COTS) software product and instructions for testing
ISO/IEC 15939	2007	Systems and software engineering -- Measurement process
ISO/IEC 26702	2007	Systems engineering -- Application and management of the systems engineering process
ISO/IEC TR 14471	2007	Information technology -- Software engineering -- Guidelines for the adoption of CASE tools
ISO/IEC 14143-1	2007	Information technology -- Software measurement -- Functional size measurement -- Part 1 (Definition of concepts)
ISO/IEC 24744	2007	Software Engineering -- Metamodel for Development Methodologies
ISO/IEC 25020	2007	Software engineering -- Software product Quality Requirements and Evaluation (SQuaRE) -- Measurement reference model and guide
ISO/IEC 25001	2007	Software engineering -- Software product Quality Requirements and Evaluation (SQuaRE) -- Planning and management
ISO/IEC TR 25021	2007	Software engineering -- Software product Quality Requirements and Evaluation (SQuaRE) -- Quality measure elements
ISO/IEC 25030	2007	Software engineering -- Software product Quality Requirements and Evaluation (SQuaRE) -- Quality requirements
ISO/IEC 12207	2008	Systems and software engineering -- Software life cycle processes
ISO/IEC 15288	2008	Systems and software engineering -- System life cycle processes

ISO/IEC TR 90005	2008	Systems engineering -- Guidelines for the application of ISO 9001 to system life cycle processes
ISO/IEC 14102	2008	Information technology -- Guideline for the evaluation and selection of CASE tools
ISO/IEC 19793	2008	Information technology -- Open Distributed Processing -- Use of UML for ODP system specifications
ISO/IEC TR 15504-6	2008	Information technology -- Process assessment -- Part 6 (An exemplar system life cycle process assessment model)
ISO/IEC TR 15504-7	2008	Information technology -- Process assessment -- Part 7 (Assessment of organizational maturity)
ISO/IEC 24773	2008	Software engineering -- Certification of software engineering professionals -- Comparison framework
ISO/IEC 25012	2008	Software engineering -- Software product Quality Requirements and Evaluation (SQuaRE) -- Data quality model
ISO/IEC 26514	2008	Systems and software engineering -- Requirements for designers and developers of user documentation
ISO/IEC/IEEE 16326	2009	Systems and software engineering -- Life cycle processes -- Project management
ISO/IEC 10746-2	2009	Information technology -- Open distributed processing -- Reference model (Foundations)
ISO/IEC 10746-3	2009	Information technology -- Open distributed processing -- Reference model (Architecture)
ISO/IEC TR 20000-3	2009	Information technology -- Service management -- Part 3 (Guidance on scope definition and applicability of ISO/IEC 20000-1)
ISO/IEC 19770-2	2009	Information technology -- Software asset management -- Part 2 (Software identification tag)
ISO/IEC TR 24766	2009	Information technology -- Systems and software engineering -- Guide for requirements engineering tool capabilities
ISO/IEC 20926	2009	Software and systems engineering -- Software measurement -- IFPUG functional size measurement method 2009
ISO/IEC 26513	2009	Systems and software engineering - Requirements for testers and reviewers of user documentation
ISO/IEC TR 18018	2010	Information technology -- Systems and software engineering -- Guide for configuration management tool capabilities
ISO/IEC TR 24774	2010	Systems and software engineering -- Life cycle management -- Guidelines for process description
ISO/IEC TR 20000-4	2010	Information technology -- Service management -- Part 4 (Process reference model)
ISO/IEC TR 20000-5	2010	Information technology -- Service management -- Part 5 (Exemplar implementation plan for ISO/IEC 20000-1)
ISO/IEC 29881	2010	Information technology -- Systems and software engineering -- FiSMA 1.1 functional size measurement method
ISO/IEC TR 24748-1	2010	Systems and software engineering -- Life cycle management -- Part 1 (Guide for life cycle management)
ISO/IEC TR 15026-1	2010	Systems and software engineering -- Systems and software assurance -- Part 1 (Concepts and vocabulary)
ISO/IEC 25045	2010	Systems and software engineering -- Systems and software Quality Requirements and Evaluation (SQuaRE) -- Evaluation module for recoverability
ISO/IEC/IEEE 24765	2010	Systems and software engineering -- Vocabulary
ISO/IEC/IEEE 29148	2011	Systems and software engineering -- Life cycle processes -- Requirements engineering

ISO/IEC TS 15504-10	2011	Information technology -- Process assessment -- Part 10 (Safety extension)
ISO/IEC TS 15504-9	2011	Information technology -- Process assessment -- Part 9 (Target process profiles)
ISO/IEC 20000-1	2011	Information technology -- Service management -- Part 1 (Service management system requirements)
ISO/IEC 14143-2	2011	Information technology -- Software measurement -- Functional size measurement -- Part 2 (Conformity evaluation of software size measurement methods to ISO/IEC 14143-1)
ISO/IEC 19761	2011	Software engineering -- COSMIC (a functional size measurement method)
ISO/IEC TR 29110-1	2011	Software engineering -- Lifecycle profiles for Very Small Entities (VSEs) -- Part 1 (Overview)
ISO/IEC 29110-2	2011	Software engineering -- Lifecycle profiles for Very Small Entities (VSEs) -- Part 2 (Framework and taxonomy)
ISO/IEC TR 29110-3	2011	Software engineering -- Lifecycle profiles for Very Small Entities (VSEs) -- Part 3 (Assessment guide)
ISO/IEC 29110-4-1	2011	Software engineering -- Lifecycle profiles for Very Small Entities (VSEs) -- Part 4-1 (Profile specifications)
ISO/IEC TR 29110-5-1-2	2011	Software engineering -- Lifecycle profiles for Very Small Entities (VSEs) -- Part 5-1-2 (Management and engineering guide)
ISO/IEC/IEEE 42010	2011	Systems and software engineering -- Architecture description
ISO/IEC/IEEE 15289	2011	Systems and software engineering -- Content of life-cycle information products (documentation)
ISO/IEC/IEEE 26515	2011	Systems and software engineering -- Developing user documentation in an agile environment
ISO/IEC 15909-2	2011	Systems and software engineering -- High-level Petri nets -- Part 2 (Transfer format)
ISO/IEC 29155-1	2011	Systems and software engineering -- Information technology project performance benchmarking framework -- Part 1 (Concepts and definitions)
ISO/IEC TR 24748-2	2011	Systems and software engineering -- Life cycle management -- Part 2 (Guide to the application of ISO/IEC 15288 (System life cycle processes))
ISO/IEC TR 24748-3	2011	Systems and software engineering -- Life cycle management -- Part 3 (Guide to the application of ISO/IEC 12207 (Software life cycle processes))
ISO/IEC/IEEE 26512	2011	Systems and software engineering -- Requirements for acquirers and suppliers of user documentation
ISO/IEC/IEEE 26511	2011	Systems and software engineering -- Requirements for managers of user documentation
ISO/IEC 15026-2	2011	Systems and software engineering -- Systems and software assurance -- Part 2 (Assurance case)
ISO/IEC 15026-3	2011	Systems and software engineering -- Systems and software assurance -- Part 3 (System integrity levels)
ISO/IEC 25040	2011	Systems and software engineering -- Systems and software Quality Requirements and Evaluation (SQuaRE) -- Evaluation process
ISO/IEC 25010	2011	Systems and software engineering -- Systems and software Quality Requirements and Evaluation (SQuaRE) -- System and software quality models
ISO/IEC 19770-1	2012	Information technology -- Software asset management- (Part 1: Processes and tiered assessment of conformance)
ISO/IEC 19506	2012	Information technology -- Object Management Group Architecture-Driven Modernization (ADM) -- Knowledge Discovery Meta-Model (KDM)

ISO/IEC/IEEE 31320-1	2012	Information technology -- Modeling Languages -- Part 1: Syntax and Semantics for IDEF0
ISO/IEC/IEEE 31320-2	2012	Information technology -- Modeling Languages -- Part 2: Syntax and Semantics for IDEF1X97 (IDEFobject)
ISO/IEC 19500-1	2012	Information technology -- Object Management Group -- Common Object Request Broker Architecture (CORBA) -- Part 1 (Interfaces)
ISO/IEC 19500-2	2012	Information technology -- Object Management Group -- Common Object Request Broker Architecture (CORBA) -- Part 2 (Interoperability)
ISO/IEC 19500-3	2012	Information technology -- Object Management Group -- Common Object Request Broker Architecture (CORBA) -- Part 3 (Components)
ISO/IEC 19507	2012	Information technology -- Object Management Group Object Constraint Language (OCL)
ISO/IEC 19505-1	2012	Information technology -- Object Management Group Unified Modeling Language (OMG UML) -- Part 1 (Infrastructure)
ISO/IEC 19505-2	2012	Information technology -- Object Management Group Unified Modeling Language (OMG UML) -- Part 2 (Superstructure)
ISO/IEC 15504-5	2012	Information technology -- Process assessment -- Part 5 (An exemplar software life cycle process assessment model)
ISO/IEC TS 15504-8	2012	Information technology -- Process assessment -- Part 8: An exemplar process assessment model for IT service management
ISO/IEC 20000-2	2012	Information technology -- Service management -- Part 2 (Guidance on the application of service management systems)
ISO/IEC 26551	2012	Software and systems engineering -- Tools and methods for product line requirements engineering
ISO/IEC TR 29110-5-1-1	2012	Software engineering -- Lifecycle profiles for Very Small Entities (VSEs) -- Part 5-1-1: Management and engineering guide: Generic profile group: Entry profile
ISO/IEC 25041	2012	Systems and software engineering -- Systems and software Quality Requirements and Evaluation (SQuaRE) -- Evaluation guide for developers, acquirers and independent evaluators
ISO/IEC TR 33014	2013	Information technology -- Process assessment -- Guide for process improvement
ISO/IEC TR 29154	2013	Software engineering -- Guide for the application of ISO/IEC 24773:2008 (Certification of software engineering professionals -- Comparison framework)
ISO/IEC 15504-6	2013	Information technology -- Process assessment -- Part 6: An exemplar system life cycle process assessment model
ISO/IEC/IEEE 29119-1	2013	Software and systems engineering -- Software testing -- Part 1: Concepts and definitions
ISO/IEC/IEEE 29119-2	2013	Software and systems engineering -- Software testing -- Part 2: Test processes
ISO/IEC/IEEE 29119-3	2013	Software and systems engineering -- Software testing -- Part 3: Test documentation
ISO/IEC 29155-2	2013	Systems and software engineering -- Information technology project performance benchmarking framework -- Part 2: Requirements for benchmarking
ISO/IEC 15940	2013	Systems and software engineering -- Software Engineering Environment Services
ISO/IEC 15026-1	2013	Systems and software engineering -- Systems and software assurance -- Part 1: Concepts and vocabulary
ISO/IEC 25064:2013	2013	Systems and software engineering -- Software product Quality Requirements and Evaluation (SQuaRE) -- Common Industry Format (CIF) for usability: User needs report

ISO/IEC 90003	2014	Software engineering -- Guidelines for the application of ISO 9001:2008 to computer software
ISO/IEC 24744	2014	Software engineering -- Metamodel for development methodologies
ISO/IEC 25051	2014	Software engineering -- Systems and software Quality Requirements and Evaluation (SQuaRE) -- Requirements for quality of Ready to Use Software Product (RUSP) and instructions for testing
ISO/IEC TR 29110-5-6-2	2014	Systems and software engineering -- Lifecycle profiles for Very Small Entities (VSEs) -- Part 5-6-2: Systems engineering -- Management and engineering guide: Generic profile group: Basic profile
ISO/IEC 25063	2014	Systems and software engineering -- Systems and software product Quality Requirements and Evaluation (SQuaRE) -- Common Industry Format (CIF) for usability: Context of use description
ISO/IEC 25000	2014	Systems and software engineering -- Systems and software Quality Requirements and Evaluation (SQuaRE) -- Guide to SQuaRE
ISO/IEC 25001	2014	Systems and software engineering -- Systems and software Quality Requirements and Evaluation (SQuaRE) -- Planning and management
ISO/IEC 33004	2015	Information technology -- Process assessment -- Requirements for process reference, process assessment and maturity models
ISO/IEC 19770-2	2015	Information technology -- Software asset management (Part 2: Software identification tag)
ISO/IEC 19770-5	2015	Information technology -- IT asset management (Part 5: Overview and vocabulary)
ISO/IEC 15414	2015	Information technology -- Open distributed processing -- Reference model -- Enterprise language
ISO/IEC 19793	2015	Information technology -- Open Distributed Processing -- Use of UML for ODP system specifications
ISO/IEC 33001	2015	Information technology -- Process assessment -- Concepts and terminology
ISO/IEC 33063	2015	Information technology -- Process assessment -- Process assessment model for software testing
ISO/IEC 33020	2015	Information technology -- Process assessment -- Process measurement framework for assessment of process capability
ISO/IEC 33002	2015	Information technology -- Process assessment -- Requirements for performing process assessment
ISO/IEC 33003	2015	Information technology -- Process assessment -- Requirements for process measurement frameworks
ISO/IEC 19770-2	**2015**	Information technology -- Software asset management -- Part 2: Software identification tag
ISO/IEC 16350	2015	Information technology -- Systems and software engineering -- Application management
ISO/IEC TS 30103	2015	Software and Systems Engineering -- Lifecycle Processes -- Framework for Product Quality Achievement
ISO/IEC 26550	2015	Software and systems engineering -- Reference model for product line engineering and management
ISO/IEC/IEEE 29119-4	2015	Software and systems engineering -- Software testing -- Part 4: Test techniques
ISO/IEC 26555	2015	Software and systems engineering -- Tools and methods for product line technical management
ISO/IEC 29110-2-1	2015	Software Engineering -- Lifecycle profiles for Very Small Entities (VSEs) -- Part 2-1: Framework and taxonomy
ISO/IEC/IEEE 26531	2015	Systems and software engineering -- Content management for product life-cycle, user and service management documentation

ISO/IEC/IEEE 15289	2015	Systems and software engineering -- Content of life-cycle information items (documentation)
ISO/IEC/IEEE 23026	2015	Systems and software engineering -- Engineering and management of websites for systems, software, and services information
ISO/IEC TR 12182	2015	Systems and software engineering -- Framework for categorization of IT systems and software, and guide for applying it
ISO/IEC 29155-3	2015	Systems and software engineering -- Information technology project performance benchmarking framework -- Part 3: Guidance for reporting
ISO/IEC TR 29110-3-1	2015	Systems and software engineering -- Lifecycle profiles for Very Small Entities (VSEs) -- Part 3-1: Assessment guide
ISO/IEC TR 29110-3-4	2015	Systems and software engineering -- Lifecycle profiles for Very Small Entities (VSEs) -- Part 3-4: Autonomy-based improvement method
ISO/IEC TR 29110-5-6-1	2015	Systems and software engineering -- Lifecycle profiles for Very Small Entities (VSEs) -- Part 5-6-1: Systems engineering -- Management and engineering guide: Generic profile group: Entry profile
ISO/IEC/IEEE 15288	2015	Systems and software engineering -- System life cycle processes
ISO/IEC 15026-3	2015	Systems and software engineering -- Systems and software assurance -- Part 3: System integrity levels
ISO/IEC 25024	2015	Systems and software engineering -- Systems and software Quality Requirements and Evaluation (SQuaRE) -- Measurement of data quality
ISO/IEC DIS 26557		Software and systems engineering -- methods and tools for variability mechanisms in software and systems product line
ISO/IEC TR 90006:2013		Information technology -- Guidelines for the application of ISO 9001:2008 to IT service management and its integration with ISO/IEC 20000-1:2011
ISO/IEC FDIS 19770-3		Information technology -- IT asset management (Part 3: Entitlement schema)
ISO/IEC CD 19770-4		Information technology -- IT asset management (Part 4: Resource Utilization Measurement (RUM))
ISO/IEC CD 33070-4		Information technology -- Process assessment -- Part 4: A process assessment model for information security management
ISO/IEC CD 33051		Information technology -- Process assessment -- Process reference model for information security management
ISO/IEC DIS 29169		Information technology -- Process assessment -- The application of conformity assessment methodology to the assessment to process quality characteristics and organizational maturity
ISO/IEC CD 19770-1		Information technology -- Software asset management -- Part 1: Processes and tiered assessment of conformance
ISO/IEC PDTS 25011		Information technology -- Systems and software quality requirements and evaluation (SQuaRE) -- Service quality model
ISO/IEC/IEEE DIS 29119-5.2		Software and systems engineering -- Software testing -- Part 5: Keyword-driven testing
ISO/IEC FDIS 26551		Software and systems engineering -- Tools and methods for product line requirements engineering
ISO/IEC CD 20246		Software and Systems Engineering -- Work Product Reviews
ISO/IEC 30130		Software engineering -- Capabilities of software testing tools
ISO/IEC CD 29110-3-2		Software engineering -- Lifecycle profiles for Very Small Entities (VSEs) -- Part 3-2: Conformity Audit Guide

ISO/IEC CD 29110-4-1		Software engineering -- Lifecycle profiles for Very Small Entities (VSEs) -- Part 4-1: Profile specifications: Generic profile group
ISO/IEC CD 29110-4-6		Software engineering -- Lifecycle profiles for Very Small Entities (VSEs) -- Part 4-6: Profile specifications: Generic profile group
ISO/IEC DIS 29110-3-3		Software engineering -- Lifecycle profiles for Very Small Entities (VSEs) -- Part 3-3: Certification requirements for process capability
ISO/IEC PDTR 29110-2-2		Software engineering -- Lifecycle profiles for Very Small Entities (VSEs) -- Part 2-2: Guide for the development of domain-specific profiles
ISO/IEC CD 42030		Systems and Software Engineering -- Architecture Evaluation
ISO/IEC CD 42020		Systems and software engineering -- Architecture Processes
ISO/IEC DIS 20741		Systems and Software Engineering -- Guideline for the evaluation and selection of software engineering tools
ISO/IEC DIS 29155-4		Systems and software engineering -- Information technology project performance benchmarking framework -- Part 4: Guidance for data collection and maintenance
ISO/IEC/IEEE CD 24748-5		Systems and software engineering -- Life cycle management -- Part 5: Software development planning
ISO/IEC/IEEE FDIS 24748-4		Systems and software engineering -- Life cycle management -- Part 4: Systems engineering planning
ISO/IEC/IEEE PDTS 24748-6		Systems and software engineering -- Life cycle management -- Part 6: Guide to system integration engineering
ISO/IEC CD 29110-4-3		Systems and Software Engineering -- Lifecycle profiles for Very Small Entities (VSEs) -- Part 4-3: Service Delivery Profile Group Specification
ISO/IEC PDTR 29110-1		Systems and Software Engineering -- Lifecycle profiles for Very Small Entities (VSEs) -- Part 1: Overview
ISO/IEC PDTR 29110-5-3		Systems and software engineering -- Lifecycle Profiles for Very Small Enterprises (VSE) -- Part 5-3: Service Delivery -- Guide
ISO/IEC CD 29110-5-2-1		Systems and software engineering - Lifecycle Profiles for Very Small Entities (VSEs) -- Part 5-2-1: Organisational management guide
ISO/IEC PDTR 29110-5-1-3		Systems and software engineering - Lifecycle profiles for Very Small Entities (VSE) -- Part 5-1-3: Software engineering - Management and engineering guide: Generic profile group - Intermediate profile
ISO/IEC CD 20246		Systems and software engineering - Requirements for testers and reviewers of user documentation
ISO/IEC/IEEE CD 12207		Systems and software engineering -- Software life cycle processes
ISO/IEC DIS 25022.2		Systems and software engineering -- Systems and software quality requirements and evaluation (SQuaRE) -- Measurement of quality in use
ISO/IEC DIS 25023.2		Systems and software engineering -- Systems and software Quality Requirements and Evaluation (SQuaRE) -- Measurement of system and software product quality
ISO/IEC DIS 25066		Systems and software engineering -- Systems and software Quality Requirements and Evaluation (SQuaRE) -- Common industry Format for Usability -- Evaluation Report
ISO/IEC NP 25044		Systems and software engineering -- Systems and software Quality Requirements and Evaluation (SQuaRE)

Appendix 2 **Respondent details**

The table below identifies the 30 sources that provided interview data, and includes brief field notes recorded at the time to log some background and contextual information.

Note that two sources were actually team meetings (RES 27-30 'Technical Team A', and RES 33-38 'Technical Team B') – one with four and one with five attendees. This means that the total number of people contributing to the study as respondents was 37.

Source	Date	Organisation	Group	Type	Notes
RES 00 - Pilot 1 respondent	2014/02/11	n/a	Other	Academic	First attempt at data elicitation - experimenting with the RepGrid approach.
RES 01 - National Software Project - Notes of a tele-meeting	2012/09/20	National Government	Other	Other	These notes are from a one-hour telephone interview; they have been provided to the individuals concerned.
RES 02 - HEI CIO & Programme manager	2013/12/04	University A	Management	Manager	No structured data gained from this open discussion (but the transcription is coded) - Two respondents - no attempt at RepGrid in this case
RES 03 - Software House CEO	2013/05/13	Small SA Software House	Business	Manager	This is a benchmark interview with a small software house owner - this was all about getting started. Ratings derived from transcript
RES 04 - HEI Technology manager	2013/11/19	University B	Administration	Manager	No structured data from this exploratory discussion (but the transcription is coded) - No attempt at RepGrid
RES 05 - HEI E-Learning director	2014/08/07	University B	Management	Academic	A very good session revealing the importance of stakeholder involvement and strategic thinking. Ratings derived from transcript
RES 06 - Mature first year student (health)	2014/09/01	University B	Academic	Student	Mature student with a strong IT background in her history, but not up-to-date with current technology, devices and capabilities. She was going through a rapid 'learning curve'. Very good session. - Strong stuff!
RES 07 - Director Research Projects	2014/10/24	University B	Research	Researcher	Interesting session turning around the challenges in managing research projects in modern academia - reveals the importance (and expense) of technology in the research lab. - Useful input - somewhat blurred?

RES 08 - Outsource partner CEO	2014/11/21	Software and systems services business	Business	Business	Reveals the difference between sometimes-fuzzy academic thinking and the stricter disciplines of working in and managing a business that is wholly dependent on good client management and revenue for its survival. Excellent open discussion, Repgrid weak?
RES 09 - IT Facilitator	2015/05/15	University C	Academic	Academic	This was an extremely productive interview with an academic with heavy administrative responsibilities and a strong interest in the effective use of IT in higher education. Very good input
RES 10 - First year student (science)	2015/05/16	University D	Academic	Student	This young student was freshly registered as a first year student, and was recovering from the early weeks of administration and self-organisation that is necessary. Very good input
RES 11 - Education activist	2015/05/16	Entrepreneur	Business	Business	Cases were identified but triadics and mapping simply did not work for this respondent, and so the effort to gain RepGrid data was terminated
RES 12 - Project manager	2015/05/04	University B	Academic	Project manager	Some comparative data here: academic vs experience in the mining industry. Low volume but good input - transcription very difficult
RES 13 - Director Research Programme	2015/05/05	University B	Management	Researcher	A big research project and a very strong focus on financial and resource management (but then, isn't that what management is a great deal to do with?). - Very managerial!
RES 14 - Research administrator	2015/05/04	University C	Administration	Researcher	A young research admin supervisor, also undertaking her own masters degree in parallel with training in the use of a new national system aimed at monitoring (and controlling?) research activity across the nation. - Good input
RES 15 - Masters student	2015/05/22	University D	Academic	Student	A masters student coming towards the end of his project, facing writing up his thesis (hence the interest in referencing academic work). A useful session, quite different to most of the others so far. - Very good input

RES 16 - Masters student	2015/05/22	University D	Academic	Student	A second Masters student in a similar position but with a stronger focus on the technical systems development issues arising with work on mobile systems. - Good input, but difficult to hear for transcription and slow to understand the triadics
RES 17 - Information manager	2015/06/30	University A	Administration	Manager	Good input, brings some real information management issues to the fore
RES 18 - Research director	2015/07/02	University B	Management	Researcher	Excellent historical background on the one institution - Rep grid not appropriate in this case
RES 19 - Academic Head of Department	2015/07/08	University B	Academic	Academic	Low level of empathy with the RepGrid stage but very willing respondent, seemed very tired towards the end
RES 20 - National standardisation delegate	2015/07/08	Independent	Technical	Technical specialist	Skype did not work, had to use the phone but he has corrected and augmented my notes
RES 21 - Help desk manager	2015/07/09	University D	Technical	Technical specialist	Excellent input - this respondent is in the 'hot seat'
RES 22 - Information manager	2015/07/09	University A	Administration	Manager	Long conversation, no time to do the RepGrid data but rich content
RES 24 - Research Lab technical specialist	2015/07/30	University B	Technical	Technical specialist	Sporadic - interrupted by meetings etc. Only one month into the job but RepGrid started to engage him nicely
RES 25 - Project manager	2015/09/01	Independent	Business	Project manager	An experienced project IT and IS manager having specific experience working with strategic projects in a large university
RES 26 - Technology manager	2015/08/11	University C	Management	Manager	Curtailed because of time constraints and family bereavement – but a very good session - this guy sits right in the middle (of technology and business) managerially and spoke knowledgeably about standards.
RES 27-30 - Technical Team A	2015/08/18	University B	Technical	Technical specialist	This was a 'team interview' producing one common set of systems/projects and related events, but with individual responses to the applicability and rating stages
RES 31 - Business consultant as PG student	2015/08/29	Independent	Academic	Business	This mature post grad student undertook a doctoral study while working as an international data migration specialist

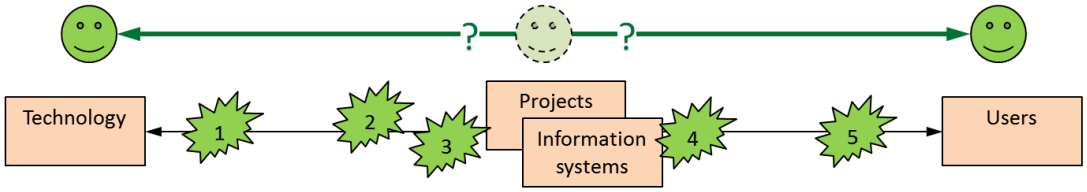
RES 32 - Information systems lecturer	2015/09/03	University B	Academic	Student	This lecturer has been involved with teaching information systems for about 20 years, and specialises in teaching system design and programming
RES 34-38 - Technical Team B	2015/10/01	University A	Technical	Technical specialist	This was a 'team interview' producing one common set of systems/projects and related events, but with individual responses to the applicability and rating stages

Appendix 3 **The interview guidelines**

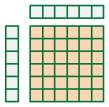
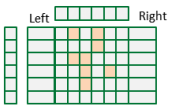
This is the interview guideline that was discussed with respondents at the start of an interview, in this case in the form used for the group interviews.

Information Management in Higher Education

The group interview "plan":



Round the table: what is your role, and where do you **fit** into the "chain" above?
(voice recording)

5 min	1 With what projects and/or systems have you had significant **involvement**? What was the outcome? (voice recording, "identify cases" and status on workbook)	
15 min	2 When working with those projects and/or systems, what **events*** come to mind that had a *consequence* for you, or for others? Again, what was the outcome? (Add events to workbook,, still voice recording)	
30 min	3 Look at these events randomly , three at a time, to find the **characteristic scales** that reveal the differences. (run "Triadics", note the "characteristics" that indicate differences)	
20 min	4 Now, look at those characteristics and rate their **applicability** to all the events that you have identified. (rate them on a scale of 1 (low) to 5 (high), leave blank if not applicable)	
20 min	5 For the *most applicable* characteristics, how do the events score on the characteristic scales that you have identified? (rate them on a scale of 1 (scores to the left) to 5 (scores to the right)	

* this research project is calling them "transactions", indicating "an exchange of value"

Andy Bytheway
andy.bytheway@gmail.com
082 8899771

August 2015

Appendix 4 **Diagnostic analysis of the qualitative content analysis**

This diagnostic report shows that there are no fundamental problems with the database containing the qualitative content analysis data, and provides a few useful or indicative statistics. It checks for sources with no chunks, chunks with no coding, and categories with no coding or no structure, and so on. The categories with no coding are higher order category codes used to group the 'children'.

Project: 'Andy's PhD interview data'
Diagnosis: 2015/12/06 - 03:35:08 PM
MSCOMCTL.OCX is registered

Originators has 31 Record(s)
Capturers has 1 Record(s)
Sources has 31 Record(s)
Chunks has 699 Record(s)
Denotata has 3423 Record(s)
Categories has 113 Record(s)

Category with ID >206< and named 'PROCESS' has no coding yet
Category with ID >207< and named 'ENTITY' has no coding yet
Category with ID >216< and named 'STRATEGY' has no coding yet
Category with ID >219< and named 'STANDARDS' has no coding yet
Category with ID >259< and named 'human entity' has no coding yet
Category with ID >261< and named 'information entity' has no coding yet
Category with ID >269< and named 'organisation entity' has no coding yet
Category with ID >262< and named 'product entity' has no coding yet
Category with ID >263< and named 'performance entity' has no coding yet
Category with ID >260< and named 'technical entity' has no coding yet
Category with ID >266< and named 'academic process' has no coding yet
Category with ID >264< and named 'admin process' has no coding yet
Category with ID >265< and named 'technical process' has no coding yet
Category with ID >267< and named 'management process' has no coding yet

Exclusions has 128 Record(s)
Structure has 113 Record(s)
Words has 36995 Record(s)
Housekeeping has 1 Record(s)

The threshold for pairs reporting is >1<
The maximum number of levels for analysing the tree structure is >2<

There are: >1193< words per source, on average
There are: >52< words per chunk, on average
There are: >4< codings per chunk, on average
There are: >30< codings per category, on average

[End of diagnosis]

Appendix 5 **Thematic analysis of the qualitative interview content**

The transcribed content of the interviews comprised about 94,000 instances of spoken or written words, which after the elimination of common words (such as 'the' and 'a') delivered 36,995 'substantive' words in a concordance that can be used to search for instances of words. Further, the transcriptions were divided into 'chunks' of text, each of which comprised one element of the conversation; typically this would be a question and an answer.

The analysis that follows was developed as 'memos' (in the manner of qualitative research content analysis, as in Strauss & Corbin, 1998) that were allowed to evolve according to the strength of the evidence, the patterns that emerged and their relevance to the whole matter of standards. As the memos were developed, the supporting evidence was logged (so that the justification for the line of argument is evidenced and can be traced, should that be necessary) in the format:

[<chunk number>:<category number>]

These references are embedded in the narrative that now follows, generally *following* the argument that they support. For example, the first reference in the analysis below appears as '[336:93]'. This refers to *Chunk 335* …

> *I teach at the moment at 3rd year level and in the second semester at 2nd year level I do work with the honours, but more on the supervision side and masters and PhD stuff … basically managing a group of people to try and see* ***what the different roles of the different people are and what they have to achieve*** *- it's timelines and things like that, so that's my role [RES 00 - Pilot 1 respondent, University B, 2014/02/11]*

… within which the emboldened text has been coded with Category 93: '*performance*'.

The analysis that follows is organised according to the 14 themes that emerged, within the four super-themes that have been adopted as the highest-level view of the data:

Management

- Planning and strategy
- Identifying the benefits (and costs)
- Changing teaching and learning
- Changing research
- Change and migration management

Process

- Engagement between stakeholders
- Method of working
- System management
- Information management

Product

- Functionality and capability
- Having the right resources
- Boundary

Scope (of a project and its system)

- Boundaries with the outside world
- The need for standards

NOTE: These memo items are numbered and cross-referenced in Table 20 in the thesis, to provide clear linkages between the reference model and the source data.

Management

Planning and strategy

The need for strategy

M1 At the highest level it is apparent that the advantages of strategic management are understood but not always fulfilled. Managing people and resources requires that goals are established and different people's roles are defined [336:93]. At the same time every institution is different and needs its own strategy and so there are no short cuts from sharing [852:163].

M2 For example, the status of transformation at different institutions is different and leads to different priorities. There is general evidence of the concern to accommodate students from different kinds of backgrounds, but variable evidence of differences at the system level that would help to achieve that [591:163]; there is even some expectation that students will help themselves, or each other. [612:189; 608:233]. While issues of transformation can be (and are often seen) at a socio-economic level, there are practical issues in accommodating the needs of transformation in systems development and deployment [1011:257].

M3 Other factors are driving the need for strategic management such as the ambition to offer short courses, to meet the expectations of the 'market' and to develop a third stream of revenue that will support the core activities of a university. It is difficult to achieve the strategic separation of administrative dependencies that such a move requires [990:224; 989:239].

The need for planning

M4 Planning follows strategy, of course, and it has to recognise the finite constraints that arise from the limited facilities that are available, such as labs and computers. However, new factors are at work, and as individual students increasingly have their own access to university portals using their own devices, and shared learning management systems, the burden shifts from PCs in the laboratory (or the residence) to the bandwidth that is needed to support all the WiFi traffic. This shift has been evident even within the relatively short timescales of this study [571:235] and leads to a need for some flexibility. Plans are of no help when they do not recognise real needs, or that are not followed in the detail, or that are not agile enough to meet changing needs [574:189; 576:220].

M5 The experiences of one established academic, who (as well as teaching) undertook a range of critical administrative roles for his faculty shows that the effectiveness of management planning and policy making is not always what is needed. He was able to refer to many instances where the wrong decision was made, or where no decision was made - all concerning the need for technology resources, the acquisition of them, or the management of them [589:230]. There was one case where, for 18 months, 300 students had to share 20 computers; not the sort of problem presently faced in all institutions, but indicative of a kind of resource availability and management problem that occurs when planning is inadequate or inappropriately managed [576:220].

M6 As is so often the case in organisations, it is found that strategy formulation is fun, but strategy implementation is much more difficult. Partly this is because of the 'churn' that exists with the turnover of executive and management appointees, causing regular shifts in the direction of information technology investment strategies [736:148], and it can be concluded that stability is needed because academic timescales are extended by the idea of the academic year. Visions have to

lead to things that can, ultimately, be measured [895:93]; for example 'Critical Success Factors' are a common device in regular businesses, that focus on and measure things that must be in place if strategy is to succeed.

M7 This leads to a need for systems that will deliver the information that is needed for planning and performance monitoring. One long-term functional manager was able to demonstrate that planning included basic mistakes arising from not understanding the information that was required [841:193]; successful planning depends *absolutely* on appropriate strategies that are negotiated, agreed and communicated [844:213], on appropriate timescales [378:169], and recognising the concomitant risks. In some circumstances managers simply do not want to take the risks that are involved, for example when replacing critical key operational systems [1003:177].

The need for engagement and understanding

M8 People need to talk to each other and understand their different positions. There is some, but evidently limited, interplay between the IT service function and 'user' departments. For example academic information systems and computer science departments seem reluctant to get involved with IT and IS management issues, despite the potential to assist with the recruitment of specialist staff and because of their distinct needs for specialist equipment and support services [735:175]. When it happens, it is good that senior management insist that parties sit and listen to each other [834:182]. It is very worrying when senior managers admit that the intended benefits of information systems investments are not negotiated and agreed [849:175]. The way in which success is gauged is changing and needs to be understood. For example, in the deployment of a new LMS it was sufficient that courses were been 'moved' onto the new learning management system ('how many lecturers have moved onto the system so far?') but now it is about far more significant outcomes, especially those that can be related to the need for national transformation [381:137], an area where engagement and understanding is critical if there is to be success.

External issues in planning and strategy

M9 Of course, institutions have to work with regard to national policies and regulations concerning education [357:163]. What often seems to drive management's thinking when considering their systems requirements are actually the requirements of the DHET: 'how many people passed this year', 'analysed by gender', that type of information [337:181]. The National Development Plan is one of the principal contextual factors that drive strategic thinking in an institution [380:163].

M10 Other external factors arise because of external partnerships and projects. The comparison between single- and multi-institution projects is significant because of the variety of situations. Because some strategy is necessary at a faculty level the same thing occurs; even between faculties these differences of situation can appear and present challenges of complexity [371:195]. Dealing with complexity is a recurring theme in this research.

M11 One feature of higher education is the availability of independent or private institutions, such as business management and hotel schools. There, the approach to things can be very different [631:191]. The experiences of one private sector school, working with the hotel industry, showed that the economics of face-to-face education (with the cost of travel and accommodation, and the loss of capacity back at the hotel) made for a very attractive argument for remote online learning and assessment [619:155], but at the same time the degree of engagement with the industry that would be employing their graduates was very deep. Their flexibility in terms of adopting new technology, and using it effectively, made their education an attractive option for both the students and the employers.

The need for portfolio management

M12 Flexibility is not always easy to achieve. In discussing the differences that can be found within a single institution it becomes clear that there are different circumstances between faculties and schools, there are innovative and non-innovative systems, and there are different kinds of technology that require different systems development approaches. According to the kind of university that you are, and the kind of engagement that you choose with your target 'market', the choice of technologies and standards will (or should) vary [382:167]. The way to deal with this is using a *portfolio management* approach, that recognises these differences, organises projects in different ways so as to deal with them, and then manages those projects appropriately [372:196]. Just a financial investment plan must recognise the differences between income generation and capital appreciation, any serious discussion about information systems strategy demands a portfolio approach to systems management that recognises present value and future value, and the variable scope and complexity of systems. In the evidence gathered this was a latent understanding, except in the case of one respondent who was keenly interested in the potential of portfolio management to unravel the complexities of a complex mix of inter-dependent systems in a distributed environment [1006:213]. But portfolio management is just one idea, and there are other more broadly based models and frameworks that have engaged the attention of university information technology managers.

Professional 'good practice'

M13 One head of an academic department has become involved in the strategic activity relating to 'Enterprise Architecture', one of the present management ideas that sets out to gather good practice at all levels – the technology, the systems, the data and the way that they will align with organisational strategy. But he considers that he is working in a place where operational managers are simply told what they must do, and what is going to happen [349:167]. At a more specific level, such professional good practice guidelines as COBIT and TickIT prove interesting to one senior IT director [360:204]. Within COBIT, the need for standards is seen to vary from the 'bottom' to the 'upper' levels of systems activity but the awareness of COBIT is far less at the upper levels of management, leading to less control. Is more control needed, or just a different kind of control? [373:174].

M14 If South African universities are to be internationally competitive, or even just viable, let's recognise that education is a very international business and there is intense interest in globalisation - at both the supply level (universities) and at the demand level (students) [404:179]. Internationally good practice is recognised and appreciated.

'E-research' emerges from the mists, internationally

M15 One of the newer strategic ideas within universities is to embark on 'e-research'. This is seen as a combination of new technology opportunities relating to the connectivity that is available to researchers and the internationalisation of major projects concerned with health and bio-informatics [442:163]. But it is not just about connectivity. One advanced research project is agonising about how to store very large volumes of research data and as well as e-research we have 'data intensive research', something that was said to already be established on the national agenda [652:197]

The corporatisation of universities

M16 In comparing higher education organisations and their methods with business, outsiders would argue that the same rules apply, and that planning and strategy is the same everywhere. Experience shows that academics, and even academic management, do not always agree [873:186] but there was some recognition that the university of today is something of a business: students pay fees, so why should they not expect value for their money? Why should the fundamental rules of business not apply?

[469:152]. For all the reluctance to 'corporatise' universities, it is interesting to hear that they are investing in 'Customer Relationship Management' systems [1003:177]; over time we may well find more and more features of business practice embedded in the way that universities work.

Identifying the benefits (and costs)

Confusion reigns

M17 There is historical confusion as to the most important areas for IT investment - historically the presumption was to invest in administration ('get the bottoms on seats, get them through the system') as opposed to actual teaching and research [744:225]. Even the national standardisation delegate, in his academic experience, had experienced a strong bias to invest in accounting systems first. In his time there was no expectation of benefits from LMS - 'one was paid to teach and promoted on research' [800:225]; the value of a university cannot be measured in terms of money alone [1012:176], but how shall it be measured?

M18 Conflicts in the pace and frequency of change, especially in association with the rigours of the academic year, sometimes lead to an investment of effort that produces no real value, just a feeling of efficiency; and efficiency alone is not the answer in the context of transformational change such as is faced by many tertiary institutions [1005:176], but just handling ever-larger numbers of student applications is just one indicator of the benefits of key operational information systems that work well [999:176]. The national investment in research information management is a case in point, being directed at assisting transformation and improving efficiency.

M19 At the workaday level, seasoned academics remember the days when someone around the corner used to do something for you in five minutes. Now you have to initiate a four-day process, riddled with uncertainty about which forms have to be filled in, and whether the *correct* forms are the ones available in your local administration office, or the ones in the administrative headquarters [574:153].

Benefits for research, nationally

M20 Although the expected benefits from the RIMS project have been articulated, there was a clear feeling amongst those involved that their achievement would depend on both the availability of appropriate resources and a general capability to get the job done, neither of which were actually evident [322:175]. Correctly, the expectation of benefits was linked to the idea that in institutions there must be an identifiable strategy for research, and that all institutions would be able to come 'up to scratch' [322:167]. However, there was a very low level of appreciation of RIMS in the conversations with those directly responsible for the management of large research projects. The majority had simply never heard of it, or were unclear as to what the benefits might be.

M21 There are many stakeholders in this context, many of whom are rather distant from actual research, being principally concerned with national needs and policies. Engagement with institutional stakeholders, especially researchers, seems very weak. It is not clear what future opportunities are enabled by the project; rather it is concerned to level the research 'playing field' for all institutions and bring them forward to a common level. Having said that, it is clear that this will not be easy, it will take a special effort in terms of project management, and this feels like a 'bottom up' (ie technology-push) project rather than a 'top down' (ie researcher and management pull) project [325:158].

M22 RIMS is a not a typical example of IT and IS investment, and its context is evolving quickly. If it is not seen that way, then it should be; this would allow a much more participative approach with clearer support from policy makers, research managers, senior academics, researchers and those whom they research. Just to add to the mix, at the time of writing InfoEd was going 'Open' (i.e. open source)

although details were not yet available and it will not necessarily be *free* and open [324:167]. A project of this nature must be driven by those it is intended to assist, and those whom it is intended to assist must have clear benefits that they seek, even if the benefit is simply to understand research processes better. When research processes are properly understood by those who are involved, then the scope and focus of an investment such as this will be much clearer and the probability of success will be much higher [334:148]. A community driven open-source project is more likely to succeed than a traditional one, that is tightly specified and 'contracted out'. The RIMS project represents an important moment in South Africa's history of investing in information technology [334:148].

Benefits for teaching and learning

M23 Benefits at a more local level are sometimes understood and delivered; some projects are being carefully assessed using a range of measures - not just 'outputs' but 'outcomes' [465:93]. The director of an e-learning unit was very tightly focused on outcomes and achievements, having a very positive outlook and clearly able to both develop a vision and deliver it [466:220]. The value of a good learning management system is quickly evident to those students who choose to use it [612:220], and students are finding that access to email and messaging, and a willingness on the part of teaching staff to use those media, is extremely helpful in managing attendance at lectures and dealing with course work [478:220].

Benefits for management

M24 When senior management have the information that they need, they can take effective action to correct problem areas and to throw clear light on disputes [836:235]; without it confusion will reign.

Changing teaching and learning

M25 Teaching and learning is a co-operation between teachers and learners, and information technology affects each differently. However, in at least one institution the LMS clearly is valued, it contributes to teaching and learning, and it is part of everyday life for teachers and students [482:155].

Two examples

M26 The introduction of an intensive eight-week postgraduate diploma course for unemployed graduates, to teach them a range of programming and system design skills, seems to have been particularly effective even though it was not in the tradition of university teaching [983:220]. Is this what is needed? Is this not the function of an FET, rather than a university? What was actually happening here is that non-technical graduates *who had been unable to find employment* were being given an opportunity to retrain (rather than re-educate?) with skills that were marketable. It has been very successful in opening the doors of employment. Modern industry has developed a range of certification schemes, especially in the IT industry, and this new programme was related to one such scheme. The question as to whether these schemes should be incorporated into the university curriculum is still an open question, but for students it is a high motivator. Why should these industry certificates have more value than a university degree? [975:220]

M27 The introduction of a full-lifecycle student management system with a 'rules engine' came to a different outcome. The lifecycle approach was used to develop a requirements specification that would cover the whole cycle of activity with students, from enquiry to graduation [879:147], then implementation was undertaken in a phased approach [879:158]. The analysis was so thorough that it identified 'bad' information management practices (or ill-managed practices?) that were exposed and corrected, at some cost to the reserves of patience of users familiar with the lax regime that had prevailed [881:144]. For example, core data was protected, and those wishing to manipulate it were forced to make a copy and work with that. No adjustments were permitted without authority - but

were some of those with the authority excluded and dis-empowered to do their job? Were there jobs actually understood anyway, by those concerned? Perhaps these rules were exactly what was actually needed? [883:145].

M28 Of course, there are numerous examples of new and innovative programmes and systems that challenge the way we work, and our ability to do the work. These two examples are simply two that emerged in the data collection process.

The student view

M29 The benefits of a good learning management system are quickly evident to those students who choose to use it; those that do not, are likely to end up in great difficulty [591:145]. However the experiences of students place great emphasis on the contribution that technology makes to communications, and also provides evidence of the breaking down of barriers with the outside world [492:153]. Most students have personal mobile devices, and universities are striving to develop applications ('apps') that make good use of them and assist students in the management and execution of their learning. The co-operation between students is seemingly an important factor in knowing what is available and how to get it, as in the case of language translators for one's smart phone – in one case in order to be able to access Chinese literature about natural health remedies [488:189].

M30 For one student, there was a very strong sense that her storage space on the LMS was hers, just hers, really hers, and only hers – this she found exciting [497:231]. Of course, the potential to gather higher volumes of statistics on academic performance (of teachers as well as students) arises, as learning management systems take over some if not most of the grunt work that has been traditional in higher education [448:185]. Our young student, excited about her private storage space, probably does not yet realise that everything that she does with the LMS could be, and might be, logged and measured.

M31 Even if they did not understand all the ramifications, the students that were respondents in this study all seemed to be already *au fait* with modern applications related to their education, or they were well able to learn about them quickly. One responding student was able to list more than six applications - none of them the common 'Office' applications, that were essential to his systems development and research management work [675:243]. The Internet provides interesting facilities of course: YouTube stands out as a resource that is of very wide significance in teaching and learning [477:199]. Finally, there have been advantages for some handicapped students, the blind and the deaf [766:182].

The teacher view

M32 Not only students, staff also use web-based services without compunction and enjoy the benefits [484:144]; closer to their actual work, Marks Administration has been a particularly challenging area for systems support, in more than one of the involved institutions [568:148]. Commitment to an externally sourced package requires that some marks administration procedures are simplified or compromised, and so additional functionality has to be added to deal with it, with all the concomitant risks in accepting future upgrades.

M33 Teachers and learners are both racing to a full understanding of the potential for information technology. In one community development initiative (not in a university) where students were being taught basic computer skills, on a charitable basis, the consequence was that their teachers were embarrassed because they knew little if anything about how to use a computer. They requested training, but it had to be at their own cost [624:199]. It is evident that in universities teachers have had to be corralled and persuaded to invest some of their time in learning more than just the basic

skills of digital literacy [459:189]. Nevertheless, any presumption that online and computer-based teaching and learning would 'solve the problem' has been proven not to be the case – eyeballs are important (to watch, as well as to watch with) [753:227]

Changing research

M34 At least one opinion was very clear, that typical 'teaching' academics are far less aware and less interested in the benefits of information technology and systems, whereas researchers are not just interested, they are moving ahead rapidly. Of course, a little reflection reveals that teachers are having to change the way they work with quite high levels of personal cost (in terms of time and effort), whereas the benefits to researchers are much more obvious, more accessible and mare rewarding [446:171]. Today research is about a lot more than just publishing [648:225]. The new tools of data management are presenting unheard-of opportunities for data-intensive research – using ontologies and analysis techniques such as Map-Reduce. This demands new skills and capabilities on all sides [649:144]. Has every area of research developed an ontology? And will they co-exist and successfully co-work? [647:185]. A very different future beckons for researchers. For example the availability of bio-information-banks leads to radical new opportunities for large-scale research and international co-operation such as we have never seen before [647:243]. Research data collected at many levels needs to be defined, organised and stored in an accessible way so that it can be re-used [646:243; 646:198]. In many areas of research the emergence of great volumes of data makes for change in the way research is designed and executed [747:225].

M35 At another much more prosaic level, in the administration of research, the ability to do statistical work with Excel, and produce mail-merge letters with Word, has delighted young administrators whose computer skills are expanding all the time [668:175; 666:176]. On the other hand, sometimes research students get involved with technology that they simply do not know how to use [825:220].

Change and migration management

M36 In reality, the realisation of benefits proves to be difficult and sometimes entirely elusive, possibly because of the degree of change that is involved. People are reluctant to change the way they work, even if there are demonstrable benefits [654:237]. It is helpful to seek out and adopt some of the principles of change management and growth expounded by others (not from academia) with demonstrable success [468:227]. For example, in the private sector strong visionary leadership makes for quick decisions about what is necessary to do, and how to do it, even from a 'cold start' – do we have visionary leaders in higher education? [617:185].

Drivers of change

M37 Transformation is at the top of this list for the South African Government, and in a context of transformation different management reporting and operational activities emerge [1011:148]. Further, over the last 10-20 years there has been a realisation that investing in administrative systems is only part of the opportunity, and that broadening the vision to include teaching and learning, and research, has significantly greater potential benefits; of course, it also changes the nature of the game and is coupled to globalisation, specialisation and much deeper levels of co-operation [447:196]. In South Africa, current policies are to greatly expand the tertiary education sector, possibly doubling the number of students in some or all institutions [838:186]. These factors all add up to a strong imperative to understand and deal with change management.

M38 Other specific developments are driving change, such as open source (on the one hand) and massive data sets (generated in the context of the ‘internet of things’). It is interesting to reflect on the challenges that arise from the open source 'industry' (because surely today it is more of an industry

than a 'community') - businesses make money from the product through services, but they do not own the product and there are rules about its enhancement [555:144]. The emergence of very large bio-databanks is just one example of how we source and manage (and share) data in that realm, and in others [647:243]. The relentless advance of technology keeps getting in the way of smooth progress, a new operating system, a new personal productivity suite, a new kind of disk storage [905:186].

M39 One problem is that the timescales and pace of change are not all the same, and certainly not synchronised with the 'academic year' that runs, in South Africa, from January to December [991:177].

Cycles of change

M40 The rapid change in technology exceeds the ability of institutions to deal with it, having investment cycles that are far longer than the cycles of technology change [737:179]. The stories told by a recently retired academic, not technical but with a strong interest in science, remind us of the startling changes of the last 30 years, creating educational opportunities that have variously been grasped or ignored, with some success and some failure [763:236]. He also reminds us how technical glitches in history sometimes put systems out of action for months; that is something that we don't have to worry about today (but we have learned to live with load shedding) [764:189]. Perhaps we need to constantly remember the extraordinary changes in speed (of data transfer, for example) and extrapolate these changes into the near and middle future [779:248]. The academic year presents some problems in that it fixes the times at which certain important systems changes can be undertaken; equally, it tends to determine the times at which new requirements and user needs become known as the experiences of one year are reviewed ahead of the next [999:186].

M41 Of course, organisations finally come face-to-face with the realities of change when it is time for the implementation of new systems.

Implementation – where the rubber hits the road

M42 Different kinds of system present different problems of implementation. Implementing a critical key operational system necessitates a lot of education (disguised as 'help') in understanding how things needed to be done. If it works, it leads to a useful level of trust [874:204], but there is always the dependency on the quality of the data that is accommodated in a new system.

M43 In any project to introduce major new systems, the validation, cleaning and migration of legacy data is a big task that has to be undertaken, to avoid problems and to keep users on-side. The RIMS project found that the quality of human resource management data, migrated in the early implementations, was poor and added to the challenges of adoption and operation [314:146; 323:170]. As systems become more complex and interdependent, the dependencies have to be managed. One seasoned academic, with both an academic and technical interest in information technology, battled repeatedly with a management that did not seem to want to understand the dependencies on technical resources, and the consequences of not having access to them. Promises were made and broken. Deals had to be struck, in the end based on factors that were in management's interest, not in the interest of teachers or students [575:220]. While this might be the way that things sometimes have to be done, it is not in line with good management practice. Systems also often fail to deliver the functionality that is required. A new human management system was unexpectedly sensitive to the platform on which it was operating, and dispensed severe 'warning' messages to users who still had little confidence in themselves, and actually felt threatened by the aggressiveness of the system (which was a bought-in package) [354:186]. The willingness and capability of users to actually use a new system that changes the status quo depends upon the possibility of real benefits from the new system [583:190]. Getting people to change the way that they work proves difficult, but it can be

done [880:220]. When there is compulsion users will react adversely, and all the strenuous efforts of a strong implementation team, who understand that things must change but cannot bring the users with them, turn to a bad outcome [347:148; 587:187]. Ultimately, a lot of the effort has to go into providing ongoing support [469:221].

When things go wrong

M44 Things go wrong for different reasons. Already we have noted the need to identify and agree benefits that will engage unwilling users, and to recognise the different kinds of system that need different kinds of management.

M45 Sometimes, in the background, basic facilities such as email prove to be wholly inadequate and poorly managed. Productivity is not enhanced, it is impeded [639:186], and users lose confidence in every effort of the IT specialists to deliver them new systems, especially if the time taken in the complete cycle of initiation, development, implementation and operation, is too long for reasons that are avoidable, or are perceived to be avoidable [722:191]. Introducing new initiatives, such as what has become known as 'e-research', presents special challenges. There is a pervading feeling that the systems support for research is not just inadequate, it is completely absent [640:161]. And when the wrong investments are made, or are not implemented, the loss of benefit hurts as the investment sits idle. This is a common story [829:158].

The need for organisational learning

M46 Small software houses acknowledge the need to reflect, and learn, in order to maintain their capabilities and their position in a competitive market place [428:173] and it behoves the specialist IT units in universities to follow this lead. The capability of students and others to use digital devices effectively is improving rapidly, perhaps more so than in the IT department itself [820:189]. New ideas emerge and seize the imagination of academics – even if they are (arguably?) simply a new packaging of old ideas; what was once simple 'statistics' is now referred to as 'analytics', and instead of statisticians we are told we need data scientists [833:148].

Process

Engagement between stakeholders

Flexibility

M47 The way that one works has to be flexible enough to accommodate the changes in context, software, and the tools of systems development. Also, the changing 'customer' requirements [391:158].

M48 At both the 'customer' level and the 'developer' level things can work out very well, as the small software house has found. But they only find their opportunities by putting themselves about, talking to others, and keeping their eyes open. It's not like in the 'old days', when the systems development tool vendors came and knocked on your door, or advertised in the technical press, it seems [395:191]. There is evidence that the same exploratory attitude can be found in corners of a university, but not necessarily in the corners of the IT function [916:173]. The boundaries between the IT function and the 'user' community are actually blurred, in particular by those who choose to work with IT on their own, or in partnership, outside the constraints of the main IT function. It is clear that it is often a struggle to find the human resources that can do the job of specifying, developing and implementing new systems. One community-based institution had trouble getting its web site up and running and maintained; in some desperation the daughter of the promoter took it over and delivered a splendid result using WordPress [628:169]. This pattern is repeated endlessly in universities, from research

managers developing their own spreadsheet financial control systems [510:144] to information managers developing their own SQL queries [156:158].

M49 Many public institutions still have web sites that have nothing like the finesse that amateurs can achieve with WordPress, perhaps for the reason that they have to be much more sophisticated and provide real functionality. But there is no reason why someone enquiring of the contact information for a research unit should have to wait more than 20 seconds for a series of un-scaled graphics to be loaded, preventing access to the textual material behind – one problem experienced with one university web site [629:171].

Sharing

M50 Successful IT is about more than the resources that one department or research programme requires, it's about the collective needs of the whole institution and the advantages that can be gained from economies of scale and rationalisation of resources [651:185; 650:163]. Funding the provision of resources for research cannot be sustained on a project-by-project basis, there is a need for a shared infrastructure, with a concentration of investment, and control, and deployment [643:235]. Security of access to systems is a concern of course, because if a domain password is all that is needed to get into all the systems, then one error might make all the systems available to a miscreant [733:222] but shared resources that are properly secured make for high quality services, according to the nature of the diverse problems that are addressed and the different people who are tasked to deal with it [732:171]. There are age-related issues here, because of the pace of change. There are questions about the involvement of senior academics in deciding about the use of technology - at least one (probably typical of many others) who confirmed that for 24 years he had relied on his secretary, and his own personal stories were about the difficulties that technology presented in use and the problems of getting them fixed; and he sadly reported that the floppy disks that had been kept for him as his personal record, can no longer be read [762:171].

M51 In championing a cause, management do have to have regard to the balance of opportunity and possibility; there is no point in managing users expectations to a very high level and then finding they are denied the facilities they need to realise the opportunity. But sharing is one way of spreading the benefits at marginal additional cost [777:186].

M52 A particular point in dealing with the outside world is to understand one's stakeholders: people and organisations (both inside and outside) who have inter-dependencies with the work of a university.

The classic IT-user gulf

M53 For example, 'IT management' 'Academics' and 'Administrators' are not always on the same side. A long history of investing in IT for administrative systems does not make it easy when opening up the investment to include academic activities such as teaching, learning and research [453:151]. One head of department does get involved with the recruitment of IT staff, recognising to some extent her competencies in terms of information technology and information systems, but at the 'Enterprise Architecture' committee she felt that she was just being told what was going to happen [350:159], feeling strongly that her expectations and her potential were not being realised.

Technologies to communicate with

M54 One student made the point that learning in a context of information technology is not just about the LMS, the university web site provides important notices about ancillary activities, including open lectures that she was able to go to. A definite value-add in her view, and valuable information for other stakeholders as well as students [494:192]. Then, on discovering the e-learning support unit

she found a welcome source of support where her academic lecturers were, in her view, not helpful at all [493:186; 491:231].

Research is a special case

M55 Research faces more challenging problems in some cases. It is always surprising that the administration of universities seems to provide so little practical support for the administration of research projects, where the dynamics and criticality of fund management (for example) are quite different to the ponderous processes of teaching and learning [510:181]. Sometimes of course, given access, just speaking to the Vice Chancellor is all that is needed to get things done, but even Rectors are becoming subject to the same information technology limitations and constraints as people in other more mundane roles [574:220].

M56 The classic divide between IT management and 'business' management can be seen in the constant cry from academics (especially professors) for the latest and greatest technology needed for their research [743:225]. It is interesting how much effort has to go into supporting research students (and their professors) in terms of identifying and configuring specialist equipment of all kinds, much of it PC-related but including such new technologies as 3-D printing and battery management [806:230]. Procurement policies do not always recognise the consequences of operational decisions that affect technology management needs in research, for example when there is a mix of PC types in a laboratory, multiplying the time and cost of support [826:186]. In a particularly large project, the historical gulf between the IT specialists and the wider organisation was found to be vast, and the IT investment was simply not delivering what was needed [876:186]. Without competent business analysis and management there are always going to be tears when it comes to time to 'go live', and it is found that what is delivered often falls short of what is needed [878:157]. When it comes to delivering real benefits, not interacting adequately with the 'user' community can have terminal consequences for a system implementation [997:158], not just in the context of research of course.

Method of working

Partnering

M57 Projects that employ different companies at different stages of the systems development cycle are putting themselves at risk - the communication and comprehension gaps are very difficult to manage safely and, in higher education, there seems to be no appreciation of the need to document everything that is done [963:153].

M58 For many people, the opportunity to adopt an open-source, community led approach to key operational systems sits nicely between the bought-in package and the entirely home-grown and home-built system [443:144].

The lifecycle

M59 When embarking on new systems ideas (which are, incidentally, shared within academia) it is necessary to put away the tools of systems development and sit with the client, to make absolutely sure that there is merit in the idea and viability of implementation [400:158]. Tertiaries have become involved with faddish ideas from the systems specialists such as Enterprise Architecture. This does not go down well with academics and administrators who do not want to be told what their 'information architecture' shall be [840:158]. But the lessons can be learned – the 'maturity model' idea starts to come through strongly when hearing the stories of a maturing research unit - the typical life history of a business (enthusiasm, contagion, confusion, control, strategic management) is reflected in what was observed here [522:197]. In research, the method of working definitely

changes as one moves from investigation, through realisation, prototyping and productisation. Research management systems are needed that recognise this [527:225].

M60 There is repeated evidence that business analysis is simply not done properly in higher education [906:158]. Database design is fundamental to successful systems design in providing proper foundations for the functionality that is needed – and business rules have to be accommodated in the data design, putting even more pressure on the analyst who prepares or evaluates specifications. The one large project into which this study had insight did exactly that, and identified the two major tables that were needed (student information and programme information) [888:158].

Resources

M61 Different development tools are required for Web development. The experiences of one small software house were that moving to the web, and adopting the tools that are available, proved to be high-risk and riddled with uncertainty, especially when compared with their long experience with a traditional systems development environment [432:168]. The need to maintain mainframe legacy systems at the same time that web and mobile apps are under development spreads things thinly in terms of IT department capability [988:166].

M62 The rapidly increasing volume of data from research, from individual students even, plagues the mind of at least one research director. Where will the capacity be found to store this data? [641:186].

M63 Extremely expensive items of equipment, such as super-computers, need to be used carefully. One argument is that because it is so expensive it should be used continuously, but the fact is that this is not always the case. Perhaps it was needed simply to attract the best professors, with the best potential to enhance the reputation of the institution? There are many sides to the cost benefit equation, it seems [758:93].

M64 Bandwidth has been a persistent problem. Sometimes teachers simply don't understand the consequences of (for example) including a video in a PowerPoint presentation that hundreds of students will want to watch, using their own devices, in different places … [899:222]. Capacity management is still one of the most difficult things to do well [896:186].

Information management

M65 One of the major changes in design thinking has been to get out of 'what can the software do' to 'what is the correct data design for my business' – but what is the quality of database design in higher education in South Africa? What would be the benefits of standards for data structuring, so that it could more easily be shared and used for reporting purposes? One is reminded of the days when retailers knew nothing about what which customers bought what, and railway managers knew nothing about how many passengers travelled from A to B (unless they stepped onto the platform to have a look). In education, the potential for improved management based on improved information availability is immense [427:189]

System management

M66 At the heart of this research is the question of how universities can manage systems more effectively, with the assistance of standards that recognise organisational needs and provide useful advice – availability, applicability and utility are the key words here. Hence, the respondents views about how systems are being managed, how they might be managed, and how they should be managed is central. There are ideas about style, process, data, integration, continuity and quality control.

Style

M67 In the world at large, the style of IT management varies from unconstrained enthusiasm to extreme caution. The role of IT management generally has been the subject of research, not always with flattering results (Chatham & Patching, 2000).

M68 One approach is to use committees, but the introduction of committees to subsume the authority of capable individuals is not helpful, and introduces unnecessary time delays [845:194]. Sometimes brilliant ideas need very special management that they will never get from a committee [323:178]. Sometimes bizarre requests arise, for example running user testing on live, operational systems; an idea like that just does not make sense and it needs prompt action to prevent potential disasters [720:222].

M69 At another level, working on projects that involve many tertiary institutions collectively presents special challenges and requires fully strategic management. With the complexities of a modern portfolio of systems, with critical dependencies on external partners, it becomes important to invest in systems that will assist the management of those systems – systems with which to manage systems. Issues of complexity soon go past the point where single individual people and small scale applications can be left to manage parts of a complex overall whole [1002:239]. The discipline of 'devops' has emerged as one that builds collaboration and communication between software developers and other technical professionals with the assistance of software tools. The objective is to build, test, and release software more rapidly, more frequently, and more reliably – this is one example of a system that assists the management of other systems [1001:235].

Process

M70 For some, the portfolio approach to managing systems is about a process of maturity: innovative systems need open management styles, key operational systems require tight discipline, and there are usually a range of local or specialist systems that can be managed locally (for example, within the HR department. Then, because the lifecycle of software development comprises a number of distinct phases, requiring distinct skills, those skills can be adapted to different requirements [362:204]. For example, one traditional and relentless issue is whether to "build or buy" [741:227]. When institutions choose to develop their own systems in-house – the 'build' option, then standards and good documentation are needed. Without documentation, it is impossible to assure the quality and longevity of a systems investment [742:186]. In the negotiation of new systems design details, 'signing off' is not enough. The complexity of inter-dependencies is difficult to manage [830:165]. It is even more difficult when the project manager and the project 'owner' insist that certain things shall be done, despite contrary arguments based on long experience, and clear responsibilities that are being ignored or overridden [831:153].

Data

M71 It is not all about process. The management of data is a separate matter that cuts across different processes (as in the case of student records) and data migration from old to new systems is one of the least understood, most difficult, and critically important stages in systems development [958:225]. Then, the kind of data that we are dealing with needs to be acknowledged and understood. Some data might be critical to safety; not only is some research commercially confidential, some can lead to products that can be life threatening. Safety critical systems development is one area that has received a lot of attention in the international standards committees [867:225].

Integration

M72 In all cases when it arose, the problem of working with distinctly separate systems, from different sources and with different standards, was revealed to be an issue. Integration is something that people want, but which is difficult to achieve [728:198], but there are different pressures from different constituencies when it comes to the expected benefits of systems, especially when they represent the aggregation of the needs of different role players [726:225]. The need to integrate data sources, especially critical data about students, for example, recured in conversations with those who rely on that information [719:186].

M73 The rapid emergence of new devices is working against integration, in that it presents real support problems [902:221] and an unwelcome or unexpected variety of applications (or 'apps') that are needed to allow access to integrated organisational data [930:154], even when there is no knowledge or appreciation of standards [917:171]. This highlights yet again the variable demands of new ideas, new technologies, and legacy systems, all of which drive to the idea of portfolio management. Having no portfolio to manage that separates out the issues of novelty, criticality and strategic significance leads to difficulties in applying the right management methods - 'one size does not fit all' [1000:196]

Quality management

M74 Unless the quality of systems processes, products and services is monitored, together with the quality of the outcomes, it will not be possible to manage pro-actively [362:93]. If you don't know that things are going wrong, then you will always have to rely on your users to tell you [1002:170], and of course (according to one expert) people need to understand that 'it is almost impossible to produce a flawless piece of software' [971:245] and so we must expect problems that need to be dealt with. The challenge is to see the extent of the need for quality management: in explaining about quality control, a senior manager explained that there are many indicators of the 'quality' that is achieved, not just system 'up-time' and not just the learning outcomes achieved by the students [364:137], the benefits of university activity reaches right into the dark corners of society.

M75 Conversations with working professionals involved in higher education, but already employed in a professional capacity elsewhere, revealed a range of stories that remind us of the hazards of depending entirely on information systems, especially new ones, because there are always problems [964:169]. When services fail, or promises are broken, it can have a severe impact on users' confidence and future levels of co-operation [774:240] and so it is necessary to have backup plan. 'Business continuity' is a current issue that is not only quite high on the agenda in real businesses – tertiaries also have a responsibility to have a plan for disasters. Are the consequences of losing continuity of academic processes assessed and understood? Is there a plan to deal with failure? [718:185]

M76 For some managers it all comes down to service. The idea of using specialist software to help in the management of good levels of service is one idea under consideration [892:239], and independent auditing is available to assist in assessing conformance with good practice, to professional and international standards [716:185]. Stability is highly desirable. Having constantly changing IT management disrupts other functions that are otherwise working smoothly [839:186].

Information management

M77 It is a self-evident fact that there are points in any academic process when it is critical to have the right information, and that it be accurate [828:228]. It is frequently the case that role players do not take the actions incumbent on them to make data available, and then to deploy the related information in the right way [828:237].

Administrative information

M78 It is the changing nature of academic processes that drive us to reconsider how that might be achieved. As we move into an age of multiple mobile devices, and ever extending data capture and collection opportunities, a more thoughtful and flexible approach to information management is needed. One aspect of that required flexibility is to ease the constraints of the 'academic year' and allow things unconnected with the traditional academic year to happen when they are actually needed – more flexibility in timing and scheduling [991:225]. In a distributed environment, managing 'stuff that is sent everywhere' requires a discipline [999:195].

Academic information

M79 One facet of modern research is that the most useful material is not necessarily to be found in the journals, it is now possible to find someone's working paper, that they lodged in a repository just last week, and that one can discuss directly with the author; even blogs can be a good source of leads, and of contacts with experts and their networks [955:191].

Product

Functionality and capability

M80 Even something as mundane as the email system can upset users when it does not do what is expected [639:186; 977:246], especially when the free, generic web-based email services are so good and evolve so smoothly. In the case of more specific tailored systems, having business analysts and systems designers who can do a good job is a huge advantage [345:145; 996:171]. When systems simply do not do what is expected of them then there have to be questions about whether there was adequate engagement between the technical team and the putative users [346:137]; any system that simply does not work the way that people want it to work is problematic, and in one case academic freedom was impeded [348:145; 359:145].

M81 Having the right functionality at hand, things can be done very much more quickly than by manual procedures - but is simple efficiency enough? [829:220]

M82 Basic systems needs of research project leaders are not met - no access to financial systems, limited access to HR systems, and delays arising from having to engage in inappropriate ways [636:225].

The user interface

M83 The learning management system is a very highly regarded facility for students, that some of them use frequently and come to rely on heavily [604:228]. There is considerable delight in the mind of at least one student about the availability of services, and the way that things generally work well [607:176]. How many education systems designers understand that users want to be able to go anywhere (in a system) with no more than five clicks of the mouse? [425:143]

M84 On the other hand, changes to a marks administration system that enforced rules, embittered more than one respondent [985:239]. Another interesting moment was when a young administrator admitted that rather than logging onto the NRF system through her browser directly, she instead searched for it on Google and then clicked on the link. Perhaps it is useful that by doing this she was adding to the richness of Google analytics ... [660:233]

Public or private?

M85 It was extraordinary the extent to which a mature first-year student was liberated and enabled by the technology that was available, but mostly from public web services like WhatsApp (the primary

vehicle for communicating with lecturers and peers) and YouTube (the primary source of supplementary learning material) [500:226]

M86 Differences are seen between bespoke and proprietary systems for all the usual reasons: the risk of relying on one or two internal people for all aspects of a bespoke system, compared with the presumed reliability of a bought-in system, notwithstanding the time it might take to get changes and upgrades developed and installed [731:222].

Reliability

M87 The reliability of technical resources in the residences is variable - the printers seem to be especially vulnerable to failures [610:189].

M88 Data needs to be maintained. There is some evidence, perhaps inevitably, that the transition from one year to the next leaves some admin tasks undone, for example fixing up the links between academic staff and the courses for which they are responsible [603:186].

M89 Load shedding in South Africa has brought to light the risks of not having uninterruptable power supplies - when the network is not protected, then effectively everything shuts down when the power goes off [729:189].

Untapped potential

M90 Despite all the criticism that was heard concerning email services, only one respondent noted the benefits of email as a repository of what has happened, with attachments and meta-data to embellish the record [986:145].

The question of capability

M91 It can be difficult when users have many disparate opinions about what is necessary and what is needed [992:186]. In research, as with 'users' generally, it is often noted that people simply do not know what they want [814:157; 817:171; 819:228], but when the design is stabilised, the program code is understood, clean and properly documented, then the outcome of an project can be excellent [995:220]. Having technical staff that are actually capable, especially with requirements elicitation and specification, helps. And this stage of requirements analysis has to be linked to the later stage of testing. After all, in the ideal case what must be tested most carefully is the very functionality that the users say (or agree) that they want. When users cannot articulate their needs, then great care must be taken to make sure that there is no presumption without exploring and validating a range of ideas [996:171].

Having the right resources

M92 A campus LMS does not always suit the requirements of a teaching programme, nor does it provide all the resources that are required, especially for an intensive programme that needs constant and reliable access to specialised computing resources - rather have them in the lab, under the control of the teacher.

M93 Hence, laboratories, specialised workstations and other materials must be managed [973:251]. Where students have their own technology, it is surprising to find that they might have a laptop, a tablet, *and* a cell phone, and they all actually serve *quite different purposes*. In lectures it is a matter of convenience (tablets not laptops), for reports it is necessary to have a laptop (because it has a proper keyboard) and for email it is best to have it in your pocket (cell phone, of course) [597:237].

People

M94 Perhaps the most important person in the provision of information technology systems and services is the Chief Information Office, whether known by that or by another name. Losing a CIO can have an adverse impact when it takes long for executive committees and councils to recognise the importance of the CIO role and even longer to decide what to do about it. The skills and competencies of senior IT management are difficult to find, and highly valued when they are found [440:172; 438:163]. When faced with real change, the involvement and support of people at senior management level is needed, and that is one area where the CIO has an important role to play, lobbying and working with his peers [894:195].

M95 Another risk area is that of 'consultants' – a phrase that is used to describe a wide range of people, some of them no more than programmers. In a successful private hotel school, a business-like approach to the implementation of systems left them exposed when the one man who understood how the system worked moved away; despite promises, he failed to provide the support that was needed. A re-implementation of an open-source solution is managed by a women, who had to follow her husband to a distant Africa country but manages to provide all the support that is needed. Similar arrangements prevail in universities and represent a high risk factor [618:220]. Consultants assisted the RIMS project, yet another external dependency [320:146]. When internal systems depend on a single person, perhaps one who is close to retirement, then continuity and sustainability are at risk [721:222], even in national service institutions they have been caught by the 'only man who knows anything about it' problem [740:222].

M96 These examples highlight the kinds of people we need who have special capabilities that we choose to not have in-house. But there are other people issues.

M97 It is not always clear in the world of the Internet exactly who you are dealing with. Students provided with email accounts tend to forward the mail automatically to their own already-extant personal accounts, for convenience, but they need to be warned that incoming mail which is important will ONLY ever be sent from an official university email address. However, some students are reluctant or unable to engage with university systems for communication and for access to learning resources – there are too many risks of misrepresentation and fraud [595:228].

Things

M98 There are many kinds of 'things' that are needed – both physical and digital. When a thing fails, then people find that they can't do anything at all [658:177]; there are always small but irritating glitches in the provision of power and other critical services, it seems [981:177; 980:211]. .

M99 It falls to someone to make sure that resources such as labs and networks are all working OK [335:189] and the demands of adopting new technologies for systems development (within the IT function) are well understood by those who make a commercial living from software services – having the wrong tools introduces severe risks, but the right ones can cut costs and increase efficiency when it works out well [394:146]. Having the biggest and best does not lead to success: at least one supercomputer given to a research unit was either beyond what was needed, beyond what the unit was able to use, or inappropriate to the task – and it has been discarded [447:220]. In research a wide range of specialist software will be needed, not just design packages like Visio, but specialist packages for telemetry, like LabView [519:189].

M100 Despite having tender committees and formalised procedures, the way in which technical resources are acquired does not seem to vary according to need and circumstance - at the same time that academics (and students) are free to use a vast range of web services to enhance their teaching and learning, there are petty procedures that sometimes cause there to be no ink, or no paper, so that

teaching (in and around the classroom) simply cannot take place. Factors other than 'need' can affect the decision to approve procurement requests. On the other hand, with management support, things can be made easy to do [586:193]. Management support can make all the difference, when managers are able to manage well by recognising and balancing priorities to serve the larger purpose [584:221].

M101 Things have to be acquired in a rational way. Getting all the technical requirements listed for special purposes requires attention to details: is a proxy facility needed? how many USB ports are needed? [909:211] And the converse: what do all these things in the supplier's catalogue actually do? [907:153].

M102 Two research students working at masters level contributed to this study, they were developing 'authoring tools' for the content of mobile applications for deaf people. There is copious evidence of the tools needed to build applications for Android, with or without Windows and we don't need to go into the details here, but it is found that these tools evolve quite quickly, they are not always consistent, nor or they compatible with the needs of a developer. Perhaps it is this level of uncertainty that needs to be understood and managed, more than the tools themselves. One thing that does stand out is the importance of XML - just one standard that seems pervasive, widely used, and very useful. The systems design challenges that these young students faced were interesting, but really that is *their* learning and again we do not need to go into those details here [707:198; 706:222; 703:244]

Teaching and learning resources

M103 A clear trend is for (good, well intentioned) students to become more and more self-sufficient, and to reach in all possible directions in their search for learning resources. It is becoming expected that students will have their own devices, but only sometimes will disadvantaged students have devices provided so as to keep them at the same level of capability – that is one issue that has to be dealt with to level the learning landscape [767:194].

M104 Once upon a time it was just about books, today the issue of books (or the internet, or 'e-books') perplexes library and academic management as new patterns of access are formed [745:183; 749:220]. Vast learning resources are available on the web and teachers have the opportunity to prepare (and even to publish) their own material relatively easily. There was an interesting case of a short course for which the lecturer had written a book - and this was neither a short nor a simple book - it was hundreds of pages and it had sophisticated content linked to web resources and course tools. This was only possible through modern personal productivity tools in the hands of a very capable individual [969:168]. Increasingly, educators can reach out and access copious educational material at little or no cost. Compared with the cost of a academic textbook (R750?), spending a few moments on YouTube downloading a 45 minute lecture that provides a lucid and essentially complete overview, can make a great deal of sense [624:228; 496:144].

Tools of the trade

M105 The resources that comprise tools in education are of course varied, but here respondents highlighted software development and research tools.

M106 The local software industry has found that the tools for newer environments related to the internet and the world wide web are cumbersome and not subjected to standardisation [409:146]. To some extent this was reflected in the comments of the two masters-level research students. But their primary concerns were elsewhere.

M107 One of the postgraduate students was facing difficulty in finding the storage capacity that he needed for his videos - up to 7Gb each, and arriving four at a time. That is indeed a lot of storage space by

yesterday's standards [687:176] … the other was troubled by how he was going to analyse his qualitative research data - an issue that this writer can sympathise with [695:164].

M108 Both were using yet another example of an open-source community-developed package called GitHub - another web service, but a technical one for programmers. It acts as a repository for program code and a version control mechanism. The Web continues to provide radical new services that are being incorporated into higher education, by the students themselves if not by anyone else [703:246; 982:220]. The scope of support that is needed for research students working with software and digital systems is remarkable, there is much evidence, too detailed to include here [808:191; 824:220].

M109 The need for systems and services to support research recurred in more than one conversation. It is surprising that universities do not provide research teams with the integrated project and financial management software that they need. There are more than a few cases where research units simply developed their own systems, for example with spread sheets. Is that right? It is never as simple as it looks at first sight and there are accounting and book-keeping standards to be considered [523:148].

Data as a resource

M110 As already noted, data is both the flesh that binds systems together, through data sharing, and a problem when it is not reliable. Data that is appropriate to the task and reliable is something that is always needed but not always available [580:186]. Each institution should consider having a policy to guide the collection, storage, and use of research data. This need cuts across departments and domains of study [644:165].

YouTube

M111 YouTube keeps coming up as an example of the 'bad' (bandwidth wastage) and the 'excellent' (teaching materials) - this must be one of the most important shifts in knowledge acquisition for a long time [979:175]. It is not appropriate to drill down into the details here, but as a genre Web-based services such as YouTube need to be incorporated into strategic thinking, even if only to acknowledge the potential, authorise teachers to use it, and manage the consequences at the level of the bandwidth.

Boundary

The scope (of a project, and the system that it delivers)

M112 In this research project, the matter of the *scope* of systems, and of projects, has emerged as pre-eminent. This is not so much because respondents talked about scope explicitly, but the opportunities and problems that they described tended to hinge around the idea of the boundary of their activity within a project (in the case of technical staff) or their work (in the case of others – academics, administrators or managers).

Simple and complex examples

M113 A simple example: in one case the HR department had acquired a system for recording holidays and travel, which because of its design could only be used on campus. This rendered it useless for a large proportion of the staff, who needed to be able to use it when working at home, or using the mobile devices [351:181; 353:177].

M114 A more complex example: in the RIMS project, there were two major components but a wide variety of perceived different needs at a range of institutions, also differing greatly in their situations,

strategies and needs. The initial scoping of the RIMS project was not detailed, and it was soon realised that implementation would be different in the different institutions [315:147]. One has the impression that the scope of this project became extremely ill-defined by the infiltration of specific requirements in different institutions [312:147]. Involved institutions have some choice and participation is voluntary, but InfoEd is customised for each one. The team has assessed each context and has made recommendations as to what would be best: the concept is to address the greatest need. This leads to a high level of 'ambiguity' in the implementation of the project across individual HEIs [316:164], and there was a high level of ambiguity in the early implementations [323:163]. As the RIMS project progressed it became clear that it was much bigger than originally thought [319:147].

M115 Engagement with the individual institutions is established but clearly limited at the management and strategic level; the project is finding (or anticipating) considerable variation of need and capability where, at the start, it was assumed that needs were common to all. As the project stands, it seems to be offering a universal solution within which individual HEIs will have to articulate and implement (with some effort) features of the one-size-fits-all system [327:155]. The Johns Hopkins experience was critically dependent on the reaction and willing support of *researchers*, as well as managers and administrators; there seems to have been little attention to fully engaging and understanding the factors that would ensure the maximum support from those who will, in effect, be providing or originating the base data with which the system will work (and without which it will not) [330:184]. The conversation did not cover the question of how the RIMS project will be funded in the future, nor what the cost to role players will be; however it did reveal an intense concern on the part of the project team that the cost of project management and implementation will be higher than expected [332:160].

Managing the edges

M116 Organisations of all kinds have battled to bring together islands of automation that were conceived and constructed separately. The HR system in the previous section is an example, and this university is still living with islands of automation that are not yet integrated and yet should be, as the users recognise [355:177].

M117 In many contexts, the scope of a project includes social media as well as (or in lieu of) traditional systems environments. There seem to be no strategies that will encourage, enable, and support the use of these media at a time when virtually all the learners entering higher education are perceived to have smart phones, if not tables and laptops. That technology is very usable, but perhaps not yet so easily engineered [635:182]. This raises questions about who exactly owns what, and what students and teachers must provide for themselves. This boundary can become blurred, and where users enhance their university-provided equipment beyond the standard specification (if there is one), then they must expect to have to manage the problems that arise [786:189]. The scope of any systems development project must include provision for support, after implementation and the commencement of operations [785:153].

M118 Perhaps it is inevitable that there were many examples of internal boundaries getting in the way of clear vision about academic and administrative processes, but the boundary of responsibility for data is yet another problem. Despite senior management mandating that no-one 'owned' data, the 'my data' and 'your data' attitudes are prevalent in at least one institution [834:155]. When the scope of different systems overlaps, for example where data is shared, then hidden interdependencies can lead to catastrophic system failure. This is not critical when it is the Student Meal Booking system that has failed, but it is disastrous when it is the Student Registration System that has failed, during the registration period [994:182]. Happily, in at least one case, the registration system seems to be working quite well and is handling a steeply rising number of online applications [993:220].

Elsewhere, when there was confusion about data and the way that it expresses the status of a student, so that a student can be prevented from doing something that they should be allowed to do, then there are severe problems and a loss of confidence on the part of all concerned [356:188].

M119 The search for integration, as seen at the senior management level, is very strong indeed [375:198] and this leads right through to more effective teaching practice and administration [377:167]. With individuals harbouring all the knowledge about particular systems, with no overall control and no documentation, ensures that there will be problems. Monitoring and control systems are needed that pull the big picture together [1007:170].

Boundaries with the outside world

Internationalisation

M120 The activities of South African universities are becoming increasingly international and are increasingly concerned with outreach and partnership. Co-operation with international universities, with which can be established in new ways [780:185] and tertiary education is now an international phenomenon; the degree to which it is difficult (or financially unattractive) to foreigners to come and study and work in South Africa is very worrying. But it can be shown that when the circumstances are right, people will come [792:163; 793:171].

M121 Among professional people who are involved with higher education there is an ever clearer understanding of global trends and practices, and in South Africa there is ongoing pressure to consider adopting, or at least recognising, international standards and norms of different kinds [950:163]. The reach of the researcher is considerably extended and language becomes an issue; with such easy access to academic literature in different languages led one researcher to conclude that the use of different languages (even different dialects of English) was creating difficulty in web searching for specific or rare sources [945:204], but the use of specialist librarians was found to solve the problem in that case [948:171]. Such are the detailed consequences of internationalisation.

The world of work and community outreach

M122 But it is not only about internationalisation. The boundary with the local ‘outside world’ presents its own opportunities and challenges. Working with employers helps to make education relevant, and reaching out to communities can assist them to improve their socio-economic circumstances.

M123 In a new postgrad course concerned with computer programming skills, there was an intense focus on creating something that mirrored the working environment in the 'real world', with set working hours, no excuses allowed, and a high level of team working that delivered impressive results. It taught a full range of skills in a short time, including systems integration and testing, specifically so as to be relevant to the world of work, outside universities [971:182]. In applied research it is fundamental to engage with the outside world, form partnerships, and deliver useful technology and ideas to what is really a market [526:156].

M124 There was considerable scepticism on the part of one senior manager, having career experience in private education sector and trying to develop community education opportunities [625:148]. In trying to develop a community 'cooking school' he was reminded how important it is to have an online Web presence in the modern world - not just for the students but also for the sponsors and funders, who want to see their support publically declared and acknowledged. They also want to see that progress is being made, so that their support can be justified [629:240]. The same is true for universities.

M125 At a more practical level, the director of a university e-learning centre provided many examples of outreach and the opportunities arising, all related to the availability of technology [472:214]. A programme of learning and self-support had been developed and delivered, and monitoring back in the communities was indicating real benefits; a key element was including training not just in the use of the technology, but also in management and marketing so that the local champions could further extend the programme and the benefits [471:220]. It is good to see that the resources from within a university can be deployed for the benefit of needy people outside, in distant communities [461:181]. This engagement with communities works both ways, for the move to community-based open-source systems is now recognised as an economical and viable option, and even a competitive threat to those institutions that have committed to expensive commercial options. The origins of such open-source systems are sometimes very modest [388:155], but can lead to a dominant international presence, as in the case of Sakai (an open-source learning management system) and Zotero (an open-source bibliography management system for researchers).

Innovation and 'third stream' revenue

M126 Having everything digital and reproducible (at very low cost) makes university management think about third stream revenue – this might be from the sales of digital artefacts [750:222; 751:193] or it might be by the development of 'innovation hubs', business partnerships and intellectual property management regimes [448:202]. There is a trend for universities to introduce or expand their ability to work with industry, so as to profit from products and services derived from their research and development efforts. The feeling and mode of working within those units can feel very different to both conventional academia and conventional business and '*it is not easy to sing two tunes at the same time*' [853:225]. Such a move can bring an institution more starkly into the international world, because high-tech business is very global today and taking charge of a business partnership project demands a wide range of managerial and technical skills [858:168]. There are excellent examples of success in Europe, it was said by one respondent, implying that South Africa needed to learn from success elsewhere [854:163].

Managing the supply side

M127 Despite the number of respondents working on the information technology side, there was relatively little reference to supply-side issues. However, one IT manager did note that supplier relationships are better when they are managed co-operatively. He referred to the Dell example, where customers could configure machine requirements according to their requirements, on the Dell web site. He pointed out that you don't get that with the low cost suppliers, and yet cost containment was driving universities to purchase from the low end of the market [910:160].

M128 Working with administrators for procurement purposes can be smooth, or bumpy. Sometimes very bumpy [807:237].

Working with the Web

M129 The World Wide Web is affecting many different aspects of education, as a learning resource, as a cheating resource and as a source of services such as email and bibliography management.

M130 A decision to 'go with Google' for email has significant implications for an organisation that has a long history of doing nearly everything for itself, but managing such a change is not easy at the same time that academics have the option to use Google and other web services whenever and to any extent that they choose, at no cost and without any dependency on the IT services department [451:193].

M131 So do students have the same options of course, and the effort to eliminate or reduce plagiarism in research and academic writing has become a battle of wits between students and examiners. On the

argument that there is a great deal of chicanery going on in the world of research, we should be concerned that information technology is both accelerating it and containing [761:163]. In fact, there was relatively little reference to plagiarism in the interviews.

The Research Information Management System - RIMS

M132 InfoEd, a spin-off from Johns Hopkins University in Baltimore, originated as a system for managing patent applications and intellectual property. It has been adopted in South Africa for the purposes of research reporting to government. Much adaptation has been required, and additional functionality has had to be added to the mix [313:152]. Despite the lack of publically available information on a major project as large and important as RIMS, it seems to have been a difficult project [386:155].

M133 In any case where systems are chosen that are from external sources, whether commercial packages or open-source community-driven initiatives, the cost of achieving enhancements and fixing problems increases according to the majority view as to what is needed. Embarking on unique enhancements or fixes, for the purposes of one's own institution, is an extremely hazardous route to take [568:148]. The case of RIMS brings mixed messages: whilst asserting that RIMS is working for those administrators concerned with monitoring publications, the administration of research grants and travel expenses has been late in delivery, and this has worried at least one administrator who has had an early-user role in the testing phase [664:178]. But she could see the benefits, and was simply frustrated that the full functionality was not yet available. She has also learned that during implementation users often have to do double the work – once in the old system and then once again in the new system [664:237], her hope to go 'paperless' was as yet unfulfilled [663:220] and she admitted that the system simply was not working yet [661:177].

The need for standards

M134 Although there was an awareness of good practice guidelines (see below) this was really confined to technical managers. On the academic and administrative side there was either a very low awareness of *available* standards and good practice guidelines, or no imperative to discuss them. This was despite knowing that the research study was directed at an understanding of standards in their working context. On the other hand, there was a high level of awareness of *the need* for standards.

Setting objectives for standardisation

M135 The adoption of a standard must be done with an understanding of what it is intended to achieve. Typically, this might be an agreed set of performance indicators and an agreed vocabulary .. 'where an event is an event, an incident is an incident, a problem is a problem' [890:93].

M136 Standards sometimes are tightly bound into the systems and software regimes that they are intended to work with. It is very frustrating in South Africa when organisations cannot gather a project team together that understands and shares a single regime for co-operation, with a common vocabulary and common rules for working cooperatively [951:204].

Kinds of standards

M137 There are different kinds of standards that serve different purpose. Some are 'top down', taking a high level view of a domain and providing a structured set of ideas that get complex situations properly organised; some are 'bottom up', taking very specific details and specifying how they will be dealt with in a way that will work well with other related specific details. For example, whereas ITIL is top down, COBIT is seen as bottom up [889:182; 890:204].

M138 There are standards for people working in the IT industry. When capable individuals are hard to find, it is useful to have certification schemes, perhaps of software and systems engineers, in any context

where there are significant dependencies on skills. That goes two ways of course: first, are universities providing that kind of education (for students to get certified), and second, should they be doing so? [799:154].

M139 In particular industries where specialists strive to work together well to common levels of quality and reliability, both the international standards organisations and professional communities offer options. When it comes to software and information systems engineering, ISO (the International Organization for Standardization) works jointly with the IEC (International Electrotechnical Commission) by means of a joint technical committee. There is only a very low level of awareness of this body of standardisation amongst respondents – just one, a research project director, made an unprompted reference to the well-known but often misunderstood quality management standard, ISO9000 [528:205].

M140 On the other hand, there is a high level of awareness of such professional good practice schemes as COBIT, ITIL, SPICE and PRINCE. There is a distinction between specific ISO-IEC standards and the more open guidelines that come from professional special interest groups, commonly referred to as 'best practice' or 'good practice' [889:158]. Where an institution invests in understanding and evaluating standards such as ITIL and COBIT it generates a degree of confidence that the partnership between the IT function and the institution at large will be manageable. Training in these 'methods' can include (should include?) management and 'users' as well as technical specialists [889:200].

M141 So much for international standards. Institutions can choose to set their own standards, and individual project teams can also adopt standards that they believe will suit them. However, having an institutional standard for PCs (in labs) does not always guarantee that all needs will be met [813:158].

Project management standards

M142 A professional project manager argues very strongly that where ever you are managing projects the same rules apply it's all about time, quality and cost [872:194]. In the case of the RIMS project, at the time of the conversation, It was admitted that there were no standards as such guiding the RIMS project [317:174] but that professional project management was needed for such a complex project [318:174]. It was considered that traditional project management techniques such as PRINCE and PMBOK simply would not work, because the project chose to take an ‘agile’ approach to the project management [321:158]. At a time of change the discipline of project management can be so easily lost, which threatens the outcome of key operational systems such as RIMS [437:186].

M143 Agility is an attempt to bypass the problems of traditional tightly structured approaches to systems development projects. In the software industry there is a very clear view as to the four or five stages that a new systems implementation has to go through: needs and requirements, viability, development (of the software), testing and then implementation. Typically this might be used to shape a project over many months, even years. Agility tries to traverse these stages in days or hours [398:178]. The reference to viability is interesting: does the higher education sector in South Africa pay adequate attention to viability before committing to projects?

Data exchange standards

M144 Standards for data exchange in industry have been largely agreed for many years now, and in some sectors are acknowledged by the South African government. But there is a long way to go with the data that is exchanged in education. Are there the same pressures to exchange information? And, are there similar patterns of benefit to be had by the exchange-ees? [407:174]

M145 Operationally, the need for standards can be seen when the exchange of information between different systems is examined [998:170]. In some areas work is under way, however: in the bio-

informatics realm the need for data standards is understood and it is being addressed [645:205]. The large volume of data involved in bio-informatics makes clear the dramatic increase in data that is being generated, especially in research. Sometimes the data that is needed for research is confidential or sensitive [816:149]; the opportunity to collect more data about teaching and learning is also there [448:185] and raises parallel questions of confidentiality and ethics [375:93].

M146 In the background, the Department of Higher Education and Training still makes demands on universities for information that can only be derived from additional functionality in the systems [997:187], but this is hardly analytics in the present sense – merely aggregated data concerned with programmes, student throughput and performance.

Professional good practice standards

M147 There are many references elsewhere to professional good practice standards, or guidelines. It is felt that at the same time that there are advantages the implementation of good practice guidelines can reveal a basic shortage of human resource with which to get the job done properly [911:190]. There is also evidence of a quite passionate view about the merits of schemes such as COBIT [368:174]. Of course, one has to be aware of the extent to which COBIT, ITIL or any comparable guidelines or standards might be actually applied in higher education and it is not clear that these kinds of guidelines have been adopted in a holistic and committed way. It is still 'early days', and there is a need to map them to actual need (as this study set out to do) [363 :158].

Conceptualisation of standards

M148 The final search for meaning in this review of the qualitative material is to look for respondents' views about what standards are, and how they might work. This is reaching from their 'real world' into the more abstract world of thinking about standards.

M149 Data standards come to the fore immediately. Ontologies are seen as the means to establish standards for shared data and the procedures whereby research data can be maintained and preserved for the future – there is extensive effort to develop ontologies in many different areas, for example in bio-informatics [645:243].

M150 More widely, 'bodies of knowledge' are one feature of the international effort to organise and disseminate knowledge about how to best understand a domain of endeavour. In discussing the relevance of this research project, the South African national standards representative working with software and systems standards was cautious in relating it to international standards, but he places some importance on the bodies of knowledge that are emerging [798:249]. Such bodies of knowledge take different forms but attempt to step right back and take the 'top down' view that is referred to above.

M151 Understanding the scope of standards is important. One university CIO, in a detailed discussion about how standards contributed strategically to the institution, made it clear that in his opinion software and systems engineering standards makers (the committees and special interest groups that develop them) had to reach further and further into the domain of the business in order to see the measures that define success [367:133] – this aligns strongly with the motivation for this research project. With the introduction of new systems that embody good practice and appropriate standards for data handling and procedures, then there is a very clear contribution to 'doing things right' but also to 'doing the right thing', with good outcomes – at the end of the day it is the outcome, in terms of educational or research achievement, that matters [577:220].

M152 Another aspect of scope is the question of which standards work with other standards. The masters students who were working to develop apps for mobile phones found incompatibilities between software and systems development tools that made things difficult. There are therefore questions

about the inter-operability of these newer, rapidly evolving software tools that are difficult to deal with, but might be inevitable, and will have to be dealt with in the end [681:162]. As the complexity of a project grows, with different teams managing different parts of distributed systems, then it is even more important that appropriate standards are needed that work together effectively [1004:204].

Final word

M153 Managing complexity becomes one of the main issues that standards must address, and they sometimes do this by the development of reference models that are the highest level of conceptualisation, provide fundamental definitions about what is what, and provide a binding framework that provides boundaries and relationships between areas of standardisation.

Appendix 6 **Data collection statistics**

		Qualitative		RepGrid				
		Responses	Word count	Responses	Events	Characteristics	Applicabilities	Ratings
Totals:	Type	38	94455	30	312	228	2242	1132
Pilot respondent		Done	3545	Done	10			
National Software Project	M	Done	2143	n/a				
HEI CIO & Programme manager	M	Done	4753	n/a				
Software House CEO	M	Done	7138	Checked	6	9	48	31
HEI Technology manager	T	Done	3894					
HEI E-Learning director	M	Done	3369	Done	10	8	80	59
Mature first year student (health)	S	Done	3252	Done	7	8	58	38
Director Research Projects	R	Done	3584	Done	5	5	25	15
Outsource partner CEO	M	Done	5114	Done	2	7	54	31
IT Facilitator	T	Done	4574	Done	15	9	111	87
First year student (science)	S	Done	2740	Done	12	6	72	43
Education activist	M	Done	3175	Done	8	2	0	0
Project manager	P	Done	1152	Done	7	5	34	21
Director Research Programme	M	Done	1680	Done	6	8	41	22
Research administrator	A	Done	1409	Done	7	8	37	27
Masters student	R	Done	3302	Done	8	8	48	43
Masters student	R	Done	1270	Done	9	6	21	19
Information manager	A	Done	2160	Done	9	5	44	22
Research director	M	Done	5055	n/a				
Academic Head of Department	E	Done	5792	Done	14	6	60	51
National standardisation delegate	T	Done	628	n/a				
Help desk manager	A	Done	2719	Done	9	7	55	48
Information manager	A	Done	5158	n/a				
Director IT development	M							
Research Lab technical specialist	T	Done	1572	Done	8	6	48	38
Project manager	P	Done	2332	Done	10	9	90	72
Technology manager	M	Done	2854	Done	8	7	54	38
Technical Team A member 1	T	Done	2538	Done	14	8	112	52
Technical Team A member 2	T	Done		Done	11	8	54	41
Technical Team A member 3	T	Done		Done	6	8	41	27
Technical Team A member 4	T	Done		Done	11	8	88	3
Business consultant as PG student	R	Done	2846	Done	9	10	90	40
Lecturer	E	Done	2675	Done	11	7	77	36
Technical Team B member 1	T	Done	2032	Partial				
Technical Team B member 2	T	Done		Done	16	10	160	53
Technical Team B member 3	T	Done		Done	16	10	160	37
Technical Team B member 4	T	Done		Done	16	10	160	38
Technical Team B member 5	T	Done		Done	16	10	160	51
Technical Team B IT Manager	M	Done		Done	16	10	160	49

Notes:

- RES 01 and 02 were early interviews, RepGrid data was not attempted
- RES 04 was not available for RepGrid data
- RES 18 was not willing to undertake the RepGrid stage of the interview
- RES 20 had no relevant educational systems experience in recent years
- RES 21 was a very long interview and family circumstances prevented a second appointment for the RepGrid stage
- RES 23 was interviewed as part of Technical Team B
- The RepGrid data for RS 33 was incomplete and therefore was not used

Appendix 7 **Tabulation of cases**

The table following lists all the cases that were nominated by respondents for analysis. As well as the name, the table provides and indication of:

- The category and type of case.
- The status of the case.
- The outcome of the case.

Category	Type	Case	Status	Outcome
Admin	Process	Assessing resources	Operational	OK
Admin	Process	Assigning resources	Operational	Excellent
Admin	Process	Communicate with fabricators	Operational	OK
Admin	Process	Establishing employment contract	Operational	Good
Admin	Project	Financial reporting	Operational	Bad
Admin	Project	Hardware purchases	Operational	Bad
Admin	Project	Nursing e-Booking System	Operational	Good
Admin	Service	Research support	Operational	OK
Admin	System	Financial order management	Operational	Good
Admin	System	My Excel System	Operational	Excellent
Admin	System	Student Meal booking system	Operational	Very bad
Core operational	Project	Timetabling	Upgrading	Excellent
Core operational	Service	Email	Operational	Good
Core operational	Service	Email & communicating	Operational	Good
Core operational	Service	Email (Groupwise)	Operational	OK
Core operational	Service	E-mail system	Operational	Very bad
Core operational	Service	Printing	Operational	OK
Core operational	Service	Procurement	Operational	Very bad
Core operational	Service	Student card	Operational	Good
Core operational	Service	University library service	Operational	Excellent
Core operational	Service	UWC Web	Operational	OK
Core operational	System	Application processing system	Operational	Bad
Core operational	System	ITS	Operational	Good
Core operational	System	LMS	Operational	Excellent
Core operational	System	LMS	Operational	Excellent
Core operational	System	Marks administration (MAS)	Retiring	Good
Core operational	System	Marks Administration System	Operational	(Other)
Core operational	System	Online content and assessment	Operational	Bad
Core operational	System	Purchasing	Operational	OK
Core operational	System	Short Course Integration Infrastructure	Operational	Good

Core operational	System	Student Application System	Operational	Good
Core operational	System	Student information system	Operational	Good
Infrastructure	Infrastructure	Internet	Operational	Good
Infrastructure	Infrastructure	Internet / networking / resources	Operational	Bad
Infrastructure	Infrastructure	Office suite Exchange Sharepoint	Operational	Good
Infrastructure	Infrastructure	Oracle for HR	Operational	Good
Infrastructure	Project	ITS integrator upgrade	Developing	OK
Innovative	Process	Brainstorming	Upgrading	Excellent
Innovative	Project	3D printing	Operational	Good
Innovative	Project	Battery management system	Developing	OK
Innovative	Project	BI Intelligence Application	Developing	Excellent
Innovative	Project	Clicker	Developing	OK
Innovative	Project	Digital inclusion & partnership with communities	Operational	Good
Innovative	Project	FOSS Lab dedicated to PGD SWD	Operational	Excellent
Innovative	Project	Mobile application development	Developing	Good
Innovative	Project	Super graphics	Operational	Excellent
Innovative	Project	UDUB IT	Developing	Good
Innovative	Project	Vehicle battery pack	Operational	Bad
Innovative	Service	Git hub	Operational	Good
Innovative	Service	Software versioning system such as GitHub	Operational	Excellent
Innovative	System	BI in Mining	Operational	Excellent
Innovative	System	RIMS	Testing	Good
Innovative	System	SMS system	Developing	Good
Innovative	System	Whatsapp	Developing	Good
Management	Project	Executive support	Operational	Excellent
Management	Project	User Engagement	Developing	Excellent
Method	Method	ASAP (rapid implementation)	Operational	Good
Method	Method	HEAT	Upgrading	Bad
Method	Method	ITIL Processes	Operational	Good
Service	Service	Google	Operational	Good
Service	Service	Google Drive	Operational	Good
Service	Service	Google Scholar	Operational	Excellent
Service	Service	Google scholar and information sourcing	Operational	Good
Service	Service	Help desk	Operational	Good
Service	Service	Web searching	Operational	Good
Service	System	Mendeley	Operational	Good
Strategic	Project	Professionalisation of T&L	Operational	Good
Strategic	Project	Research initiative	Operational	Excellent
Strategic	Project	Selecting new LMS for	Operational	Excellent

Strategic	System	Kuali	Tentative	OK
Strategic	System	Labview	Operational	Bad
Strategic	System	LMS	Developing	Good
Strategic	System	Student mentoring project	Operational	Bad
Technical	Project	Database design	Developing	Good
Technical	Project	System Modules	Developing	Good
Technical	Project	Web development vs Desktop	Testing	Good
Technical	Project resource	Android studio	Operational	Bad
Technical	Project resource	Eclipse/Text pad	Operational	Good
Technical	Project resource	Java/Latex	Operational	OK
Technical	Project resource	Net Bean	Operational	OK
Technical	Service	API documentation	Operational	OK
Technical	Service	Maintain iKamva	Operational	Good

Appendix 8 **Tabulation of events**

The table following lists all the bottom-level events that were nominated by respondents for analysis. As well as the name, the table provides:

- Explanatory notes from the researcher, giving additional background for each.
- An allocation to an event group based on the chain of value that is the IMBOK.
- A simple note concerning the outcome of the event.

Name	Notes	Group	Outcome
Access to travel services	Student registration supported by readable student cards provides access to a range of supporting services, for example travel services.	BP	Good
Accommodating requests	Having a system for timetabling provided a better means to accommodate requests coming in from teachers.	IS-BP	Excellent
Accommodating requirements	Choices will be based on compromise if all requirements are to be met.	IS-BP	Excellent
Achieve staff development	New systems mean career development opportunities for staff.	BP	Good
Achievement of a complex, working piece of software	At the end of an intensive programme of tuition, students have the satisfaction of producing a system that actually works, and that is not simple.	BP	Excellent
Additional functional capabilities for business units	Good systems deliver additional functions to help people in their work.	IS-BP	Good
Adopt Financial Management	Managing expenditure in a funded research project needs supporting financial management systems.	IS-BP	Good
Adoption	Adoption is about hearts and minds, not always easy.	IS-BP	OK
Agreeing full time working	This is another example of HR issues that sit in the background of university working.	MAN	Good
Agreeing to fresh start	Sometimes it is better to start over than to try and recover from a confused situation.	MAN	Excellent
Approval for new computers	Equipping a laboratory with new PCs is expensive and the priorities are not always understood by managers who have to approve the expenditure.	MAN	Bad
Asset Management strategy in place	All the technology has to be recorded and looked after.	BS	Good
Assisting users to understand the benefit of applying project management principles in delivering the requirement	This project manager did not focus adequately on EVENTS, but here she refers to the establishment of an understanding of the need for proper project management - necessary apparently in the case at hand.	MAN	Good
Authentication	Authentication makes sure that who people say they are is who they (almost certainly?) actually are.	IT-IS	Excellent
AV problems	Basic facilities like audio visual need to be working for large classes.	BP	OK
Availability of theses and articles for free	Contemporary access to academic publications is orders-of-magnitude easier than it ever has been.	BP	Excellent

Name	Notes	Group	Outcome
Bandwidth for streaming	The perpetual problem of not enough bandwidth for data-intensive systems activities like video.	IT	Bad
Being tasked by the Dean	When the Dean says 'this is what you must do' then it helps to have their authority and support.	MAN	Good
Blog Tool	Here a re-usable module was sought to augment the capability of a learning management system - it was not easy.	IS	Bad
Bootcamp	This idea, to go to a boot camp, got the team started with their portfolio of software development.	BP	Excellent
Broken dependency	An example of excessive change in the capabilities and details of IDE components.	IT-IS	Very bad
Build android app with libraries	A modern trend is to build apps for mobile devices, introducing a new 'ecosystem' with new tools and source code libraries.	IT-IS	OK
Build change - reinstall	One of the problems with modern programming is the speed with which development environments change, sometimes affecting the inter-operability of key components of the IDE.	IT	OK
Build new system	Initiating new applied chemistry research requires time and effort - this was the realisation that the lab telemetry system was going to be expensive and difficult to deal with.	IT-IS	Bad
Can't get functional upgrades	Upgrading key operational systems is resource and time consuming.	IS-BP	Bad
Capability of attachments	This is historical - but the issue of attachments is still important, now for reasons of security and abuse.	IS	Good
Challenges in terms of virtual roles vs. grading. Staff shortages	The adoption of good practice guidelines led to a definition of roles that went beyond the human resources available.	MAN	Bad
Change in specification every year	This is about asynchrony between academic and technology processes. Here there is an annual discussion about changes, that can then take a long time to get implemented …	IS-BP	Very bad
Change requests	People change their minds, and circumstances change.	IS-BP	Bad
Changes to the process	Processes change (but people are not always told about it …)	BP	OK
Changing storage (pressure to use equipment not yet provided)	The pace of change of technology needs to be managed in relation to the technology that people actually on their desks, to use.	IT	Bad
Changing the business model	With the emergence of open source community-based systems, the nature of the systems services business changes - revenue must be generated from support, because (often? always?) there is no licence fee income when it is open source.	BP	OK
Clash of quotes	This was a difficult event that actually had a good outcome, after the problems had been dealt with.	MAN	Good
Closing lease agreement	Decisions to change the basis of financing technology can have undesirable consequences.	MAN	Very bad

Name	Notes	Group	Outcome
Completion of the specification	Finalising a specification of requirements provides some stability when it is done well, it is a problem when it is not.	IT-IS	Bad
Complex rollout	A critical time is when rolling out upgrades to key operational systems, or rolling out new systems of course. It puts particular stress on the systems support staff.	IS-BP	Bad
Computer lab crashing	It makes for difficulty when lab facilities are unreliable.	IT	Very bad
Conference Committee (ConfCom)	This is a home-grown spreadsheet system developed by the administrator that deals with requests for financial support for academics hoping to attend conferences.	BP	Good
Cost too high	Having looked at the total cost of moving to web development, it was decided to take a different approach.	BS	Very bad
Could not print report - lorries not coming in	This is another side comment from a part time student currently working on contract, but it illustrates the fact that external factors can come in and create avoidable difficulties that have to be worked around.	IT-IS	Very bad
Council listens and agrees	With a good case, well supported with facts and documentation, it is possible to get a university council to agree to major investments.	MAN	Excellent
Create main class	A key task in using modern object oriented development environments is to create classes.	IT-IS	OK
Crisis management (lack of info)	When the information is not available that is needed, there can be avoidable crises.	IS-BP	OK
Critical to the success of a project of this nature impacting on the entire Institution	Getting the management on board, and keeping them there.	MAN	Excellent
Customer Review of Beta	Making sure that the user knows what is coming helps to deliver a successful outcome.	IS-BP	Excellent
Data captured not usable	An investment in capturing data turns sour when it is clear that the data is not usable, for whatever reason.	IS	Very bad
Data extraction mgt & ad hoc	Getting into the data is necessary for an information manager.	IS-BP	OK
Database design needed	Legacy systems often run with databases that were designed a long time ago, and amended from time to time so as to lose their integrity and their appropriateness in light of changing organisational needs. This moment was the moment when it was realised	IT-IS	Good
Day to day activity	Personal productivity software assists professional staff working with information.	BP	OK
Dealing with custom software	When custom software is needed, a project has to be mounted.	IT	OK
Dealing with data quality	New systems can reveal the inadequacy of legacy data that is migrated and imported into the new system from old ones.	IS-BP	OK

Name	Notes	Group	Outcome
Dealing with tekkies - loss of password!	When personal equipment is sent for repair, it does not always come back in the intended condition - like when the password has been changed without permission.	IS-BP	Bad
Deciding not ready to host internally	The internal university IT services were unable to provide hosting facilities for a new learning management system.	MAN	Bad
Deciding to 'go' with Academic partner	This is a case where a business partner took a strategic decision to work closely with a university.	MAN	Good
Decision to go with Linux	The choice of Linux is seen as liberating by some technical people. Here it provided the liberty to choose the functional components of the environment from a wide selection of options.	IT	Excellent
Decision to move into research	This was an internal management decision to press on and start a research programme within a service department.	MAN	Good
Defining responsibilities	New systems make it necessary to redefine responsibilities, possibly causing unwelcome change to work practices but welcomed when there are real benefits for the users.	MAN	Good
Delivering a module for a specific area in the student administration process seamlessly integrating with the bigger solution	This project manager did not focus adequately on EVENTS, but here she refers to the establishment of a system requirement.	IT-IS	Excellent
Demo workshop	When admin staff are faced with the introduction of new systems, it is good to give them a chance to see what is proposed, ahead of time.	IS-BP	Good
Dependency on single person to operate and understand system	With no documentation, everything begins to depend on the one person who knows how a system works (because they wrote it, and they chose not to document it).	IS	Very bad
Dept of Mathematics Partnership	In this case, a strategic partnership with an academic department arose because one academic from the department became involved with a project idea. Serendipity?	BS	Excellent
Different interface Mac and Windows	The clash of systems architectures: Apple Macs do not work the same way as Microsoft Windows.	IT	Bad
Different interface Mac and Windows	The clash of systems architectures: Apple Macs do not work the same way as Microsoft Windows.	IT-IS	Bad
Discovered chat rooms	The LMS provided more than just access to learning resources, it has chat rooms.	IS	Excellent
Discovered PLECO - Chinese translator	Students help each other sometimes: here a mature student was introduced to a translator that she could have on her smart phone, ahead of learning about oriental health management systems from literature written in Chinese.	IS	Excellent
Discovering for reference management	As a research student, it was gratifying to find support for managing bibliographies and references on free-to-download software packages.	IS	Excellent
Discovering how to use the service	Printing is often the most difficult and expensive aspect of using information technology - in this case it was well provided and well supported.	IS-BP	Excellent

Name	Notes	Group	Outcome
Discovering Prof Fink on YouTube	This was the source of much delight on the part of the student - faced with a challenging series of lectures, there was relief at finding a high-quality YouTube video dealing with the subject matter more coherently and at a simpler level.	BB	Excellent
Discussion of requirements	The classic stage when user requirements are discussed ahead of specification, design, coding and testing.	IS-BP	Good
Documentation for decision to "GO"	Developing the arguments to replace and reinvest in major core systems requires careful collection and documentation of all the facts, so that senior management can make an informed decision.	MAN	Excellent
Download	NetBeans is a development utility that can be downloaded, but it needs to be assessed against the other options that exist.	IT	OK
Downloaded but a few days to see tabs	The data in key operational systems needs to be maintained - this was a case where last year's data had not been taken down from the LMS and this caused confusion amongst the new first year students.	IS	Good
Draft engineering drawings communicate fabrications	In applied research it is necessary to buy in fabrications from specialists, and they need to be specified and documented.	BP	Bad
Drag and drop is good	A useful feature of using Google Drive is 'drag and drop'.	IT	Good
Drives home cooperative nature of software development	An outcome of learning about software development in a team context.	BB	Good
Edwin Gale reference to old paper in French	Having access to so many academic sources means that one is likely to be taken to foreign sources in different languages.	BP	Excellent
Electronic application process results in more efficiency	Now that students can apply online, with no paperwork, efficiency is increased. But it is still necessary to process some paper applications because not all applicants have access to email and the Web.	BB	Excellent
End user computing & PC management	Using the Office suite for personal productivity.	IS-BP	OK
Engagement with IT	Working with the IT services people to sort out email problems was not a good experience.	IT-IS	Very bad
Establishing component set	Organising an innovation unit needs an understanding of the core component set that will support the R&D work, and sustain the product that is developed in testing and installation.	BP	Good
E-Tools course now embedded in the programme	Academic staff have to be given time to learn and absorb the use of digital tools for teaching and learning. The staff induction programme was augmented to include a module on e-tools.	BP	Good
Failed access to res	When basic core systems do not work immediately it is disappointing and problematic.	BP	Bad
Failure to repair cable	When data networks are damaged then everything comes to a stop. Well, nearly.	IT	Very bad

Name	Notes	Group	Outcome
Feedback meeting	As systems become available during development it is important to review what has been done with users. Good feedback indicates that things are going well.	IT-IS	Good
Filter for date	In her personal research the use of Google Scholar and its many features was providing much delight.	IS	Excellent
Finalisation of training programme including DESIGN	This was a course offered as outreach, and the finalisation of the design was an important milestone.	BP	Good
Find people	No need for the telephone book, people can be found more easily with Google, where ever they are in the world.	BP	Good
First forum by email - student discussions	This is historical - but the capability to share educational activities globally is a feature of modern education.	BP	Excellent
First overnight email with N Hemisphere	This is historical - but the capability to exchange information regardless of time, distance and size continues to expand.	BP	Excellent
Fixing reference problems	Learning to use bibliography managers has its problems.	BP	Good
Gaining agreement	Ideas have to be agreed before acting on them.	MAN	Good
Getting big Battery pack working	When it works, it's good.	BP	Good
Getting difficult documents via library service	There were occasions when this student had to revert to the library to access obscure documents, with excellent results.	BP	Excellent
Getting marks	Immediate access to marks via email is seen as a real benefit by this student.	IS-BP	Good
Getting messages from lecturer etc.	Students are delighted when they find that email is a good and reliable medium with which to communicate with lecturing staff.	IS-BP	Good
Getting NASA notices	This was personal interest, but the facilities available were helpful in augmenting personal (but serious) side-interests, without significant cost to the individual nor to the university.	BP	Good
Getting recent information compared library	The web proves to be a great tool for information sources.	BP	Excellent
Good instructions	The use of the printing facilities was well documented.	MAN	Good
Govt decided to close access for motor vehicles	This is a side comment from a part time student currently working on contract, but it illustrates the fact that external factors can come in and create avoidable difficulties that have to be worked around.	MAN	Bad
Handover	When it works, handing over a new system is a good experience.	IS-BP	Good
Having a module approach assists in building the relationship between project and user, promoting delivery of a quality solution	This is a comment on breaking down complex systems into modules that will be easier to manage.	IT-IS	Excellent
Human Error	It happens, and it makes for trouble.	IT-IS	Bad

Name	Notes	Group	Outcome
I just had to "go there …"	The level of support can be challenging - 'just go there …' is not the most helpful advice to give a first year student.	IS-BP	OK
Imaging across PC types	Running a PC lab involves managing the content of the disk drives. 'Imaging' is a way of rapidly applying a standard configuration of operating system software, utilities and applications software to all the PCs in a lab - but they all have to be identic	IT	Bad
Imposing standards	New systems provide the opportunity to impose standards or rules that have previously been flouted.	MAN	Good
Informs method	The use of this IDE provided a masters research student with guidance as to the methods of systems development in a mobile environment.	IT	OK
Integrated database seamless to the user across various modules supporting the administration process to the student	This project manager did not focus adequately on EVENTS, but here she refers to the establishment of a system design issue.	IT-IS	Excellent
Integration	Integration is a late stage in putting together systems development components - GitHub is a recent innovation for tracking and managing the different versions of code and documents.	IT-IS	Good
Integration	Having a modular approach is good, but then everything has to be put together.	IT-IS	Excellent
Introduction of automated development operations (‘devops’)	One recent idea from experts is that there needs to be a proper regime of managing development operations. We will see … but is this not an obvious and already-understood idea?	IT-IS	Excellent
Involving identified Executive role players in the user engagement also assisted in improving Operational relationships	This is about getting champions to work with you.	MAN	Excellent
Involving users in the project with regards to their specific need in order to deliver a technology solution that will simplify their daily tasks adhering to institutional policies and standards	This project manager did not focus adequately on EVENTS, but here she refers to the establishment of a project management issue a the requirements analysis stage.	IS-BP	Good
Lack of business process documentation from business units	Too often business people do not document what they do - so that individuals become the sole repositories of 'how to do this' and building systems that actually match the requirement is difficult.	IS-BP	Bad
Lack of help "follow the instructions!"	In this case there was no human help about printing documents, but the instructions later proved to be adequate.	IS-BP	Bad
Lack of lifecycle management of portfolio	This reference to lifecycles and the portfolio idea is interesting - this team is considering adopting this more strategic approach to managing the investment in new systems.	BS	Bad
Lack of user level advice / user experience	Dealing with users depends on their own capability and experience, as well as the availability of the right advice to assist them.	IS-BP	Bad
Laying down conditions	Sometimes there can be negotiation when there is a conflict of priorities and availabilities. This was an HR management answer to an operational and	MAN	Good

Name	Notes	Group	Outcome
	investment problem.		
Limitations of duplication objects	A technical issue in developing with Java and the LaTeX document management system.	IT	Bad
Link to SIS - intertwined	Key operational systems become interdependent and share data in ways that lead to difficulties when change is needed.	IS	Bad
Load shedding	At the time of the data collection for this research electrical power was submit to interruption by load shedding.	IT	Bad
Loading money	One necessary system feature is to be able to load money that can be disbursed on chargeable services such as printing.	BP	Good
Loss of sound feature	When personal equipment is sent for repair, it does not always come back in the intended condition - in this case the sound feature had been disabled.	IT	Bad
M&G during tutorial in USA	This is historical - a student in the USA accessed the South African Mail and Guardian newspaper during an early international 'online' tutorial. But education continues to be ever more international, and evermore online.	BP	Good
Mail merge	Competency with mail merging gives this young administrator satisfaction (and saves her a lot of time and allows her to do a better job).	BP	Excellent
Mail overflow	The email system was prone to mailbox overflow - at an inappropriately low threshold, but it was sorted out.	IT	Good
Mailbox size woefully inadequate	This email system was far short of the expectations of this user, who could see beyond the use of an email system for communications - he also saw it as a repository of everything that he had been doing.	IS	Bad
Making a choice	Design of new systems is always about making choices.	MAN	Excellent
Managing the project	Working with businesses that might wish to take up innovations and productise them requires project management.	MAN	OK
Match need to expectation	A financial reporting system that did not do what was needed.	BB-BS	Bad
Maxima ERP at BAA - project shut down - 4wk delay	This is another side comment from a part time student currently working on contract, but it illustrates the fact that external factors can come in and create avoidable difficulties that have to be worked around.	BP	Bad
Meeting with partners	Working with businesses that might wish to take up innovations and productise them requires partnership. And meetings.	MAN	OK
Mind change is achieved - integration	It's good when the people decide to come on board with you.	BP	Good
Most recent review resulted in a lot of fixes of unknown issues	This review leads to a lot of corrective work in relation to one new project.	IT-IS	Good

Name	Notes	Group	Outcome
Moving into research (National Vision wrt Skills)	A service department in a university has the potential to initiate and benefit from research, undertaken by itself for its own benefit and having the possibility to publish the results.	BS	Good
Need for a dashboard	Having a 'dashboard' is a required feature of a business intelligence system, and it was built into the requirements specification.	IS-BP	Excellent
Need Stackoverflow	Stackoverflow is a remarkable community web site that provides answers to endless questions about working in all sorts of different systems development contexts.	IS	Bad
Need to learn PCB CAD	Working with innovative product ideas requires new skills to be learned, in this case the use of software that designs new printed circuit boards.	BP	OK
New applicants not feeding through to other environments at correct time	The integration of complex systems sometimes leads to inconsistent working. Here data is not migrating from one system to the next.	IS	Bad
No documentation of operational system	No documentation leads to risks, uncertainty, and extra work at the end of the day.	IS-BP	Bad
No power points for student laptops	Basic requirements are often overlooked - in the modern age every desk should have a power point.	IT	OK
No test environment for operational system - only production	This is another reference to the situation where there is no sage environment within which to test critical key operational systems.	IT-IS	Very bad
No threads on discussion	The management of the threads in the chat rooms was not well organised.	IT	Bad
Not synched with lecturers view	There was a problem synchronising the student and lecturer views of the data in the learning management system.	BP	Bad
Only 15 gig is shared	Google Drive is a good resource, but the storage limitations are inadequate for a student working with video material.	IT	Very bad
Organising access	Teaching needs resources that have to be accessed.	MAN	OK
Out of specification	When things drift out of specification then it's bad.	IS-BP	Bad
Outsource Labview	A decision to outsource the management and operation of a lab telemetry system.	IT	OK
Page Redirection	This is a feature of web systems that needs to be dealt with properly.	IT-IS	Good
Pages showed last year's stuff	Same comment: The data in key operational systems needs to be maintained - this was a case where last year's data had not been taken down from the LMS and this caused confusion amongst the new first year students.	IS	OK
Paper trail	What is needed is a 'paper trail' (probably one that is not actually on paper) that shows where the money and other resources have actually gone.	BP	OK
Periodic communication (reporting)	The routine need to report on progress in a research programme.	BP	Good
Plato did not record the marks	An early experience when a complete loss of marks data caused huge embarrassment.	IS	Very bad

Name	Notes	Group	Outcome
Porting to Windows	Having developed a system and tested its technical operation, it is possible to port it to different environments.	IT-IS	OK
Presentation to Exec	Getting the senior management on-side.	MAN	Good
Pride - partnership is achieved	Outreach to communities (whether communities of need or of interest) augments reputation when it is successful.	BB-BS	Excellent
Problems with monitoring the distributed environment	When systems are diverse and distributed then monitoring and management becomes significantly more difficult.	MAN	Bad
Problems with Oracle software on Linux	This is another indication of incompatibilities, or issues that need a technical work-around. Environments have to be chosen and manged carefully.	IT	OK
Prototype	Building a prototype ahead of moving into development and commercial production.	IT-IS	Good
Purely Native	Sometimes it is better to keep things simple.	IT-IS	OK
Realisation business people do not understand	This is a side comment from a part time student currently working on contract, but it illustrates the fact that even with standards in place, a team has to be educated, persuaded and then instructed to work according to the standards that have been chosen	IS-BP	Good
Realisation needed control and management	Running large projects is not possible without progress data that permits monitoring, control and management.	MAN	Excellent
Realisation of isolation	The first year in university can be tough, and this was the moment when a first year student realised the risk of isolation and decided to do something about it, using WhatsApp.	MAN	Good
Realisation of the 5-clicks rule	This senior manager took delight in recounting the moment when his team realised that users have thresholds of intolerance - they adopted the rule that users want to be able to see anything with no more than five clicks of the mouse.	IS	Good
Realisation there was so much more to learn	Starting to study brings the realisation that there is much more to learn than might have been expected. This relates to the use of a Learning Management System that made the extent of learning clear for the first time.	MAN	Good
Receipt at 7am, and it worked	When basic core systems like 'student cards' work, so quickly, then there is delight for the new student.	BB	Excellent
Receiving data	When a new system works well it provides the data that people need in their work.	IS	Excellent
Refer for details	The documentation that supports modern IDE working is not always adequate.	IT-IS	Bad
Registered as a user	Becoming registered as a new user gives satisfaction to a young administrator.	IS-BP	Excellent
Reporting necessary needs to sponsor	In an outreach project dependent external sponsorship, the email system was unhelpful in maintaining communication with the sponsors.	MAN	Very bad

Name	Notes	Group	Outcome
Routine HR actions	HR information is part of running any organisation.	BP	OK
Sakai pilot "WOW" moment	When Sakai was finally shown, it was exciting and very well received.	BP-BB	Excellent
SASI Integration Issues	A learning management system has to be aligned with (synchronised with?) the administrative information that keeps the university under good management. When it is not, there are problems.	IT-IS	Bad
Scope Creep	Keeping the scope of a project within reasonable boundaries is critical, otherwise cost and time goes out of control	MAN	(Other)
Setting requirements	Innovation requires new ideas, and brainstorming is one way to generate them.	IS-BP	OK
Significant knowledge investment/realisation of benefits	When it works as well as this, we can all relax and pat ourselves on the back (it seems). This is a comment based on the adoption of professional good practice guidelines.	BB	Excellent
Signing off cost to resource (recovery cost)	The routine need to sign off expenditure.	BP	Excellent
Silo'd teams in distributed environment	There has to be a flow of information and understanding between the different roles; when there is not, then there are problems.	MAN	Bad
Single source of correct information for the academic program enabling correct student advise on application and registration in order to graduate	This project manager did not focus adequately on EVENTS, but here she refers to the establishment of a system requirement	IS-BP	Excellent
Single source of correct information for the student life cycle from point of interest up to after graduation	This project manager did not focus adequately on EVENTS, but here she refers to the establishment of a system requirement.	IS-BP	Excellent
Specifying super silent computer to a spec	Research sometimes requires special considerations, for example where noise cannot be tolerated.	IT	Excellent
Start-up meeting with the champion	Having a champion who supports and promotes new systems is helpful.	IT-IS	Good
Statistical summary	Competencies with spreadsheets help to make summaries of statistical data for management review.	BP	Good
Students broke printer	Damage like this was not often reported - this was a new 3-D printer recently delivered.	IT	Very bad
Submit application for the job	Applying for jobs is one thing that we all have to do from time to time.	BP	OK
Summarising history	Organising all the data that is needed to make a case for a new investment requires that history is collated, documented and understood.	MAN	Good
Supplier failing to implement according to tender specs	A rare reference to the possible problems right at the beginning - the acquisition of required technology components.	IT	Bad
System has a lot of redundancy and unnecessary processes	This comment arises from use of a new marks administration system that simply did not do what the lecturer wanted, despite the redundancy.	IS	Bad
System is a rule-enforcement system not a marks administration system	This is a comment on a marks administration system that was deliberately designed to force the	IS	Bad

Name	Notes	Group	Outcome
	application of rules.		
System is non-intuitive to use	Perhaps using a system is the only way to decide how easy it is to use …	IS-BP	OK
System is often down/inaccessible	Reliability leads to a reluctance to get involved with using systems if there are alternatives.	IT	Bad
Take over for change management	Previous experience in business had been better than the experience within a university.	IS-BP	Good
Terminal window	This is a feature of program coding today - used frequently.	IT	OK
Testing on production	The idea of testing upgrades on a production system (i.e. with live data) is an extremely bad idea.	IT-IS	Very bad
Training module	Training ahead of the introduction of a new national research reporting system.	IS-BP	Good
Trying to assess expenditure	Sometimes the information is there, and assessments can be undertaken.	BP	Excellent
Underlying operational system failed	Another case where inter-system co-operation is failing?	IS	Very bad
University Administration	Administration is seen as a constraint on the operation and maintenance of a learning management system.	BP	Bad
Unpack the box	Receiving deliveries of new technology for postgraduate research.	IT-IS	Good
Upgrade	Upgrading is necessary, and sometimes goes well with open source software that is in the care of a worldwide community.	IT-IS	Excellent
Use of different language (e.g. Australians)	In order to share structured reference information languages have to be standardised.	IS	OK
User involvement in understanding the requirement and enabling them to be part of the testing process to promote user buy-in	This project manager did not focus adequately on EVENTS, but here she refers to the involvement of users at the system requirement stage	IS-BP	Excellent
User testing	In the later stages of testing, it is necessary that the users commit the necessary time to making sure that what has been produced is usable and useful.	IT-IS	Very bad
Using remote access	Accessing academic sources from anywhere at any time makes research easier.	IS	Good
Value of testing against specifications	Specifications don't just indicate what must be developed, they provide the foundations of good testing as well.	IT-IS	Excellent
Version control	Version control avoids the confusion that arises when systems development artefacts are saved many times over, in different versions. GitHub deals with this well.	IT-IS	Excellent
Very complete specifications	When the specifications are complete, it makes for a much better chance of success.	IS-BP	Excellent
Ward Facility Visit	In this case, a project to develop a system for trainee nurses required a visit to the ward, to see what working conditions were actually like.	IS-BP	Excellent

Name	Notes	Group	Outcome
Web deployment in Zim - web education	University work sometimes extends beyond the campus, and beyond the borders of the country.	IS-BP	Good
Web devt tools not mature	Moving into a web development environment, it was a surprise to discover that web development tools were immature and unreliable. Compatibility issues were rife.	IT-IS	Excellent
WeBWorKs Integration on Hold	A web development tool was not all that it was hoped it would be.	IT-IS	Bad
Yearly change in specification that does not add value	The yearly 'changes' exercise makes work but does not really deliver benefits.	IS-BP	Bad

Appendix 9 **Tabulation of scales**

The table following lists all the bottom-level bipolar scales that were nominated by respondents for analysis. As well as the name, the table provides:

An indication of the two ends of the scale – generally, where the idea of 'good' and 'bad' does apply, the 'good' end is at the left, and the 'bad' end is at the right.
Explanatory notes from the researcher, giving additional background for each.

Name	Left end : Right end	Notes
Academic	Academic : Non-academic	Even though in her first year as a undergraduate student, this respondent was acutely aware of what was academic and what was not - arising mostly from the intensive admission, accommodation and registration procedures.
Academic	Successful : Unsuccessful	Academic outcomes for this respondent were highly strategic, partly because of responsibility for a new strategically important programme undertaken with the support of senior management and external business partners.
Access	Secure : Insecure	This respondent was responsible for the implementation and monitoring of institutional compliance, with information management standards and legislation such as might be applicable.
Action	Reactive : Proactive	Do we react to circumstances, or are we making things happen the way we want? This is a great scale, but it was not rated by the respondent. It would be good to include in a new survey, perhaps.
Adoption	Successfully adopted : Not Adopted	Having responsibility for the implementation of technology, this respondent was particularly sensitive to the success or otherwise of adoption in the institution at large.
Advantage	Helps : Hinders	As a masters student working with software development getting the job done properly means seeking advantage from all possible sources. Where there is disadvantage it hinders progress, as was the case with certain of the tools being used.
Anxiety	Anxiety creating : Anxiety easing	As a first year but mature undergraduate, perhaps it is not unexpected that certain aspects of systems and information services, like getting marks, leads to anxiety; also a feeling of isolation in coming to terms with a new environment.
Approach	Traditional : Agile/SCRUM	This is an interesting case where an outsource partner faced difficulty in the way projects are handled - agile methods were unhelpful whereas more traditional discussion of requirements lead to a better outcome.
Automation	Automated : Human	The degree to which student services are automated or not was very clear to this young first year student. As soon as queueing, or form filling, was concerned, the outcome was poor; equally, when systems were not in synch, things became difficult.
Behaviour	Changing : Not changing	Changing the behaviour and habits of the user community are often pre-requisites to success; in this case, this respondent was successful in achieving a high degree of behavioural change with good outcomes. Although this scale emerged from the triadic a

Name	Left end : Right end	Notes
Bespoke	Completely bespoke : Proprietary	This information manager had concerns, based on recent experience, about the dependency on the source and nature of systems: bespoke systems should be within the control of the institution (but subject to resource limitations) and bought-in systems limit
Boundary	In the university : Out of the university	This is related to the location of something, not in the system or project sense (that would be 'scope'), rather in the geographical or organisational sense.
Boundary	Internal : External	Working on innovation and third stream revenue from product development brings this research director face to face with the boundary between the institution and the outside world. A scale that emerged from triadics but was not rated.
Business	High : Low	The achievement of real business benefits was very high on the list for this institutional technology manager. A mixture of good and bad outcomes is evident.
Capability	Fulfils needs : Does not fulfil	This master's student was focused on the capability of his software development tools to conveniently undertake the work he needed to do. Quite clear opinions about what worked well and what did not.
Capacity	Enough : Not enough	This was a frustrated reference to the fact that Google Drive only provides 15Gb of data storage - as he was actually working with video material then this might indeed have been too little (but one has to wonder!!)
Cardinality	Many-ness : Oneness	Although called 'cardinality', this idea is about the complexities that arise when there are many things to deal with in achieving one aim - too many emails.
Challenge	Unchallenging : Challenging	Anyone working on a help desk is bound to face challenges, and this scale was strongly applicable to about half of what he reported that he does (through the events that he highlighted).
Champion	Good : Bad (Culture)	As an outside partner and service provider, this respondent had clear views (and interesting stories) about the role of champions. Here she is concerned with the control that is needed from the champion, not just the leadership.
Change	Tight : Loose	In a situation where things are changing, achieving change control is necessary. This respondent had several instances where the absence of change control led to problems.
Change	Take-up : No take-up	Another project manager another case of change control being seen as necessary. But this respondent had stories about how it had been made to work as well as concern that it be put into place.
Commercial	High : Low	When a business works with an educational institution, the differences between commercial and academic content become important to understand, and to manage appropriately. Where business interferes for shallow or short term business reasons, the outcome can be bad.
Connectedness	Connected : Disconnected	As a mature first year student, the need to be connected (with academic staff, administrators and peers - despite age differences) was strong.
Consequentiality	Consequence : NO consequence	Bad things can be avoided when the consequences of our actions can be anticipated and dealt with.
Consistency	Consistent : Inconsistent	For a research student working in the later stages of a project, inconsistency of tools and resources has a very bad effect on the outcome.

Name	Left end : Right end	Notes
Continuity	High : Low	At a time when national electricity supplies were subject to load shedding, it is not surprising that continuity (off electricity, and of the IT based services that it enables) as at the forefront.
Control	In control : Out of control	Control in the sense of internal control within a functional unit of the organisation. Although this scale emerged from the triadic analysis, it was not deployed.
Control	Liberating : Constraining	This is control in the sense of the need for reasonable personal control over facilities; when infrastructure changes are made that affect what users can do, there are bad consequences.
Cost	Low : High	In the later stages of system implementation and handover, the cost is highly dependent on the co-operation and capability of the 'user' community. Moving to cloud storage (obviating the need to install and maintain data storage locally, at the client's premises) is very advantageous.
Criticality	Critical : Not critical	When things are critical information is needed in order to keep things under control.
Data	Storage : Movement	This experienced academic was very sensitive to the idea of information and data, both 'on the move' and 'at rest, in storage'. Hardly a continuous scale, but interesting to recognise the differences.
Decisiveness	Decisive : Indecisive	This is a scale that the respondent attributed to external authorities that took decisions without proper assessment of the consequences, and (more specifically) in the sense that users can be indecisive. Ratings were middling, I am not convinced that
Delivery	Easy : Difficult	Very similar to the idea of the cost of rollout being variable, the ease with which systems and upgrades can be implemented is variable and significant, and leads to additional costs that might be avoidable.
Delivery	Delivered : Not delivered	Not everything that is expected or intended is delivered. Although this scale emerged from the triadic analysis, it was not deployed.
Dependency	Dependant : Independent	In a research management role, the dependency of the project on funding and the rate of expenditure is important. This respondent suffered unexpected dependencies with bad consequences
Design	Well-designed : Poorly-designed	Largely related (in the view of this respondent) to the problematic results of poor design and a failure to recognise the actual needs of users.
Development	Not challenging : Challenging	The middle stages of any project, when the design and coding is happening, can vary in difficulty, for example because of the tools available and certainty that prevails as to what 'users' actually want.
Development / Operations	Developing : Operating	There was a recurring idea that some things are clearly in the 'development' realm, in that they are under the control of developers; other things are in the 'operational' realm because they are under the control of operational staff and they are serving the needs of users.
Development Methodology	Agile : Big upfront design (Waterfall)	There are great differences between the flexible 'agile' approaches to development, and the traditional more 'structured' approaches. The choice of one or the other (or some compromise between the two) might depend on the classification of the project in

Name	Left end : Right end	Notes
Difficulty	Straightforward : Difficult	Difficulty arising from the inadequacy of the tools of software and system development - felt quite severely by this masters student.
Discretion	Within my discretion : Outside my discretion	This director of a strategic research project felt the differences between what he could decide about and what others would decide for him. A scale that emerged from triadics but was not rated (a pity about that).
Documentation	Documented : Not documented	This respondent reinforced the traditional view that documentation is very important to success.
Domain	Research : Investigation	This is really a hint of the stages that one goes through in research - first investigation and then the actual research. Needs to be related to project lifecycle ideas?
Ease	Complicated : Simple	This project manager sees ease of use as highly important, and leading to excellent results.
Embedding	Embedded : Not embedded	The idea of embedding seemed particularly important to this respondent in describing her experiences as the manager of a technically oriented unit setting out to achieve organisational change and improvement.
Enablement	Enabling : Disabling	This mature first year student was interviewed early in her first term in her first year, and that might have been disabling, but she was able to get registered, get connected and get involved without real problems.
Enablement	Enabling : Disabling	Enablement is a recurring scale, here an experienced academic acting in an admin role was variously enabled and disabled by different circumstances. Occasionally an inability to do something led to a bad result, but there are many more beneficial experiences.
Enablement	Enabling : Disabling	A young first year student finds the on-campus student services very enabling, in most but not all cases.
Enablement	Enabling : Disabling	Enabling here - for a long-term senior academic - is still important and leads to good and bad outcomes.
Engagement	Listening : Not listening	Close to embedding, the respondent sees effective communication as important, and effective in delivering good outcomes.
Engineering	Destructive : Constructive	Not everything goes straightforwardly and when things get broken it is necessary to find engineering fixes. A lot of what this 'help desk manager' does is constructive engineering, however.
Expanding	Working together : Working in silos	This technology manager had a very broad strategic vision, that included the idea that IT and IS investments present opportunities to expand the business of education, but highlighted the risks when partners on the supply side fail to perform.
Expense	Cheap : Expensive	No complexity here, this is just about the cost of getting the business done.
External	In your control : Outside your control	This is really about control. Needs to be reviewed for relocation in that group?
Externalisation	Contained, internal : Not contained, external	Part of the work that was needed was outsourced - a move that was not in line with previous practice. Hence re-inforcing the importance of the organisational boundary and its ability to manage partnerships.

Name	Left end : Right end	Notes
Facilitation	Succeeds : Fails	Having a high level of facilitation might contribute to personal success or not. This respondent sees GitHub as successfully facilitating, at the personal level, whereas certain institutional facilities were the opposite.
Feasibility	Feasible : Not feasible	As a mid-level academic, this respondent was particularly committed to assisting with the support and implementation of IT in his institution, and developed a keen sense of what was feasible and what was not, and what the consequences might be.
Flexibility	Flexible : Inflexible	The flexibility or inflexibility of the tools of modern software development are keenly felt by this masters student, with inflexibility leading to bad outcomes, and the converse of course.
Functionality	Functional : Non-functional	Functionality was a recurring scale. The idea that some things work well, and others do not, was uppermost in a conversation with this young first year undergraduate. In rating her events, most were at the '1' or '5' extremes, and none were in the middle
Functionality	Works : Does not work	Functionality was a recurring scale. This masters student found that most things worked for him, and led to good or acceptable outcomes.
Functionality	Meets requirements : Does not meet requirements	Functionality was a recurring scale. This information manager had milder views about the functionality of his systems than were found with other respondents.
Functionality	Functional : Dysfunctional	Another scale that came from consideration of the advantages of going to a Linux environment; re-enforced by a contrary view about certain institutional systems facilities that were highly dysfunctional. Functionality was a recurring scale with other res
Fund/Admin	Funding : Admin	This is a case where the respondent saw differences based on whether the event concerned her work on research funding, or her general administration. This is really a reflection of the different roles that she fulfils.
Give/take	Giving : Taking	Working in administration, for this respondent, leads to clear distinctions between giving and taking, which idea served to characterise her events quite strongly, all seen with a good or excellent outcome.
Guidance	Clear : Unclear	The role of IT support is to assist, and having clarity in the guidance that is available and that is given is important. Despite clarity, though, not everything goes well. Good advice does, after all, have to be received and understood.
Imp/Use	Implementation : Using	As an admin 'person', this respondent had become involved in the early stages of a major systems initiative. She had therefore developed a sense of the differences between the implementation stages and the operational stages when a system is in use.
Information	Good : Bad	Getting the right level of quality of information in new systems was seen as critical by this project manager respondent, leading to good results when it is achieved.
Informational	Information : Not Information	For this respondent (who works with the migration of very large databases for large clients) the idea of 'informational' or not indicated some important differences. Interesting that having established the idea, he then rated nothing as 'Not information'

Name	Left end : Right end	Notes
Input-Output	Input : Output	Like some others, this respondent saw input and output as a key feature of the processes of education. Most of what she rated, was rated as input (!).
Int/ext	Internal : External	A recurring idea whereby some things are internal to an institution and some things are external.
Integration	Standalone : Integrated	For this project manager, integrating things makes for excellent results.
Intellectual	IP critical : Not IP critical	When innovating technologically, recognising and protecting intellectual property is a concern. This research project director had concerns, but it is not clear the extent to which this is relevant to information systems. RIMS comes to mind, of course,
Interfacing	Technical : Practical	This team interview revealed the importance of interfacing, at a human and technical level. In these contexts, interfacing was seen as either 'technical' or 'practical'.
Language	Linguistic : Non Linguistic	As a postgraduate researcher this respondent made extensive searches of the literature, including oriental and foreign language papers that had to be translated. In a global context, it cannot be assumed that English alone is sufficient.
Learning	Simple : Complicated	This technical team was learning rapidly, and enjoyed getting away to a Bootcamp, which first introduced them to many of the technology issues in modern university working.
Level	Exciting : Tedious	This is a reflection of how exciting or tedious activities at university seem to be for a young first year student.
Level of Control	High : Low	Managing projects, and managing the operation of systems, needs a degree of control. Innovation (for example) needs some freedom to go where it seems best from time to time.
Liberation	Liberating : Constraining	The theme of constraint, or freedom, emerged largely through consideration of events that were in fact liberating. A very positive outlook.
Lifecycle	Determining Requirements : Implementation of Requirements	A critical scale separating out the determination of requirements as distinct from the implementation of requirements - always separate in the traditional model but allowed to combine in (for example) Agile SCRUM approaches to project development.
Lobbying	Successful : Unsuccessful	Relates to the effort involved in gaining senior management approval to start projects. Although this scale emerged from the triadic analysis, it was not deployed.
Locus	In locus : Out if locus	A rather more abstract idea about the in/out distinction, much concerned here with the 'locus of control' or 'locus of discretion' wherein an individual can make his own decisions or not.
Managing Complexity	Effective (can do) : Ineffective (cannot do)	Managing complexity has been said to be a critical competitive advantage in the modern age, but of course much complexity can be incorporated and dealt with within systems, making it simple in the eyes of the user.
Measurability	Measureable : Not measureable	If you can't measure it, you can't manage it. A focus on assessing and understanding outcomes on the part of this respondent seems to have helped deliver good outcomes.
Methodological	Methodology : Not Methodology	This was a specific comment about access to information through the university library, needs examination?

Name	Left end : Right end	Notes
Methodology	Structure : Chaos	This is a clearer reference to the methodical or other way of working - structured or chaotic in this case. Structured methods of working are deemed to lead to high levels of success.
Modularised	Standalone : Integrated	Yet another allusion to boundary considerations, and the differences between integrated and standalone (modularised?) designs. For this respondent, 'integrated' is good. Very good.
Monitoring	Proactive : Reactive	Without reliable performance data to work with, nothing can be managed proactively. When life is full of surprises, we might call the consequence 'managing by exigency'.
Motivation	High : Low	Without a high level of motivation things on a project can come out badly.
Multiplicity	Once : Many times	The idea of one as opposed to many comes up occasionally. Here the masters student is showing that 'many' is not always bad! It all depends on what you are talking about.
Nature	Research driven : Management driven	At heart this leader of a strategic research project sees research-driven activity as dangerous without proper management. A strong sense of control here, again - now in the context of co-operation with external organisations.
Need	High (might do own) : Low	This respondent was aware of the availability and possible need for 'standards' but pointed out that they would likely develop their own where they are deemed to be needed.
Need	Novel therefore high : Familiar therefore low	Technology moves on quickly and there is a frequent (if not constant) need for training in new tools and techniques. However this might not be formal training, it could be self-learning using the web (e.g. Stackoverflow or YouTube).
Negotiation	Negotiable : Not negotiable	It might be better to be able to negotiate, but the differences in rating here are not large and it might be despite the applicability of this scale, it did not really figure in the larger scheme of things.
Novelty	Novel : Familiar	Facing new challenges can take respondents out of their familiar territory, and this might in turn lead to short term success (although we find elsewhere that novelty in systems development can present serious difficulties).
Operational	Poor : Excellent	This is about working together, co-operatively. Excellent relationships lead to excellent results.
Operational Planning	Adequate : Inadequate	The extent to which it is known how a system will be operated.
Out/in	Out of office : In office	Occasionally this administrator had to travel (for example to training and evaluation workshops). Hence the ideas of in and out of the office … but ratings indicate only 'in' the office.
Output	Deliverables : Support	This is about value in the outputs of a project: support is one thing, but real deliverables are better! Not rated in this interview though.
People	In-house development : External non-development	This respondent was acutely aware of the need to distinguish between internal and external resources, being in a competitive context (software house, not educational institution)

Name	Left end : Right end	Notes
Planning	In plan : Off plan	In line with other scales developed with this respondent, having a grip on things through adequate planning was important to her; things that were off plan needed special attention (and seemed to get it …).
Platform	Facilitation : Obstruction	A very technical scale relating to the degree of integration of things, for example (in the view of this respondent) the advantages of going to a Linux environment where things are (in his view) highly integrated.
Predictability	Known : Unknown	Dealing with uncertainty is important to successful project management and this technical team achieved excellent outcomes when different stages in the development lifecycle were 'known'.
Preparation	Prepared : Not prepared	Close to 'on plan' and 'off plan'? Although this scale emerged from the triadic analysis, it was not deployed.
Prioritization	Consistent : Ad Hoc	This relates to the portfolio idea: consistency is needed in scheduling work on key operational systems; innovation can happen when it is possible to happen, which will not be always.
Procedural	Process : Non Process	Another scale that tries to deal with the differences between process and non-process events, although the ratings do not indicate a strong leaning either way.
Process	In process : Out of process	For a first year student, the boundary between what is within the institution and what is without it, becomes clear. Not associated with the success or otherwise of the outcome, but the discovered reliance on external sources is interesting to note.
Process	Supports whole lifecycle : Supports only one section of lifecycle	This is about the extent to which something concerns the whole or just a part of the project lifecycle, with either good or bad outcomes.
Processing	Processing information : Moving information	An experienced and purportedly non-technical academic sees big differences between information on the move and information at rest, being processed. But this scale was not deployed so perhaps it falls away?
Productivity	Institutional productivity : Personal productivity	Personal productivity comes to some - it is not really clear the reasons why. Interesting that it does not seem to have applicability to difficult external relationships.
Progress	Operational : Strategic	This takes progress and pitches it at two different levels: strategic progress and operational progress. Working with IT operationally did not deliver good results.
Progress	Forwards : Backwards	We can understand the feelings of a masters student, working under pressure with sometimes difficult tools of software development, in having to admit that sometimes they have to go backwards to go forwards!
Progress	Progressive : Regressive	Again, the idea of moving forwards or backwards. Despite the regressive nature of some events, this evidence suggests that when things are sorted out good things happen.
Progress	Forwards : Backwards	Another allusion to forwards and backwards progress, this time from the technical team interview. Outcome is strongly related to which way things are going, of course.
Progression	Progressive : Non-progressive	Somewhat related to productivity? But seen as different by this respondent probably because there is a difference between doing things right, and doing the right thing.

Name	Left end : Right end	Notes
Quality	Non-useable : User-friendly	More from this project manager's 'wish list' of things to get right in project management. Clearly quality is important, but here it is seen in terms of usability and user-friendliness.
Reach	Out-reach : In-reach	The ability to reach out of an institution to make international contacts, undertake international activity, and to break down the borders of academic work is very pleasing to this experienced academic whose early days were quite different.
Recognising	Recognising : Not recognising	Success depends on recognition of what people can do, and what they cannot do. For this respondent, recognising the human capital component reveals both good and bad outcomes, attributable no doubt to recognising either the presence or absence of capability.
Reflection	Not reflecting : Dependant	This is a funny one, I am not sure it is useful. And it was not rated. There is a hint of data accuracy ('this report reflects the situation') but also of the managerial dependency on reliable information. Think about this?
Relationship	Informing : Deciding	From the managerial viewpoint one might be informed by an event, or one might be making a decision. Very close to Venkatraman's DIKAR ideas. Interesting. But not related to good or bad outcomes!
Relationships	One-Sided : Cooperative	Generally this technical team sees co-operative relationships as leading to good results, although there were moments when it was argued that coding is a very individual thing that needs solitude.
Reliability	Reliable : Unreliable	The manager's best friend? Critical to keeping things under control. Documentation is seen as a component of reliability (leading to good outcomes).
Reliability	Reliable : Unreliable	Another allusion to the need for reliability, in this case in terms of the technical tools and methods that are available. Unreliability leads to bad outcomes.
Repeatability	One off : Repeatable	This is an important scale that did not feature in exactly this way as much as might have been expected. Strong ratings, suggesting that both one-off and repeatable events can lead to bad outcomes.
Reputation	Good and improved : Bad and diminished	This respondent revealed the idea of 'reputation' during the triadics but it was not deployed. Achieving and promoting reputation, as seen outside of the organisation, is important to her. Perhaps it is for others to rate reputation from an external viewpoint.
Requirements	Fixed : Changing	It is interesting that both fixed and changing requirements can lead to good and bad outcomes. Perhaps it all comes down to how well the details of a project are being managed, especially in terms of change control.
Requirements	Clearly Defined : Uncertain	Generally, clearly defined requirements lead to good outcomes, but not always. Here, the blog tool was clearly specified (it was a brought-in module) but it did not suit the users, and the outcome was bad; this was actually a clash between the well-defined.
Research	This was research : This was not research	The unit working under the direction of this respondent was shifting from a workaday support role to a research role. It was really a question of the balance of the two, and the way that the mixture led to a sense of fulfilment for the people involved.

Name	Left end : Right end	Notes
Resource	Dependent : Not dependent	Generally the recognition of a resource dependency leads to better outcomes. In one case, where dependencies were not recognised, the outcome was very bad.
Resource	Adequate : Inadequate	This respondent had very strong views about the level of resource that was available, for example in terms of mailbox size ('abysmal') and also the availability of external resources such as GitHub ('Drives home cooperative nature of software development'
Responsibility	Given responsibility : Received responsibility	Although working in a regular academic role, this respondent had a very clear sense of responsibility which got things done well in setting out the faculty timetable. Never an easy thing to do to everyone's satisfaction. The idea of given and received r
Responsibility	My action : Someone else's action	This is yet another indication of the importance of boundaries, in this case between responsibility for one's personal actions and other people's responsibilities and actions. Other people do not always do what is needed for a good outcome.
Retro/Pro	Retrospective : Prospective	Looking forwards and backwards needs information to reflect on - here, looking at the expenditure backwards was good because reports were available; looking forwards was not working because of a mismatch of future expectations.
Satisfaction	Satisfied : Not satisfied	This seems like a simple idea, but the ratings are puzzling. From the personal view of the respondent, satisfaction does not relate with the event outcome, but this could be because even though the event was bad ('the students broke the printer') he was satisfied.
Satisfaction	Satisfactory : Unsatisfactory	A lighter example of how satisfaction distinguishes one event from another, but with a hint of the same thing: dealing with difficult problems is satisfying.
Scope	In scope : Out of scope	Although this scale emerged from the triadic analysis, it was not deployed.
Scope	In scope : Out of scope	A great idea, and an important one, but not deployed!
Scope	Internal : External	Here, for this academic with some important administrative responsibilities, understanding the scope of things as internal or external is important; internal events are generally but not always good.
Security	Applies : Does not apply	This single comment on the security issues that are dealt with by good version control is probably more important that many other scales, that seem to have been dealt with more generously. Version control is emerging as something that we will all want.
Sep/Int	Separated : Integrated	This is something to do with the fragmentation of work as academics. Strong feelings were expressed, many relating to the inadequacies of the email system.
Show-stopping	Showstopper : Non Showstopper	This is a nice idea (has this respondent been watching the Great British Bake-off?!). We need to recognise the way in which the show does come to a grinding halt when bad things happen!
Space	Good use : Bad use	This is a very specific scale, indicative of a more generalised problem. Dealing with screen management is important to a software developer (there are many concurrent views of program code, and it's execution, that are needed). But this is true of many

Name	Left end : Right end	Notes
Specificity	All projects : One project	Another scoping issue, here concerning things that affect all projects or just one. A hint of Porter's value chain? This is an important idea for organising the way that we manage IT - in the large and in the small.
Sponsorship	Unsupportive : Promoting	The promotion of good project management practice leads to success, this respondent believes.
Stability	Stable : Unstable	Scoping? Or Change management? Instability is something of a threat (but not really rated here) whereas stability is an important factor in achieving a good outcome.
Stage	Design stage : Client operations	This respondent sees a clear difference between the internal work on systems design and the implementation on client premises, involving themselves with client operations.
Stats/not	Stats : Communication	Another factor which identifies the different kinds of work that this administrator undertakes. It's important to understand what one is doing, but it seems there is some concurrency here.
Strat/Ops	Strategic : Operational	In a strategic context, much of what this respondent talked about was actually operational. The problems with the email system really dragged things down for this individual, doing an important job at the boundary of the institution with its partners.
Strategic	Very strategic : Not strategic	Recognising what is strategic and what is not has assisted this middle-level manager to achieve well, and it has provided her team with the satisfaction of working for a progressive unit in a progressive institution.
Success	Usable : Not usable	The outcome of this respondent's actions can be measured in terms of the success of his actions, not necessarily correlated with the nature of the event. Some interesting stuff here.
Support	High : Low	Having the support of those who will support you, and have influence, is clearly useful in achieving a good outcome.
Support	Online support : No support	It is a feature of the modern age that we get more and more assistance online than we do offline. Googling 'How do I … <do something or other> … ' is remarkably effective in solving our problems. This masters student knows this and makes extensive use of support.
Support	Good : Bad	A lighter case of the quality of support leading to good and bad outcomes.
Tech/not	Technical : Non-technical	When reflecting on work in educational administration those things that are technical and those that are not become evident. Here, getting involved in a new research management system caused this administrator to feel the new 'technicality' of her work.
Technicality	Technical : Human	This is a case where someone who was already very comfortable with the technical world shows a strong interest in those things that are 'human' in nature, generally but not always with a good outcome.
Technicality	Technical : Non technical	The help desk is at the interface of the technical and non-technical world. And again we see that success does not derive from the degree of technicality in something, there are other factors at work that lead to successful outcomes.
Technicality	Technical : Not Technical	A recurring theme, that some things are technical and some are not - shared with several other respondents.

Name	Left end : Right end	Notes
Technology	New technology - High : Older technology - Low	Experiences in moving to web-based systems development environments and in developing web-based systems for users, this respondent discovered high levels of risk in using new technologies, because of unreliability and instability.
Testable	Very : None	The idea that a developing system is testable is important because there are some pre-conditions before testing makes any sense: units all tested, system complete, test scripts available, trial data available, and so on.
Time	Short : Intensive	It is to be expected that working at the help desk is a pressured job, with some operations being lengthy, some short, some intensive and some not. This scale is something of a mixture, and warrants further investigation.
Timeliness	Instantaneous : Delayed	In the first weeks of life on campus, so many things happen instantaneously that when things take time it is frustrating. Here instantaneous is seen as good.
Timeliness	Timely : Slow	Another case of speed being welcome, and tardiness being bad. A very clear interdependency.
Timeously	Timely : Untimely	A scale that arose from consideration of the consequences of poor systems implementation having a very bad consequence for the operations of an organisation, in terms of the timing of material inputs.
Timescale	Short-term : Long-term	Some things can happen quickly, other things take longer. This is about elapsed time, not the 'busy' time that is occupied when actually undertaking a task.
Urgency	Urgent : Not urgent	Again, some things are urgent and some are not. In senior management roles urgency is something that we have to live with, and can have bad outcomes.
Usability	High : Low	A combination of user-perceived usability and other issues such as availability (systems are not usable when they are not available. Strongly related to functionality in the view of this respondent.
User	Good : Poor	Having the user 'on board' makes all the difference to success. In her roles as analyst, project manager and chief executive this respondent has learned the importance of this.
Value	Given : Received	Although this scale emerged from the triadic analysis, it was not deployed.
Value	Valuable : Not Valuable	Value might be seen differently by different role players, but in aggregate the value of a system is the improved performance of the organisational process or processes that it supports.
Viablility	Doable : Not Doable	Working as a technical team, on software development and implementation, the viability of an option is important. But as with the help desk function, something that seems not to be viable usually can be done, and sometimes with excellent outcomes.
Visibility	Process : Product	This is a rather abstract distinction between seeing the product and process perspective - this might re-inforce the idea that people generally see the process perspective more clearly or in more detail than the product. Needs more analysis?

UNIVERSITY of the
WESTERN CAPE

Appendix 10 **Repertory Grid results by interview**

Individual respondent grids

The detailed Repertory Grid results of the 20 individual responses, and the two team responses, are summarised in the following 22 pages. The analysis was undertaken using RStudio, Version 0.98.1103, with the OpenRepGrid Library, Version 0.1.9.

On each page is shown:

The Ratings in the layout of a Repertory Grid, with the events (elements) in the columns and the constructs (scales) in the rows.
This is followed by a Principal Component Analysis showing the components that emerged from a varimax rotation, and indicating the portion of the data that was accommodated within the analysis.
The final block of data is a Pearson Correlation analysis.

The review process that followed included:

Values in the principal component analysis and correlation analysis that were over 0.70, or under -0.70, were highlighted. 37 Scales were rejected as not significant, having a value between -0.69 and 0.69.
Components that were not rejected were reviewed, and were assigned to non-specific groups in the source data tables.
Initially, 26 non-specific scale groups were created, labelled from A to Z. As the review progressed, qualifying scales from each component were added to these target groups, based solely on their co-occurrence in a component, and (where it happened) on their prior occurrence elsewhere.
Hence, *need*, *novelty* and *visibility* are three scales that co-occur in PC1 in the first example on the next page (RES 03), and they were all allocated to Scale Group 'A' .
Later, where recurring scales such as *functionality* (that occurred multiple times) were in each case assigned to the same group as the first occurrence (Group 'C', in the case of *functionality,* as it happened), together with its companions with in the principal component in which they were found.
When the process was complete, there were 25 scale groups. The content of the groups was reviewed, and two were clearly loaded with scales of a kind: Group L (55 scales) and Group W (39 scales). It was evident that Group L was predominantly concerned with *process* issues, and that Group W was predominantly concerned with *product* issues.
It was thereby found that the repertory grid analysis had revealed two scale groups that closely align with the reference model PROCESS and PRODUCT components.
Review of the remaining scales, significant but not yet allocated to a group, allowed the construction of two further groups aligned with *service* (18) and *management* (23), thereby finding a complete alignment with the reference model SERVICE and MANAGEMENT components, without difficulty.

The pages that follow now present the source data from which this analysis was drawn, for each of the respondents and the two respondent groups. Note that the scale names are truncated by the analysis software that was used.

There is a more detailed discussion of these results in the body of the thesis, in Section **Error! Reference source not found.**, '**Error! Reference source not found.**'

RES 03

RATINGS:

```
                Database design needed - 3 4 - Need for a dashboard
                       Cost too high - 2 | | 5 - Realisation of the 5-clicks ru
                  Complex rollout - 1 | | | | 6 - Web devt tools not mature
                                      | | | | | |
                    Cost  (Low (1)    5 3 3 4 3 3   (1) High)
                Delivery  (Easy (2)   5 4 3 3 2 4   (2) Difficult)
 Development  (Not challenging (3)    4 5 3 3 3 4   (3) Challenging)
    Need  (High (might do own) (4)    3 1 2 3 3 1   (4) Low)
            Novelty  (Familiar (5)    3 2 3 4 5 3   (5) Novel)
 People  (In-house development (6)    3 4 3 3 3 2   (6) External non-development)
          Stage  (Design stage (7)    5 4 2 3 3 1   (7) Client operations)
Technology  (Older technology  (8)    3 4 4 5 4 5   (8) New technology - High)
          Visibility  (Process (9)    3 1 3 5 5 3   (9) Product)
                 Outcome (Bad (10)    2 1 4 5 4 5   (10) Good)
```

PRINCIPAL COMPONENT ANALYSIS

	RC1	RC3	RC2
Cost (Low - High)	0.12	0.13	**0.96**
Delivery (Easy - Difficult)	**-0.73**	0.00	0.68
Development (Not challenging - Challenging)	**-0.88**	0.31	0.07
Need (High (might do own) - Low)	**0.85**	0.20	0.49
Novelty (Familiar - Novel)	**0.94**	-0.13	-0.07
People (In-house development - External non-development)	-0.15	**0.93**	-0.17
Stage (Design stage - Client operations)	-0.01	**0.80**	0.57
Technology (Older technology - Low - New technology - High)	0.06	-0.68	-0.51
Visibility (Process - Product)	**0.94**	-0.31	0.07
Outcome (Bad - Good)	0.52	-0.82	-0.20

	RC1	RC3	RC2
SS loadings	4.12	2.89	2.30
Proportion Var	0.41	0.29	0.23
Cumulative Var	0.41	0.70	**0.93**

PEARSON CORRELATION

		1	2	3	4	5	6	7	8	9	10
Cost (Low - High)	1		0.57	0.00	0.61	0.00	0.00	0.68	-0.48	0.16	-0.22
Delivery - Difficult)	2			**0.70**	-0.29	**-0.74**	0.00	0.40	-0.38	-0.63	-0.52
Developmen - Challengin	3				-0.66	**-0.79**	0.39	0.35	-0.22	**-0.87**	**-0.75**
Need (Hig - Low)	4					**0.72**	0.00	0.43	-0.32	0.77	0.19
Novelty (- Novel)	5						-0.31	-0.14	0.17	**0.94**	0.59
People (I - External n	6							0.67	-0.42	-0.42	**-0.77**
Stage (De - Client ope	7								**-0.75**	-0.19	**-0.77**
Technology - New techno	8									0.29	**0.73**
Visibility - Product)	9										**0.73**
Outcome (B - Good)	10										

RES 05

RATINGS:

```
            Finalisation of training progr - 5 6 - Mind change is achieved - inte
          E-Tools course now embedded in - 4 | | 7 - Moving into research (National
        Documentation for decision to  - 3 | | | | 8 - Pride - partnership is achieve
      Deciding not ready to host int - 2 | | | | | | 9 - Sakai pilot "WOW" moment
        Council listens and agrees - 1 | | | | | | | 10 - Summarising history
                                       | | | | | | | | | |
          Embedding  (Embedded (1)     3 3 3 1 1 2 4 2 3 3    (1) Not embedded)
        Engagement  (Listening (2)     1 3 2 2 3 2 3 1 1 2    (2) Not listening)
Externalisation  (Contained, i (3)     3 3 3 2 4 1 3 4 3 1    (3) Not contained, external)
  Measureability  (Measureable (4)     3 3 2 2 2 2 1 2 4 2    (4) Not measureable)
            Planning  (In plan (5)     3 4 1 2 2 3 4 3 3 1    (5) Off plan)
        Reliability  (Reliable (6)     3 3 1 2 2 4 3 3 3 2    (6) Unreliable)
  Research  (This was research (7)     3 3 3 4 4 5 1 5 3 3    (7) This was not research)
    Strategic  (Very strategic (8)     1 3 3 2 3 1 1 2 3 1    (8) Not strategic)
                 Outcome (Bad (9)      5 2 5 4 4 4 4 5 5 4    (9) Good)
```

PRINCIPAL COMPONENT ANALYSIS

	RC2	RC1	RC3
Embedding (Embedded - Not embedded)	-0.33	0.54	-0.14
Engagement (Listening - Not listening)	**-0.92**	-0.18	0.00
Externalisation (Contained, internal - Not contained, external)	-0.04	0.02	**0.78**
Measureability (Measureable - Not measureable)	0.44	0.35	0.56
Planning (In plan - Off plan)	-0.24	**0.88**	0.19
Reliability (Reliable - Unreliable)	0.17	**0.85**	-0.18
Research (This was research - This was not research)	0.64	-0.26	0.03
Strategic (Very strategic - Not strategic)	-0.08	-0.31	**0.90**
Outcome (Bad - Good)	0.71	-0.16	-0.07

	RC2	RC1	RC3
SS loadings	2.16	2.14	1.83
Proportion Var	0.24	0.24	0.20
Cumulative Var	0.24	0.48	0.68

PEARSON CORRELATION

	1	2	3	4	5	6	7	8	9
Embedding - Not embedd	1	0.00	-0.05	0.07	0.32	0.14	**-0.78**	-0.24	0.00
Engagement - Not listen	2		0.00	-0.50	0.13	-0.16	-0.35	0.14	**-0.74**
Externalis - Not contai	3			0.11	0.27	-0.15	-0.07	0.56	0.18
Measureabi - Not measur	4				0.15	0.19	0.09	0.43	0.06
Planning - Off plan)	5					**0.78**	-0.21	-0.11	-0.36
Reliabilit - Unreliable	6						0.18	-0.42	-0.17
Research - This was n	7							0.10	0.12
Strategic - Not strate	8								-0.13
Outcome (B - Good)	9								

RES 06

RATINGS:

							4 - Getting messages from l	
	Getting marks - 3						5 - I just had to "go the	
g Prof Fink on YouTu - 2							6 - Realisation of isol	
LECO - Chinese tra - 1							7 - Realisation there	
xiety creating (1)	3	3	1	3	3	2	3	(1) Anxiety easin
y (Out of uni (2)	1	1	3	2	3	3	3	(2) In uni)
lity (Oneness (3)	3	2	3	5	3	4	3	(3) Manyness)
ss (Connected (4)	2	3	1	2	2	1	4	(4) Disconnected)
ent (Enabling (5)	1	1	2	3	2	3	2	(5) Disabling)
Output (Input (6)	2	1	3	1	2	3	1	(6) Output)
vel (Exciting (7)	1	3	1	3	3	3	2	(7) Tedious)
n (Liberating (8)	2	1	3	3	3	3	2	(8) Constraining)
s (In process (9)	5	5	3	1	2	3	3	(9) Out of proces
Outcome (Bad (10)	5	5	4	4	3	4	4	(10) Good)

PRINCIPAL COMPONENT ANALYSIS

	RC1	RC2	RC3
Anxiety (Anxiety creating - Anxiety easing)	0.03	**0.89**	-0.22
Boundary (Out of uni - In uni)	0.14	-0.27	**0.92**
Cardinality (Oneness - Manyness)	**0.96**	-0.06	0.09
Connectedness (Connected - Disconnected)	-0.43	**0.84**	0.02
Enablement (Enabling - Disabling)	**0.83**	-0.12	0.46
Input-Output (Input - Output)	0.03	**-0.93**	0.20
Level (Exciting - Tedious)	0.46	0.55	0.19
Liberation (Liberating - Constraining)	0.63	-0.49	0.55
Process (In process - Out of process)	**-0.71**	-0.10	-0.64
Outcome (Bad - Good)	-0.29	0.01	**-0.92**

	RC1	RC2	RC3
SS loadings	3.01	3.0	2.75
Proportion Var	0.30	0.3	0.28
Cumulative Var	0.30	0.6	**0.88**

PEARSON CORRELATION

	1	2	3	4	5	6	7	8	9	10
Anxiety (- Anxiety ea	1	-0.48	-0.03	0.68	-0.26	**-0.81**	0.41	-0.46	0.06	0.13
Boundary - In institu	2		0.26	-0.21	0.64	0.45	0.08	**0.70**	-0.63	**-0.83**
Cardinalit - Manyness)	3			-0.37	**0.86**	0.06	0.26	**0.70**	**-0.75**	-0.33
Connectedn - Disconnect	4				-0.38	**-0.84**	0.12	-0.68	0.20	0.19
Enablement - Disabling)	5					0.23	0.43	**0.78**	**-0.84**	-0.59
Input-Outp - Output)	6						-0.33	0.57	0.02	-0.23
Level (Ex - Tedious)	7							0.03	-0.39	-0.33
Liberation - Constraini	8								**-0.79**	**-0.75**
Process (- Out of pro	9									**0.80**
Outcome (B - Good)	10									

RES 07

RATINGS:

```
                          3 - Draft engineering dra
    Build new system - 2 | 4 - Outsource labview
nancial Management - 1 | | | 5 - Prototype
                     | | | | |
ary  (Internal (1)   3 3 2 4 3   (1) External)
hin my discret (2)   3 3 4 2 3   (2) Outside my di
(Investigation (3)   3 3 4 2 3   (3) Research)
xpense  (Cheap (4)   3 3 3 5 4   (4) Expensive)
  (IP critical (5)   3 1 1 3 1   (5) Not IP critic
esearch driven (6)   3 1 4 4 3   (6) Management dr
 (Deliverables (7)   3 3 4 2 3   (7) Support)
y  (Repeatable (8)   3 5 1 3 3   (8) One off)
ope  (In scope (9)   3 4 2 3 3   (9) Out of scope)
 (One project (10)   3 3 5 3 1   (10) All projects
 Outcome (Bad (11)   4 2 2 3 4   (11) Good)
```

PRINCIPAL COMPONENT ANALYSIS

	RC1	RC2	RC3
Boundary (Internal - External)	**0.95**	-0.25	0.19
Discretion (Within my discretion - Outside my discretion)	**-0.95**	0.25	-0.19
Domain (Investigation - Research)	**-0.95**	0.25	-0.19
Expense (Cheap - Expensive)	**0.84**	0.21	0.19
Intellectual (IP critical - Not IP critical)	**0.75**	0.25	0.08
Nature (Research driven - Management driven)	0.25	**0.96**	0.01
Output (Deliverables - Support)	**-0.95**	0.25	-0.19
Repeatability (Repeatable - One off)	0.26	**-0.96**	0.08
Scope (In scope - Out of scope)	0.26	**-0.96**	0.08
Specificity (One project - All projects)	-0.24	0.40	**-0.85**
Outcome (Bad - Good)	0.24	0.16	**0.92**

	RC1	RC2	RC3
SS loadings	5.17	3.32	1.77
Proportion Var	0.47	0.30	0.16
Cumulative Var	0.47	0.77	**0.93**

PEARSON CORRELATION

	1	2	3	4	5	6	7	8	9	10	11
Boundary - External)	1	**-1.00**	**-1.00**	**0.79**	0.65	0.00	-1.00	0.50	0.50	-0.50	0.35
Discretion - Outside my	2		**1.00**	**-0.79**	-0.65	0.00	1.00	-0.50	-0.50	0.50	-0.35
Domain (I - Research)	3			**-0.79**	-0.65	0.00	1.00	-0.50	-0.50	0.50	-0.35
Expense (- Expensive)	4				0.41	0.46	**-0.79**	0.00	0.00	-0.40	0.28
Intellectu - Not IP cri	5					0.37	-0.65	0.00	0.00	0.00	0.46
Nature (R - Management	6						0.00	**-0.87**	**-0.87**	0.29	0.20
Output (D - Support)	7							-0.50	-0.50	0.50	-0.35
Repeatabil - One off)	8								**1.00**	-0.50	0.00
Scope (In - Out of sco	9									-0.50	0.00
Specificit - All projec	10										**-0.71**
Outcome (B - Good)	11										

RES 08

```
RATINGS:
   Deciding to 'go' with Academic - 4 5 - Discussion of requirements
 Completion of the specificatio - 3 | | 6 - Feedback meeting
              Clash of quotes - 2 | | | | 7 - Startup meeting with the champ
Changing the business model - 1 | | | | | | 8 - User testing
                              | | | | | | | |
 Approach  (Traditional (1)   3 4 2 3 1 4 3 4   (1) Agile/SCRUM)
        Champion  (Good (2)   3 3 2 3 3 4 1 5   (2) Bad (Culture))
         Change  (Tight (3)   4 5 4 3 3 4 3 5   (3) Loose)
       Commercial  (Low (4)   3 5 4 5 3 3 3 4   (4) High)
      Motivation  (High (5)   3 1 3 3 3 3 1 5   (5) Low)
   Requirements  (Fixed (6)   3 5 2 3 2 4 3 5   (6) Changing)
         Support  (High (7)   3 3 2 1 3 2 1 3   (7) Low)
            User  (Good (8)   3 3 2 3 2 4 1 5   (8) Poor)
         Outcome (Bad (9)   3 4 2 4 4 4 4 1   (9) Good)

PRINCIPAL COMPONENT ANALYSIS
                                        RC2   RC1   RC3
Approach  (Traditional - Agile/SCRUM)  0.92  0.05  0.00
Champion  (Good - Bad (Culture))       0.46  0.73  0.30
Change  (Tight - Loose)                0.71  0.30  0.51
Commercial  (Low - High)               0.60  0.04 -0.40
Motivation  (High - Low)              -0.07  0.99  0.05
Requirements  (Fixed - Changing)       0.93  0.11  0.24
Support  (High - Low)                  0.10  0.28  0.90
User  (Good - Poor)                    0.62  0.71  0.20
Outcome (Bad - Good)                  -0.07 -0.77 -0.17

                RC2  RC1  RC3
SS loadings    3.20 2.80 1.46
Proportion Var 0.36 0.31 0.16
Cumulative Var 0.36 0.67 0.83

PEARSON CORRELATION
                          1     2     3     4     5     6     7     8     9
Approach   - Agile/SCRU 1      0.45  0.64  0.30  0.00  0.90  0.00  0.64 -0.11
Champion   - Bad (Cultu 2            0.57  0.13  0.75  0.60  0.54  0.96 -0.41
Change  (T - Loose)     3                  0.34  0.23  0.77  0.63  0.67 -0.55
Commercial - High)      4                        -0.06  0.37 -0.09  0.23 -0.07
Motivation - Low)       5                               0.07  0.31  0.69 -0.72
Requiremen - Changing)  6                                     0.31  0.71 -0.18
Support  ( - Low)       7                                           0.42 -0.35
User  (Goo - Poor)      8                                                -0.47
Outcome (B - Good)      9
```

RES 09

RATINGS:

```
                                  8 - Closing lease agreement
        Changes to the process - 7 | 9 - Dealing with data quality
             Change requests - 6 | | | 10 - Defining responsibilities
  Being tasked by the Dean - 5 | | | | | 11 - Imposing standards
proval for new computers - 4 | | | | | | | 12 - Laying down conditions
ieve staff development - 3 | | | | | | | | 13 - Making a choice
odating requirements - 2 | | | | | | | | | | 14 - Organising access
mmodating requests - 1 | | | | | | | | | | | | 15 - Receiving data
                       | | | | | | | | | | | | | |
ent  (Enabling (1)    2 1 3 5 2 4 4 2 4 4 4 3 3 4 1    (1) Disabling)
ity  (Feasible (2)    3 1 3 4 3 5 3 3 3 2 2 3 3 1 1    (2) Not fesible)
cus  (In locus (3)    2 2 1 3 3 4 3 2 3 4 3 4 3 3 3    (3) Out if locus)
n  (Negotiable (4)    2 2 3 3 2 3 3 3 4 4 3 4 3 3 2    (4) Not negotiabl
(Not dependent (5)    4 3 3 3 3 4 5 2 3 4 4 4 4 3 3    (5) Dependent)
(Received resp (6)    5 5 3 3 3 2 3 3 3 2 3 3 3 2 3    (6) Given respons
ope  (Internal (7)    1 1 3 1 3 3 2 3 3 2 3 3 3 1 1    (7) External)
ility  (Stable (8)    3 3 3 1 3 3 4 3 1 1 3 3 1 1 1    (8) Unstable)
ty  (Technical (9)    3 3 3 5 3 3 3 3 3 4 4 4 5 5 3    (9) Human)
 Outcome (Bad (10)    5 5 4 2 4 2 3 1 3 4 4 4 5 3 5    (10) Good)
```

PRINCIPAL COMPONENT ANALYSIS

	RC1	RC2	RC3
Enablement (Enabling - Disabling)	**0.77**	0.38	0.17
Feasibility (Feasible - Not fesible)	0.10	**0.79**	0.11
Locus (In locus - Out if locus)	0.65	0.10	0.46
Negotiation (Negotiable - Not negotiable)	0.69	0.40	0.11
Resource (Not dependent - Dependent)	0.12	0.09	**0.96**
Responsibility (Received responsibility - Given responsibility)	**-0.76**	-0.34	0.08
Scope (Internal - External)	0.05	**0.75**	0.08
Stability (Stable - Unstable)	-0.68	0.51	0.31
Technicality (Technical - Human)	**0.76**	-0.33	0.02
Outcome (Bad - Good)	-0.33	-0.67	0.48

	RC1	RC2	RC3
SS loadings	3.26	2.44	1.52
Proportion Var	0.33	0.24	0.15
Cumulative Var	0.33	0.57	**0.72**

PEARSON CORRELATION

	1	2	3	4	5	6	7	8	9	10
Enablement - Disabling)	1		0.44	0.43	0.67	0.36	-0.60	0.17	-0.23	0.52	-0.50
Feasibilit - Not fesibl	2			0.18	0.24	0.20	-0.19	0.48	0.25	-0.08	-0.52
Locus (In - Out if loc	3				0.47	0.45	-0.57	0.13	-0.27	0.33	-0.12
Negotiatio - Not negoti	4					0.20	-0.57	0.45	-0.25	0.32	-0.36
Resource - Dependent)	5						-0.05	0.06	0.27	0.09	0.29
Responsibi - Given resp	6							-0.36	0.35	-0.35	0.48
Scope (In - External)	7								0.29	-0.16	-0.23
Stability - Unstable)	8									-0.58	-0.07
Technicali - Human)	9										-0.03
Outcome (B - Good)	10										

RES 10

```
RATINGS:
           Good instructions - 6 7 - Lack of help "follow the in
      Failed access to res - 5 | | 8 - Loading money
aded but a few days to s - 4 | | | | 9 - No threads on discussio
ing how to use the ser - 3 | | | | | | 10 - Not synched with lec
iscovered chat rooms - 2 | | | | | | | | 11 - Pages showed last
to travel services - 1 | | | | | | | | | | 12 - Receipt at 7am,
                       | | | | | | | | | | | |
mic  (Academic (1)    3 3 3 1 3 3 3 3 3 2 1 5    (1) Non-academic)
on   (Automated (2)   1 4 3 3 1 1 3 1 1 3 3 3    (2) Human)
ent  (Enabling (3)    1 2 1 5 3 1 3 1 3 3 3 1    (3) Disabling)
y  (Functional (4)    1 1 1 5 4 1 3 1 4 5 5 1    (4) Non-functiona
ty  (My action (5)    3 3 1 5 3 3 5 1 3 5 5 1    (5) Someone else'
(Instantaneous (6)    1 1 1 3 5 3 3 2 3 3 3 3    (6) Delayed)
  Outcome (Bad (7)    4 5 5 4 2 4 2 4 2 2 3 5    (7) Good)
```

PRINCIPAL COMPONENT ANALYSIS

	RC1	RC3	RC2
Academic (Academic - Non-academic)	**-0.97**	0.04	0.00
Automation (Automated - Human)	0.17	-0.16	**0.96**
Enablement (Enabling - Disabling)	**0.74**	0.51	0.28
Functionality (Functional - Non-functional)	**0.74**	0.61	0.11
Responsibility (My action - Someone else's action)	**0.83**	0.34	0.19
Timeliness (Instantaneous - Delayed)	0.07	**0.94**	-0.10
Outcome (Bad - Good)	-0.42	**-0.75**	0.31

	RC1	RC3	RC2
SS loadings	2.92	2.23	1.15
Proportion Var	0.42	0.32	0.16
Cumulative Var	0.42	0.74	0.90

PEARSON CORRELATION

	1	2	3	4	5	6	7
Academic - Non-academ	1	-0.17	-0.69	**-0.71**	**-0.73**	-0.09	0.31
Automation - Human)	2		0.26	0.13	0.28	-0.26	0.29
Enablement - Disabling)	3			**0.89**	**0.78**	0.50	-0.54
Functional - Non-functi	4				**0.77**	0.61	**-0.72**
Responsibi - Someone el	5					0.34	-0.60
Timeliness - Delayed)	6						-0.66
Outcome (B - Good)	7						

RES 12

RATINGS:

```
                          4 - Presentation to Exec
         Mail overflow - 3 | 5 - Realisation needed co
  Engagement with IT - 2 | | | 6 - Reporting necessary
          Adoption - 1 | | | | | 7 - Take over for cha
                       | | | | | | |
nstitutional p (1)     5 3 5 3 4 3 3    (1) Personal prod
  (Operational (2)     3 1 3 5 4 4 3    (2) Strategic)
  (Progressive (3)     5 3 5 3 3 3 3    (3) Non-progressi
t  (Integrated (4)     5 3 5 1 2 1 1    (4) Separated)
  (Operational (5)     3 3 3 2 3 2 2    (5) Strategic )
  Outcome (Bad (6)     3 1 4 4 5 1 4    (6) Good)
```

PRINCIPAL COMPONENT ANALYSIS

	RC1	RC3	RC2
Productivity (Institutional productivity - Personal productivity)	**0.93**	0.17	0.30
Progress (Operational - Strategic)	-0.06	**-0.85**	0.45
Progression (Progressive - Non-progressive)	**0.99**	0.07	0.01
Sep/Int (Integrated - Separated)	**0.89**	0.44	-0.04
Strat/Ops (Operational - Strategic)	0.54	**0.78**	0.18
Outcome (Bad - Good)	0.12	-0.13	**0.96**

	RC1	RC3	RC2
SS loadings	2.94	1.56	1.26
Proportion Var	0.49	0.26	0.21
Cumulative Var	0.49	0.75	0.96

PEARSON CORRELATION

	1	2	3	4	5	6
Productivi - Personal p	1	-0.06	**0.92**	**0.88**	**0.70**	0.37
Progress - Strategic)	2		-0.16	-0.45	-0.53	0.48
Progressio - Non-progre	3			**0.92**	0.55	0.16
Sep/Int (- Separated)	4				0.81	0.03
Strat/Ops - Strategic	5					0.08
Outcome (B - Good)	6					

RES 13

RATINGS:

```
                          Paper trail - 3 4 - Periodic communication (report
           Match need to expectation - 2 | | 5 - Signing off cost to resource (
    Crisis management (lack of inf - 1 | | | | 6 - Trying to assess expenditure
                                      | | | | | |
Consequentiality  (Consequence (1)    1 3 1 1 3 3   (1) NO consequence)
    Criticality  (Not critical (2)    5 4 4 4 3 3   (2) Critical)
      Dependency  (Independent (3)    3 4 4 3 3 2   (3) Dependant)
      Relationship  (Informing (4)    3 1 2 3 1 3   (4) Deciding)
       Retro/Pro  (Prospective (5)    3 2 3 3 3 4   (5) Retrospective)
          Urgency  (Not urgent (6)    5 5 2 3 3 3   (6) Urgent)
                  Outcome (Bad (7)    3 2 3 4 5 5   (7) Good)
```

PRINCIPAL COMPONENT ANALYSIS

	RC1	RC2	RC3
Consequentiality (Consequence - NO consequence)	0.07	**-0.97**	0.15
Criticality (Not critical - Critical)	-0.28	**0.79**	0.52
Dependency (Independent - Dependant)	**-0.98**	0.18	-0.02
Relationship (Informing - Deciding)	0.72	0.66	0.05
Retro/Pro (Prospective - Retrospective)	**0.89**	0.04	-0.39
Urgency (Not urgent - Urgent)	-0.14	-0.03	**0.99**
Outcome (Bad - Good)	**0.74**	-0.38	-0.48

	RC1	RC2	RC3
SS loadings	2.92	2.18	1.65
Proportion Var	0.42	0.31	0.24
Cumulative Var	0.42	0.73	0.97

PEARSON CORRELATION

	1	2	3	4	5	6	7
Consequent - NO consequ	1	**-0.73**	-0.24	-0.56	0.00	0.15	0.30
Criticalit - Critical)	2		0.41	0.32	-0.42	0.54	**-0.73**
Dependency - Dependant)	3			-0.59	**-0.84**	0.11	**-0.80**
Relationsh - Deciding)	4				0.64	-0.08	0.22
Retro/Pro - Retrospect	5					-0.52	0.78
Urgency (- Urgent)	6						-0.54
Outcome (B - Good)	7						

RES 14

```
RATINGS:
             Find people - 4 5 - Mail merge
       Filter for date - 3 | | 6 - Registered as a user
       Demo workshop - 2 | | | | 7 - Statistical summary
ommittee (ConfCom) - 1 | | | | | | 8 - Training module
                       | | | | | | | |
dmin  (Funding (1)    3 3 3 2 3 4 3 3   (1) Admin)
/take  (Giving (2)    3 1 5 5 3 1 4 5   (2) Taking)
Implementation (3)    3 3 4 4 3 5 1 5   (3) Using)
ext  (Internal (4)    1 1 3 3 3 5 3 1   (4) External)
in  (In office (5)    3 3 3 3 3 1 3 1   (5) Out of office
ot  (Technical (6)    3 3 3 3 3 1 3 1   (6) Non-technical
  Outcome (Bad (7)    4 4 5 4 5 5 4 4   (7) Good)

PRINCIPAL COMPONENT ANALYSIS
                                        RC1   RC2   RC3
Fund/Admin  (Funding - Admin)         -0.39  0.35 -0.79
Give/take  (Giving - Taking)          -0.04 -0.05  0.93
Imp/Use  (Implementation - Using)     -0.85  0.20  0.16
Int/ext  (Internal - External)        -0.10  0.89 -0.10
Out/in  (In office - Out of office)    0.96 -0.06  0.22
Tech/not  (Technical - Non-technical)  0.96 -0.06  0.22
Outcome (Bad - Good)                  -0.11  0.92 -0.15

                RC1  RC2  RC3
SS loadings    2.72 1.80 1.64
Proportion Var 0.39 0.26 0.23
Cumulative Var 0.39 0.65 0.88

PEARSON CORRELATION
                          1     2     3     4     5     6     7
Fund/Admin - Admin)     1    -0.63  0.20  0.38 -0.58 -0.58  0.52
Give/take  - Taking)    2          0.03 -0.15  0.14  0.14 -0.18
Imp/Use   ( - Using)    3                0.15 -0.71 -0.71  0.32
Int/ext   ( - External) 4                     -0.22 -0.22  0.68
Out/in   (I - Out of off 5                           1.00 -0.15
Tech/not    - Non-techni 6                                -0.15
Outcome (B - Good)      7
```

RES 15

```
RATINGS:
ixing reference problems - 4 5 - Informs method
 Drag and drop is good - 3 | | 6 - Limitations of duplic
g for reference mana - 2 | | | | 7 - Only 15 gig is shar
terface Mac and Wi - 1 | | | | | | 8 - Porting to Window
                       | | | | | | | |
antage  (Helps (1)    3 1 1 5 1 5 2 3    (1) Hinders)
Fulfills needs (2)    4 1 1 3 1 3 3 4    (2) Does not fulf
acity  (Enough (3)    3 3 3 3 3 3 5 3    (3) Not enough)
y  (Consistent (4)    5 4 1 3 1 3 3 4    (4) Inconsistent)
ity  (Flexible (5)    4 3 1 3 3 5 3 4    (5) Inflexible)
nality  (Works (6)    3 2 1 3 1 4 3 1    (6) Does not work
ity  (Reliable (7)    4 4 1 4 1 5 2 4    (7) Unreliable)
Online support (8)    3 1 2 1 1 1 1 3    (8) No support)
  Outcome (Bad (9)    2 5 4 4 3 2 1 3    (9) Good)

PRINCIPAL COMPONENT ANALYSIS
                                                    RC1   RC2   RC3
Advantage  (Helps - Hinders)                       0.88  0.02 -0.02
Capability  (Fulfills needs - Does not fulfill)    0.65  0.37  0.61
Capacity  (Enough - Not enough)                   -0.13  0.90 -0.17
Consistency  (Consistent - Inconsistent)           0.64  0.02  0.56
Flexbility  (Flexible - Inflexible)                0.83  0.14  0.21
Functionality  (Works - Does not work)             0.82  0.36 -0.28
Reliability  (Reliable - Unreliable)               0.92 -0.24  0.20
Support  (Online support - No support)            -0.05 -0.08  0.97
Outcome (Bad - Good)                              -0.25 -0.89 -0.18

                 RC1  RC2  RC3
SS loadings     3.90 1.96 1.85
Proportion Var 0.43 0.22 0.21
Cumulative Var 0.43 0.65 0.86

PEARSON CORRELATION
                          1     2     3     4     5     6     7     8     9
Advantage  - Hinders)   1      0.68 -0.15  0.36  0.64  0.71  0.73 -0.01 -0.26
Capability - Does not f 2            0.15  0.69  0.66  0.47  0.60  0.54 -0.58
Capacity   - Not enough 3                  0.00 -0.09  0.26 -0.29 -0.28 -0.62
Consistenc - Inconsiste 4                       0.61  0.43  0.78  0.44 -0.15
Flexbility - Inflexible 5                             0.58  0.77  0.10 -0.47
Functional - Does not w 6                                   0.61 -0.30 -0.47
Reliabilit - Unreliable 7                                        0.14  0.00
Support  ( - No support 8                                              -0.12
Outcome (B - Good)      9
```

RES 16

RATINGS:

```
                            5 - Integration
                Download - 4 | 6 - Need stackoverflow
     Create main class - 3 | | | 7 - Refer for details
d change - reinstall - 2 | | | | | 8 - Terminal window
 Broken dependency - 1 | | | | | | | 9 - Version control
                       | | | | | | | | |
traightforward (1)   5 2 3 3 3 3 4 3 3   (1) Difficult)
plicity  (Once (2)   2 3 1 3 3 5 3 3 5   (2) Many times)
ess  (Forwards (3)   5 1 3 3 2 4 3 3 1   (3) Backwards)
rity  (Applies (4)   3 3 3 3 3 3 3 3 1   (4) Does not appl
ace  (Good use (5)   3 3 3 3 3 3 3 1 3   (5) Bad use)
  Outcome (Bad (6)   1 3 3 3 4 2 2 3 5   (6) Good)
```

PRINCIPAL COMPONENT ANALYSIS

	RC1	RC2	RC3
Difficulty (Straightforward - Difficult)	**0.91**	0.02	0.13
Multiplicity (Once - Many times)	-0.10	**0.83**	-0.07
Progress (Forwards - Backwards)	**0.91**	-0.28	-0.11
Security (Applies - Does not apply)	0.25	**-0.88**	-0.16
Space (Good use - Bad use)	0.03	0.03	**0.99**
Outcome (Bad - Good)	**-0.80**	0.48	0.00

	RC1	RC2	RC3
SS loadings	2.36	1.78	1.03
Proportion Var	0.39	0.30	0.17
Cumulative Var	0.39	0.69	**0.86**

PEARSON CORRELATION

	1	2	3	4	5	6
Difficulty - Difficult) 1		-0.26	**0.74**	0.10	0.10	-0.61
Multiplici - Many times 2			-0.29	-0.56	0.03	0.35
Progress - Backwards) 3				0.51	-0.06	**-0.84**
Security - Does not a 4					-0.12	-0.68
Space (Go - Bad use) 5						-0.04
Outcome (B - Good) 6						

RES 17

```
RATINGS:
                              5 - Link to SIS - intertwined
er computing & PC manage - 4 | 6 - Load shedding
   Day to day activity - 3 | | | 7 - Routine HR actions
raction mgt & ad hoc - 2 | | | | | 8 - Submit application
unctional upgrades - 1 | | | | | | | 9 - Testing on produc
                       | | | | | | | | |
ccess  (Secure (1)    3 3 3 5 3 3 3 3 3   (1) Insecure)
  (Proprietary (2)    4 3 3 4 5 4 3 3 4   (2) Completely be
tinuity  (High (3)    3 3 4 3 3 4 3 3 2   (3) Low)
Meets requirem (4)    4 2 3 3 4 3 3 3 3   (4) Does not meet
Support  (Good (5)    4 2 3 3 3 3 3 2 3   (5) Bad)
  Outcome (Bad (6)    2 3 3 3 2 2 3 3 1   (6) Good)

PRINCIPAL COMPONENT ANALYSIS
                                                                          RC1   RC2   RC3
Access  (Secure - Insecure)                                              0.04 -0.01  0.99
Bespoke  (Proprietary - Completely bespoke)                              0.80 -0.37  0.15
Continuity  (High - Low)                                                 0.06  0.93 -0.08
Functionality  (Meets requirements - Does not meet requirements)        0.91 -0.01 -0.07
Support  (Good - Bad)                                                    0.88  0.07  0.01
Outcome (Bad - Good)                                                    -0.55  0.65  0.37

                RC1  RC2  RC3
SS loadings    2.54 1.44 1.15
Proportion Var 0.42 0.24 0.19
Cumulative Var 0.42 0.66 0.85

PEARSON CORRELATION
                           1     2     3     4     5     6
Access  (S - Insecure)  1      0.18 -0.07 -0.07  0.07  0.29
Bespoke  ( - Completely 2          -0.20  0.69  0.49 -0.65
Continuity - Low)       3                -0.04  0.04  0.45
Functional - Does not m 4                       0.73 -0.41
Support  ( - Bad)       5                            -0.45
Outcome (B - Good)      6
```

RES 19

```
RATINGS:
       Failure to repair cable - 7 8 - First forum by email - studen
aling with tekkies - loss of - 6 | | 9 - First overnight email with
     Computer lab crashing - 5 | | | | 10 - Getting NASA notices
ng storage (pressure to  - 4 | | | | | | 11 - Loss of sound feature
ability of attachments - 3 | | | | | | | 12 - M&G during tutorial
dwidth for streaming - 2 | | | | | | | | | 13 - Out of specificati
 of theses and art - 1 | | | | | | | | | | | 14 - Plato did not re
                     | | | | | | | | | | | | |
l  (Liberating (1)   3 5 1 5 5 5 5 3 3 3 5 1 5 5   (1) Constraining)
Data  (Storage (2)   5 5 5 1 3 3 3 5 5 5 3 5 3 1   (2) Movement)
ent  (Enabling (3)   1 5 1 5 5 5 5 1 1 1 5 1 5 5   (3) Disabling)
cessing inform (4)   3 2 4 3 3 3 3 3 3 3 3 3 3 3   (4) Moving inform
ach  (Outreach (5)   1 1 1 3 3 3 3 1 1 1 3 1 3 3   (5) Inreach)
iness  (Timely (6)   1 5 1 3 5 3 5 1 4 1 3 1 5 5   (6) Slow)
  Outcome (Bad (7)   5 2 4 2 1 2 1 5 5 4 2 4 2 1   (7) Good)
```

PRINCIPAL COMPONENT ANALYSIS

	RC1	RC3	RC2
Control (Liberating - Constraining)	**0.72**	0.40	-0.50
Data (Storage - Movement)	**-0.94**	-0.18	-0.04
Enablement (Enabling - Disabling)	**0.77**	0.51	-0.31
Processing (Processing information - Moving information)	0.02	-0.19	**0.97**
Reach (Outreach - Inreach)	**0.92**	0.34	0.05
Timeliness (Timely - Slow)	0.38	**0.85**	-0.30
Outcome (Bad - Good)	**-0.74**	-0.58	0.14

	RC1	RC3	RC2
SS loadings	3.54	1.68	1.41
Proportion Var	0.51	0.24	0.20
Cumulative Var	0.51	0.74	0.95

PEARSON CORRELATION

	1	2	3	4	5	6	7
Control (- Constraini	1	**-0.70**	**0.91**	-0.52	**0.78**	**0.78**	**-0.79**
Data (Sto - Movement)	2		**-0.78**	0.00	**-0.90**	-0.54	**0.77**
Enablement - Disabling)	3			-0.38	**0.87**	**0.80**	**-0.95**
Processing - Moving inf	4				0.00	-0.44	0.25
Reach (Ou - Inreach)	5					0.63	**-0.85**
Timeliness - Slow)	6						-0.77
Outcome (B - Good)	7						

RES 21

RATINGS:

```
                            5 - Imaging across PC types
                Handover - 4 | 6 - Specifying super silent
g with custom software - 3 | | | 7 - Students broke printe
 captured not usable - 2 | | | | | 8 - Unpack the box
d app with librari - 1 | | | | | | | 9 - Web deployment in
                       | | | | | | | | |
(Unchallenging (1)    3 3 5 3 5 3 5 3 5    (1) Challenging)
 (Constructive (2)    2 3 2 3 1 1 5 3 2    (2) Destructive)
  (Progressive (3)    3 5 2 3 3 1 5 3 1    (3) Regressive)
(Not satisfied (4)    3 3 2 1 4 5 5 1 2    (4) Satisfied)
ccess  (Usable (5)    5 1 3 1 3 1 4 1 3    (5) Not usable)
ty  (Technical (6)    2 1 1 3 1 1 1 3 1    (6) Non technical
  Time  (Short (7)    3 5 4 3 5 3 5 3 5    (7) Intensive)
  Outcome (Bad (8)    3 1 3 4 2 5 1 4 4    (8) Good)
```

PRINCIPAL COMPONENT ANALYSIS

	RC2	RC1	RC3
Challenge (Unchallenging - Challenging)	-0.03	**0.92**	0.20
Engineering (Constructive - Destructive)	**0.85**	0.07	-0.23
Progress (Progressive - Regressive)	**0.98**	-0.07	0.11
Satisfaction (Not satisfied - Satisfied)	0.08	0.05	**0.89**
Success (Usable - Not usable)	0.09	**0.71**	0.06
Technicality (Technical - Non technical)	0.09	-0.48	**-0.83**
Time (Short - Intensive)	0.36	0.65	0.48
Outcome (Bad - Good)	**-0.81**	-0.35	-0.37

	RC2	RC1	RC3
SS loadings	2.49	2.13	1.96
Proportion Var	0.31	0.27	0.24
Cumulative Var	0.31	0.58	0.82

PEARSON CORRELATION

	1	2	3	4	5	6	7	8
Challenge - Challengin	1		0.04	-0.09	0.22	0.51	-0.60	**0.71**	-0.34
Engineerin - Destructiv	2			**0.73**	-0.04	0.08	0.20	0.20	-0.50
Progress - Regressive	3				0.16	0.08	0.05	0.34	**-0.85**
Satisfacti - Satisfied)	4					0.29	-0.69	0.33	-0.35
Success (- Not usable	5						-0.30	0.25	-0.35
Technicali - Non techni	6							**-0.71**	0.40
Time (Sho - Intensive)	7								**-0.71**
Outcome (B - Good)	8								

RES 24

```
RATINGS:
    Getting big Battery pack worki - 4 5 - Managing the project
               Gaining agreement - 3 | | 6 - Meeting with partners
    Establishing component set - 2 | | | 7 - Need to learn PCB CAD
  Agreeing full time working - 1 | | | | | 8 - Setting requirements
                               | | | | | | |
    Dependency (Internal (1)   3 3 5 4 3 5 3 5   (1) External)(
    Discretion (Personal (2)   3 3 1 3 2 1 3 1   (2) Business)
       Finality (Has end (3)   3 5 5 5 2 5 3 4   (3) No end)
          Grouping (Self (4)   5 5 1 3 3 1 4 1   (4) Many)
           Role (Leading (5)   1 1 5 5 4 3 3 5   (5) Team member)
Technicality  (Technical (6)   3 3 3 4 3 2 5 5   (6) Non technical)
            Outcome (Bad (7)   4 4 4 4 3 3 3 3   (7) Good)

PRINCIPAL COMPONENT ANALYSIS
                                                RC1   RC2   RC3
Dependency (Internal - External)(             -0.95  0.25  0.01
Discretion (Personal - Business)               0.94  0.16  0.19
Finality (Has end - No end)                   -0.41  0.83 -0.11
Grouping (Self - Many)                         1.00  0.05 -0.05
Role (Leading - Team member)                  -0.73  0.00  0.55
Technicality  (Technical - Non technical)      0.08 -0.16  0.95
Outcome (Bad - Good)                           0.35  0.86 -0.11

                 RC1  RC2  RC3
SS loadings     3.60 1.54 1.26
Proportion Var  0.51 0.22 0.18
Cumulative Var  0.51 0.73 0.91

PEARSON CORRELATION
                           1     2     3     4     5     6     7
Dependency - External)( 1     -0.85  0.60 -0.93  0.63 -0.07 -0.13
Discretion - Business)  2           -0.24  0.93 -0.55  0.20  0.40
Finality ( - No end)    3                 -0.35  0.14 -0.22  0.45
Grouping ( - Many)      4                 -0.77  0.04  0.39
Role (Lead - Team membe 5                       0.36 -0.24
Technicali - Non techni 6                            -0.25
Outcome (B - Good)      7
```

RES 25

```
RATINGS:
grated database seamless t - 5 6 - Involving identified Exec
 a module approach assis - 4 | | 7 - Involving users in the
ng a module for a spec - 3 | | | | 8 - Single source of corr
o the success of a p - 2 | | | | | | 9 - Single source of co
ers to understand  - 1 | | | | | | | | 10 - User involvement
                       | | | | | | | | | |
ange  (Take-up (1)    3 1 3 3 3 2 2 2 1 1    (1) No take-up)
 Ease  (Simple (2)    3 1 1 3 3 3 1 1 1 1    (2) Complicated)
rmation  (Good (3)    3 1 3 1 1 3 3 1 1 3    (3) Bad)
n  (Integrated (4)    3 1 3 3 1 2 3 1 1 3    (4) Standalone)
gy  (Structure (5)    2 1 2 1 1 3 2 1 1 2    (5) Chaos)
d  (Integrated (6)    3 2 2 3 1 2 3 1 1 3    (6) Standalone)
al  (Excellent (7)    2 2 3 2 1 1 2 1 1 2    (7) Poor)
(User-friendly (8)    1 2 1 1 1 2 2 1 1 1    (8) Non-useable)
ip  (Promoting (9)    2 1 3 2 1 1 1 1 1 1    (9) Unsupportive)
 Outcome (Bad (10)    4 5 5 5 5 5 4 5 5 5    (10) Good)

PRINCIPAL COMPONENT ANALYSIS
                                                RC1   RC2   RC3
Change  (Take-up - No take-up)                 0.06  0.48  0.81
Ease  (Simple - Complicated)                   0.12 -0.12  0.93
Information  (Good - Bad)                      0.89  0.20 -0.03
Integration  (Integrated - Standalone)         0.73  0.61  0.10
Methodology  (Structure - Chaos)               0.85 -0.09  0.10
Modularised  (Integrated - Standalone)         0.77  0.37 -0.01
Operational  (Excellent - Poor)                0.39  0.83 -0.26
Quality  (User-friendly - Non-useable)         0.51 -0.55 -0.27
Sponsorship  (Promoting - Unsupportive)        0.11  0.90  0.24
Outcome (Bad - Good)                          -0.65 -0.05 -0.15

                 RC1  RC2  RC3
SS loadings     3.51 2.59 1.77
Proportion Var  0.35 0.26 0.18
Cumulative Var  0.35 0.61 0.79

PEARSON CORRELATION
                             1     2     3     4     5     6     7     8     9    10
Change  (T - No take-up   1      0.64  0.12  0.37  0.07  0.13  0.24 -0.34  0.65 -0.24
Ease  (Sim - Complicate   2            0.00  0.13  0.18  0.15 -0.26 -0.09  0.12 -0.10
Informatio - Bad)         3                  0.74  0.90  0.60  0.47  0.22  0.30 -0.50
Integratio - Standalone   4                        0.54  0.88  0.71 -0.07  0.58 -0.48
Methodolog - Chaos)       5                              0.44  0.19  0.39  0.14 -0.30
Modularise - Standalone   6                                    0.62  0.18  0.29 -0.54
Operationa - Poor)        7                                          -0.03  0.75 -0.23
Quality  ( - Non-useabl   8                                                -0.39 -0.22
Sponsorshi - Unsupporti   9                                                      -0.08
Outcome (B - Good)       10
```

RES 26

```
RATINGS:
             Integration - 4 5 - Lack of business proces
es in terms of virtual - 3 | | 6 - Lack of user level ad
gement strategy in p - 2 | | | | 7 - Significant knowled
unctional capabili - 1 | | | | | | 8 - Supplier failing
                       | | | | | | | |
ssfully adopte (1)    3 4 3 3 3 3 3 4    (1) Not Adopted)
Business  (Low (2)    4 2 5 5 1 2 5 3    (2) High)
rking together (3)    2 3 3 2 4 4 3 4    (3) Working in si
n your control (4)    2 3 3 1 5 3 3 4    (4) Outside your
idance  (Clear (5)    2 3 3 2 1 1 1 3    (5) Unclear)
ts whole lifec (6)    1 3 3 1 1 1 1 3    (6) Supports only
  (Recognising (7)    2 3 4 3 1 1 1 3    (7) Not recognisi
  Outcome (Bad (8)    4 4 2 5 2 2 5 2    (8) Good)
```

PRINCIPAL COMPONENT ANALYSIS

	RC2	RC1	RC3
Adoption (Successfully adopted - Not Adopted)	0.59	0.15	**0.78**
Business (Low - High)	0.24	-0.68	-0.55
Expanding (Working together - Working in silos)	-0.09	**0.93**	0.21
External (In your control - Outside your control)	-0.07	**0.89**	0.23
Guidance (Clear - Unclear)	**0.98**	-0.10	0.15
Process (Supports whole lifecycle - Supports only one section of lifecycle)	**0.92**	0.24	0.23
Recognising (Recognising - Not recognising)	**0.95**	-0.22	-0.14
Outcome (Bad - Good)	-0.22	-0.92	0.20

	RC2	RC1	RC3
SS loadings	3.16	3.11	1.14
Proportion Var	0.40	0.39	0.14
Cumulative Var	0.40	0.78	**0.93**

PEARSON CORRELATION

	1	2	3	4	5	6	7	8
Adoption - Not Adopte	1	-0.34	0.28	0.26	0.67	**0.75**	0.40	-0.11
Business - High)	2		-0.68	-0.67	0.19	-0.02	0.40	0.53
Expanding - Working in	3			**0.86**	-0.18	0.21	-0.33	**-0.77**
External - Outside yo	4				-0.13	0.23	-0.31	-0.69
Guidance - Unclear)	5					**0.89**	**0.93**	-0.11
Process (- Supports o	6						0.77	-0.35
Recognisin - Not recogn	7							-0.04
Outcome (B - Good)	8							

RES 27 - 30

RATINGS:

```
                              Page Redirection - 7    8 - Purely Native
                                 Human Error - 6 |    |    9 - SASI Integration Issues
          Dept of Mathematics Partnershi - 5     | |    |    |    10 - Scope Creep
            Customer Review of Beta - 4      |      | |     |     |     |     11 - University
Administration
                    Bootcamp - 3     |    |    | |    |    |    |    |    12 - Upgrade
               Blog Tool - 2     |     |     |    | |    |    |    |    |    |    13 - Ward
Facility Visit
     Authentication - 1     |     |     |     |    | |    |    |    |    |    |    |    14 -
WeBWorKs Integratio
                       |    |    |    |    |    | |    |    |    |    |    |    |    |
ng  (Technical (1)       1 3.25 3.75    2    3 3  3.5 3.75    1 3.75    3  1.5    3  3.5   (1)
Practical)
rning  (Simple (2)    3.75    3  1.5  3.5    3 3 3.75 2.25 3.25 3.75    3  3.5    3 2.25   (2)
Complicated)
rmining Requir (3)    3.75 1.25 2.25 3.25 3.25 1 3.75  1.5 2.25    1    1  2.5  3.5    1   (3)
Implementatio
bility  (Known (4)    3.75 3.75    3  3.5    3 3    3 3.75    1    3    3 3.25 3.25  1.5   (4)
Unknown)
ess  (Forwards (5)     3.5 3.25  3.5    3 3.25 1  3.5    1  1.5 1.25 2.25  3.5    3 1.75   (5)
Backwards)
ps  (One-Sided (6)       3 3.75    3    1  2.5 1    3    3 3.75 3.75    1    3 1.25    3   (6)
Cooperative)
learly Defined (7)       1 3.75 3.25  3.5 3.75 3    1    1    3 1.25    3 3.75 3.25    2   (7)
Uncertain)
ility  (Doable (8)       1 3.75 3.75  3.5    3 3 3.75 1.25    3 3.75    3  3.5    3 1.25   (8)
Not Doable)
  Outcome (Bad (9)       5    2    5    5    5 2    4    3    2    2    2    5    5    2   (9)
Good)
```

PRINCIPAL COMPONENT ANALYSIS

	RC1	RC3	RC2
Interfacing (Technical - Practical)	-0.08	**-0.88**	-0.04
Learning (Simple - Complicated)	0.10	**0.73**	-0.06
Lifecycle (Determining Requirements - Implementation of Requirements)	**0.79**	0.49	-0.02
Predictability (Known - Unknown)	**0.69**	-0.30	-0.05
Progress (Forwards - Backwards)	**0.78**	0.23	0.31
Relationships (One-Sided - Cooperative)	-0.23	0.19	-0.36
Requirements (Clearly Defined - Uncertain)	0.03	0.04	**0.92**
Viablility (Doable - Not Doable)	0.03	0.04	**0.78**
Outcome (Bad - Good)	**0.91**	0.18	0.12

	RC1	RC3	RC2
SS loadings	2.61	1.76	1.69
Proportion Var	0.29	0.20	0.19
Cumulative Var	0.29	0.49	**0.67**

PEARSON CORRELATION

	1	2	3	4	5	6	7	8	9
Interfacin - Practical) 1		-0.50	-0.42	0.15	-0.23	0.00	-0.19	0.15	-0.27
Learning - Complicate 2			0.36	0.15	0.14	0.00	-0.17	0.20	0.06
Lifecycle - Implementa 3				0.22	**0.70**	-0.10	-0.01	0.04	**0.84**
Predictabi - Unknown) 4					0.37	-0.23	-0.05	0.07	0.42
Progress - Backwards) 5						0.02	0.31	0.30	0.75
Relationsh - Cooperativ 6							-0.32	-0.04	-0.19
Requiremen - Uncertain) 7								0.51	0.18
Viablility - Not Doable 8									0.07
Outcome (B - Good) 9									

RES 31

RATINGS:

```
                              5 - Govt decided to close acc
g recent information com - 4 | 6 - Maxima ERP at BAA - pro
difficult documents vi - 3 | | | 7 - Realisation business
 reference to old pa - 2 | | | | | 8 - Use of different la
int report - lorri - 1 | | | | | | | 9 - Using remote acce
                       | | | | | | | | |
ess  (Decisive (1)    3 3 2 2 2 4 3 3 3    (1) Indecisive)
n  (Documented (2)    2 1 1 2 3 3 3 2 3    (2) Not documente
  (Information (3)    3 3 2 2 3 3 3 3 3    (3) Not Informati
e  (Linguistic (4)    3 1 3 3 3 3 3 2 3    (4) Non Linguisti
(Not Methodolo (5)    3 3 3 2 3 3 3 3 3    (5) Methodology)
ural  (Process (6)    3 3 2 3 3 3 3 3 2    (6) Non Process)
 (Satisfactory (7)    3 4 3 3 3 3 3 3 3    (7) Unatisfactory
  (Showstopper (8)    1 5 3 4 2 1 2 4 3    (8) Non Showstopp
ty  (Technical (9)    2 2 3 2 3 3 3 3 1    (9) Not Technical
usly  (Timely (10)    2 4 2 5 3 3 3 3 3    (10) Untimely)
 Outcome (Bad (11)    1 5 5 5 2 2 4 3 4    (11) Good)
```

PRINCIPAL COMPONENT ANALYSIS

	RC1	RC2	RC3
Decisiveness (Decisive - Indecisive)	-0.03	**0.77**	-0.09
Documentation (Documented - Not documented)	**-0.73**	0.37	0.19
Informational (Information - Not Information)	-0.03	**0.93**	-0.13
Language (Linguistic - Non Linguistic)	**-0.92**	-0.34	-0.08
Methodological (Not Methodology - Methodology)	0.04	0.57	**-0.79**
Procedural (Process - Non Process)	-0.03	0.58	0.66
Satisfaction (Satisfactory - Unatisfactory)	**0.90**	0.26	0.08
Showstopping (Showstopper - Non Showstopper)	**0.84**	-0.33	0.26
Technicality (Technical - Not Technical)	-0.25	0.14	-0.08
Timeously (Timely - Untimely)	0.36	-0.16	**0.89**
Outcome (Bad - Good)	0.61	-0.63	0.13

	RC1	RC2	RC3
SS loadings	3.45	2.99	2.01
Proportion Var	0.31	0.27	0.18
Cumulative Var	0.31	0.59	**0.77**

PEARSON CORRELATION

	1	2	3	4	5	6	7	8	9	10	11
Decisivene - Indecisive	1		0.32	0.66	-0.18	0.44	0.24	0.12	-0.33	-0.03	-0.16	-0.39
Documentat - Not docume	2			0.49	0.57	0.10	0.15	-0.55	-0.60	0.02	-0.04	-0.49
Informatio - Not Inform	3				-0.27	0.66	0.36	0.19	-0.29	-0.04	-0.24	-0.58
Language - Non Lingui	4					-0.18	-0.27	**-0.88**	**-0.72**	0.08	-0.32	-0.31
Methodolog - Methodolog	5						-0.19	0.12	-0.33	0.23	**-0.76**	-0.39
Procedural - Non Proces	6							0.19	-0.09	0.35	0.37	-0.40
Satisfacti - Unatisfact	7								0.60	-0.23	0.36	0.39
Showstoppi - Non Showst	8									-0.26	0.60	**0.77**
Technicali - Not Techni	9										-0.27	-0.20
Timeously - Untimely)	10											0.50
Outcome (B - Good)	11											

RES 32

RATINGS:

```
                                6 - No power points for student
box size woefully inadequa - 5 | 7 - Problems with Oracle soft
 home cooperative nature - 4 | | | 8 - System has a lot of red
ision to go with Linux - 3 | | | | | 9 - System is a rule-enfo
         AV problems - 2 | | | | | | | 10 - System is non-intu
of a complex, work - 1 | | | | | | | | | 11 - System is often
                       | | | | | | | | | |
c  (Successful (1)    1 3 2 1 3 3 3 3 3 3 3   (1) Unsuccessful)
(Well-designed (2)    1 3 2 1 3 4 3 4 4 3 3   (2) Poorly-design
ion  (Succeeds (3)    2 3 1 2 3 3 3 3 3 3 3   (3) Fails)
y  (Functional (4)    1 3 1 2 3 3 3 3 3 3 4   (4) Dysfunctional
 (Facilitation (5)    1 3 1 2 3 3 3 3 3 3 3   (5) Obstruction)
rce  (Adequate (6)    1 3 1 1 5 3 3 3 3 3 4   (6) Inadequate)
ability  (High (7)    2 3 3 2 3 3 3 4 3 4 3   (7) Low)
  Outcome (Bad (8)    5 3 5 4 2 3 3 2 2 3 2   (8) Good)
```

PRINCIPAL COMPONENT ANALYSIS

	RC1	RC2	RC3
Academic (Successful - Unsuccessful)	0.52	**0.70**	0.43
Design (Well-designed - Poorly-designed)	0.56	**0.73**	0.20
Facilitation (Succeeds - Fails)	**0.90**	0.27	0.26
Functionality (Functional - Dysfunctional)	**0.83**	0.31	0.39
Platform (Facilitation - Obstruction)	**0.85**	0.40	0.30
Resource (Adequate - Inadequate)	0.57	0.30	**0.76**
Usability (High - Low)	0.18	**0.93**	0.15
Outcome (Bad - Good)	**-0.76**	-0.37	-0.46

	RC1	RC2	RC3
SS loadings	3.72	2.45	1.35
Proportion Var	0.46	0.31	0.17
Cumulative Var	0.46	0.77	0.94

PEARSON CORRELATION

	1	2	3	4	5	6	7	8
Academic - Unsuccessf	1	**0.91**	**0.76**	**0.82**	**0.85**	**0.83**	**0.77**	**-0.81**
Design (W - Poorly-des	2		**0.72**	**0.73**	**0.80**	0.69	**0.73**	**-0.80**
Facilitati - Fails)	3			**0.89**	0.94	**0.81**	0.47	**-0.87**
Functional - Dysfunctio	4				0.95	**0.84**	0.51	**-0.92**
Platform - Obstructio	5					**0.83**	0.58	**-0.92**
Resource - Inadequate	6						0.50	**-0.88**
Usability - Low)	7							-0.56
Outcome (B - Good)	8							

RES 34 - RES 38

RATINGS:

```
                New applicants not feeding thr - 8   9 - No documentation of operationa
             Most recent review resulted in - 7   |   |   10 - No test environment for operat
         Lack of lifecycle management o - 6   |   |   |   |   11 - Problems with monitoring the
d
     Introduction of automated deve - 5   |   |   |   |   |   |   12 - Silo'd teams in
distributed en
Electronic application process - 4   |   |   |   |   |   |   |   |   13 - Underlying
operational system
ndency on single person to - 3   |   |   |   |   |   |   |   |   |   14 - Value of testing
against s
n specification every  - 2   |   |   |   |   |   |   |   |   |   |   |   15 - Very
complete specific
ing to fresh start - 1   |   |   |   |   |   |   |   |   |   |   |   |   |   16 - Yearly
change in s
                     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
erations  (Dev (1)      1 1.8 2.8 0.2 0.6   1   3   3 0.8   2 0.8   3 0.6   3 0.8   2   (1)
Operating)
odology  (Big  (2)    0.2 1.4   3   3 0.4 0.8 0.6   3   3 0.6 0.8   3   3   3   3 1.4   (2)
Agile)
Control  (High (3)      3 1.4 0.8   3 0.4 1.4 0.4 3.4   3 1.8   3 0.6 4.4 0.6 0.6 0.6   (3)
Low)
ity  (Effectiv (4)      3   3 0.2   3 0.2 0.6 0.2   3 0.6 3.2   1 0.6 3.8 1.6 0.8   0   (4)
Ineffective (
ng  (Proactive (5)    0.6 0.6   3 0.6   3 0.2   3   3 0.8 1.2 0.8   3 0.8 0.2 1.2 0.8   (5)
Reactive)
ning  (Adequat (6)    0.6 0.6   1   3 0.4   3   3   1 0.8 2.6 1.8 1.2 2.8 0.4   3 1.8   (6)
Inadequate)
n  (Consistent (7)    0.2 1.4   1   3   3   3   3 1.6 1.4 2.4 3.6 1.6 3.2 0.6   1 0.8   (7) Ad
Hoc)
estable  (Very (8)    0.2 0.4 0.8 0.4 0.6 1.2 0.6   3 1.8 2.8 2.4 0.8 1.4 2.2 1.4 0.4   (8)
None)
ale  (Shorterm (9)    0.6 2.8 0.6 1.2 0.6 2.8   3   3   2 1.8 0.6 0.6 0.8 0.4 0.6 3.2   (9)
Longterm)
ue  (Valuable (10)    0.8   2   1   3 0.6 1.6 0.4   3 0.8   3 1.6 2.2   3   2 2.6 1.6   (10)
Not Valuable
 Outcome (Bad (11)      5   1   1   5   5   2   4   2   2   1   2   2   1   5   5   2   (11)
Good)
```

PRINCIPAL COMPONENT ANALYSIS

	RC1	RC2	RC3
Development / Operations (Developing - Operating)	-0.03	**0.83**	-0.38
Development Methodology (Big upfront design (Waterfall) - Agile)	0.52	0.09	-0.50
Level of Control (High - Low)	**0.70**	-0.37	0.22
Managing Complexity (Effective (can do) - Ineffective (cannot do))	**0.75**	-0.31	0.05
Monitoring (Proactive - Reactive)	-0.27	0.59	-0.14
Operational Planning (Adequate - Inadequate)	0.17	-0.09	**0.70**
Prioritization (Consistent - Ad Hoc)	0.06	-0.08	**0.80**
Testable (Very - None)	0.63	0.28	0.02
Timescale (Shorterm - Longterm)	-0.01	0.53	0.48
Value (Valuable - Not Valuable)	**0.85**	-0.03	0.06
Outcome (Bad - Good)	-0.41	-0.55	-0.28

	RC1	RC2	RC3
SS loadings	2.71	1.95	1.91
Proportion Var	0.25	0.18	0.17
Cumulative Var	0.25	0.42	**0.60**

PEARSON CORRELATION

	1	2	3	4	5	6	7	8	9	10	11
Developmen - Operating)	1		0.16	-0.44	-0.18	0.51	-0.27	-0.38	0.19	0.25	-0.04	-0.22
Developmen - Agile)	2			0.17	0.09	0.07	-0.03	-0.26	0.20	-0.23	0.47	-0.08
Level of C - Low)	3				0.69	-0.32	0.10	0.26	0.32	-0.04	0.38	-0.24
Managing C - Ineffectiv	4					-0.34	0.07	0.05	0.24	-0.03	0.65	-0.12

Monitoring - Reactive)	5	-0.17	0.08	-0.04	-0.01	-0.22	-0.05
Operationa - Inadequate	6		0.53	0.02	0.20	0.38	-0.03
Prioritiza - Ad Hoc)	7			0.13	0.06	0.11	-0.13
Testable - None)	8				0.00	0.44	-0.28
Timescale - Longterm)	9					-0.03	-0.36
Value (Va - Not Valuab	10						-0.21
Outcome (B - Good)	11						

Consolidated RepGrid results

RATINGS:

	Information Technology - 1	IT-IS - 2	Information System - 3	IS-BP - 4	Business Process - 5	6 - BP-BB	7 - Business Benefit	8 - BB-BS	9 - Business Strategy	10 - MAN	
MANAGEMENT CHALLENGE (Doable (1)	3	3.82	2.5	2.7	3.86	3	3	2	3	3.69	(1) Not doable)
MANAGEMENT CONTEXT (One thing (2)	3	4.33	3	5	3	3	3	3	2	4.5	(2) Another thing)
MANAGEMENT SCOPE (In scope (3)	3	3	5	4	4	3	3	3	3	4	(3) Out of scope)
MANAGEMENT SIGNIFICANCE (High (4)	3	3	1.8	3.33	4.5	3	3	4	5	3.7	(4) Low)
MANAGING CHANGE (Managed (5)	3	1.67	3	3	2.67	3	3	3	3	2.5	(5) Not managed)
PROCESS CHALLENGE (Low (6)	2.25	3.25	2.67	2.33	3.17	3	5	2	2.5	1.8	(6) High)
PROCESS CONTEXT (Good (7)	3	3.43	4	3.86	4	3	4.5	3	3	3.5	(7) Bad)
PROCESS CONTROL (In control (8)	1	3	3	1	5	3	3	3	3	3	(8) Out of control)
PROCESS METHOD (Traditional (9)	3	2.89	1	3.4	2.25	3	3	3	3.5	3.29	(9) Novel)
PROCESS NATURE (One thing (10)	3.2	3.5	3	3.5	2.67	3	3	4	3	4.3	(10) Another thing)
PROCESS PROGRESS (Forwards (11)	3.2	3.57	2.67	2.75	2	3	3	3	5	1.88	(11) Backwards)
PROCESS RESULT (Good (12)	1	3.75	1.5	2.73	2.75	3	3	3	2	3.14	(12) Bad)
PROCESS SCOPE (More controlle (13)	5	4.33	2.86	3.46	3.2	3	3.67	2	3	3.25	(13) Less controlled)
PROCESS TIMING (Short term (14)	2.5	3.33	4	3	3.11	3	3	3	3	2.75	(14) Long term)
PRODUCT BENEFITS (High (15)	2.73	3.2	3.17	3.87	2.88	3	4.67	3	3	3.23	(15) Low)
PRODUCT FUNCTIONALITY (High (16)	3.8	5	2.67	3.5	3.17	3	4.5	3	3	5	(16) Low)
PRODUCT NATURE (One thing (17)	4.4	3.2	3.5	3.45	2.67	3	3	3	3	2.2	(17) Another thing)
PRODUCT QUALITY (Good (18)	3.43	3.36	3.2	3.75	4	3	4.5	3	4.5	1	(18) Poor)
SERVICE NATURE (One thing (19)	4.5	3.47	2.8	2.25	4	3	5	2	3	4	(19) Another thing)
SERVICE OUTCOME (Effective (20)	3	3	3	2.67	4.33	3	3	3	3	3	(20) Not effective)
SERVICE QUALITY (High (21)	4.75	4.5	5	3.67	3.8	3	3	3	3	4.4	(21) Low)
AVERAGE SUCCESS IN IMBOK (High (22)	2.74	3.32	2.75	3.47	3.94	5	4.57	3.5	2.94	3.42	(22) Low)

PRINCIPAL COMPONENT ANALYSIS

	RC1	RC2	RC3
MANAGEMENT CHALLENGE (Doable - Not doable)	0.56	0.50	0.01
MANAGEMENT CONTEXT (One thing - Another thing)	-0.02	**0.83**	0.11
MANAGEMENT SCOPE (In scope - Out of scope)	-0.05	0.07	**0.85**
MANAGEMENT SIGNIFICANCE (High - Low)	0.15	-0.19	-0.64
MANAGING CHANGE (Managed - Not managed)	-0.29	**-0.67**	-0.04
PROCESS CHALLENGE (Low - High)	**0.77**	-0.24	0.03
PROCESS CONTEXT (Good - Bad)	**0.63**	0.02	0.52
PROCESS CONTROL (In control - Out of control)	**0.71**	-0.22	0.14

PROCESS METHOD (Traditional - Novel)	-0.06	0.27	**-0.92**
PROCESS NATURE (One thing - Another thing)	-0.34	**0.70**	-0.26
PROCESS PROGRESS (Forwards - Backwards)	-0.28	-0.42	-0.47
PROCESS RESULT (Good - Bad)	0.59	0.43	-0.35
PROCESS SCOPE (More controlled - Less controlled)	-0.04	0.41	0.04
PROCESS TIMING (Short term - Long term)	0.10	-0.26	**0.73**
PRODUCT BENEFITS (High - Low)	0.46	0.06	-0.05
PRODUCT FUNCTIONALITY (High - Low)	0.32	**0.84**	-0.19
PRODUCT NATURE (One thing - Another thing)	-0.59	-0.20	0.20
PRODUCT QUALITY (Good - Poor)	0.24	**-0.70**	-0.10
SERVICE NATURE (One thing - Another thing)	0.50	0.22	0.03
SERVICE OUTCOME (Effective - Not effective)	0.57	-0.22	0.22
SERVICE QUALITY (High - Low)	-0.31	0.50	**0.72**
AVERAGE SUCCESS IN IMBOK (High - Low)	**0.67**	-0.12	-0.32

	RC1	RC2	RC3
SS loadings	4.3	4.27	3.99
Proportion Var	0.2	0.19	0.18
Cumulative Var	0.2	0.39	0.57

PEARSON CORRELATION

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
MANAGEMENT - Not doable	1		0.27	-0.01	0.21	-0.69	0.21	0.17	0.40	0.11	-0.11	-0.20	0.35	0.49	-0.16	-0.09	0.60	-0.37	-0.14	0.58	0.50	0.28	0.13
MANAGEMENT - Another th	2			0.27	-0.26	-0.48	-0.20	0.23	-0.35	0.20	0.57	-0.48	0.47	0.24	-0.06	0.27	0.57	-0.12	-0.48	-0.11	-0.28	0.35	-0.02
MANAGEMENT - Out of sco	3				-0.35	0.09	-0.23	0.50	0.14	-0.69	-0.04	-0.55	-0.25	-0.24	0.61	-0.01	-0.24	-0.11	-0.27	-0.19	0.18	0.55	-0.31
MANAGEMENT - Low)	4					0.03	-0.21	-0.31	0.35	0.56	0.05	0.28	0.18	-0.27	-0.47	-0.24	-0.09	-0.45	0.18	-0.07	0.40	-0.54	0.02
MANAGING C - Not manage	5						-0.06	0.00	-0.25	-0.04	-0.26	0.04	-0.58	-0.36	-0.13	0.11	-0.68	0.25	0.26	-0.16	-0.13	-0.39	0.09
PROCESS CH - High)	6							0.64	0.30	-0.12	-0.56	0.06	0.26	0.21	0.18	0.68	0.23	-0.06	0.58	0.55	0.18	-0.30	**0.57**
PROCESS CO - Bad)	7								0.24	-0.40	-0.29	-0.45	0.15	0.04	0.40	0.73	0.20	-0.18	0.26	0.37	0.24	0.11	0.22
PROCESS CO - Out of con	8									-0.35	-0.27	-0.21	0.38	-0.45	0.34	-0.15	-0.10	-0.69	0.04	0.13	0.78	-0.20	0.34
PROCESS ME - Novel)	9										0.39	0.34	0.34	0.16	-0.81	0.16	0.38	-0.16	-0.01	0.04	-0.33	-0.52	0.20
PROCESS NA - Another th	10											-0.24	0.37	-0.17	-0.29	-0.02	0.46	-0.29	-0.76	-0.26	-0.45	0.11	-0.21
PROCESS PR - Backwards)	11												-0.20	0.09	-0.03	-0.08	-0.17	0.30	0.54	-0.18	-0.36	-0.33	-0.25
PROCESS RE - Bad)	12													-0.22	-0.01	0.32	0.49	-0.68	-0.21	-0.08	0.05	-0.37	**0.57**
PROCESS SC - Less contr	13														-0.34	0.05	0.55	0.56	0.13	0.64	-0.08	0.50	-0.20
PROCESS TI - Long term)	14															0.05	-0.33	-0.03	0.13	-0.35	0.05	0.28	-0.15
PRODUCT BE - Low)	15																0.37	-0.13	0.30	0.27	-0.31	-0.30	0.40
PRODUCT FU - Low)	16																	-0.22	-0.34	0.57	-0.17	0.26	0.06
PRODUCT NA - Another th	17																		0.36	0.01	-0.32	0.36	-0.43
PRODUCT QU - Poor)	18																			0.08	0.18	-0.39	0.08
SERVICE NA - Another th	19																				0.30	0.20	0.18
SERVICE OU - Not effect	20																					0.01	0.18
SERVICE QU - Low)	21																						**-0.63**
AVERAGE SU - Low)	22																						

Appendix 11 **An organisation of scales**

By inspection of the repertory grid data, the qualifying original scales (that featured adequately in the constructs, or in the correlations) were organised into new groups: first into the top level groups (Management, Process, Product and Service), and then into intermediate groups according to their nature, as indicated in the listing that follows.

The intermediate groups are used in a final set of tables for each respondent role, summarising counts, ratings and success for each of the intermediate scale groups, in each IMBOK domain. These are to be found in Appendix 1.

Scale groups

Top level group
Intermediate level group
Original scales allocated to the intermediate group

MANAGEMENT

- MANAGEMENT CHALLENGE (Doable : Not doable)
  - Ease (Simple : Complicated)
  - Feasibility (Feasible : Not fesible)
  - Novelty (Familiar : Novel)
  - Operational Planning (Adequate : Inadequate)
  - Planning (In plan : Off plan)
  - Urgency (Not urgent : Urgent)
  - Viablility (Doable : Not Doable)
- MANAGEMENT CONTEXT (One thing : Another thing)
  - Fund/Admin (Funding : Admin)
  - Nature (Research driven : Management driven)
  - People (In-house development : External non-development)
  - Sponsorship (Promoting : Unsupportive)
  - Visibility (Process : Product)
- MANAGEMENT SCOPE (In scope : Out of scope)
  - Productivity (Institutional productivity : Personal productivity)
  - Scope (In scope : Out of scope)
  - Scope (Internal : External)
- MANAGEMENT SIGNIFICANCE (High : Low) Continuity (High : Low)
  - Operational (Excellent : Poor)
  - Prioritization (Consistent : Ad Hoc)
  - Strategic (Very strategic : Not strategic)
- MANAGING CHANGE (Managed : Not managed)
  - Change (Take-up : No take-up)
  - Change (Tight : Loose)
  - Decisiveness (Decisive : Indecisive)

PROCESS

- PROCESS CHALLENGE (Low : High)
  - Capacity (Enough : Not enough)
  - Challenge (Unchallenging : Challenging)
  - Delivery (Easy : Difficult)

- Dependency (Independent : Dependant)
- Difficulty (Straightforward : Difficult)
- Managing Complexity (Effective (can do) : Ineffective (cannot do))
- Resource (Adequate : Inadequate)

PROCESS CONTEXT (Good : Bad)

- Cardinality (Oneness : Manyness)
- Champion (Good : Bad (Culture))
- Documentation (Documented : Not documented)
- Integration (Integrated : Standalone)
- Motivation (High : Low)
- Recognising (Recognising : Not recognising)
- User (Good : Poor)

PROCESS CONTROL (In control : Out of control)

- Control (In control : Out of control)
- Control (Liberating : Constraining)
- Predictability (Known : Unknown)

PROCESS METHOD (Traditional : Novel)

- Approach (Traditional : Agile/SCRUM)
- Development (Not challenging : Challenging)
- Development Methodology (Big upfront design (Waterfall) : Agile)
- Lifecycle (Determining Requirements : Implementation of Requirements)
- Methodological (Methodology : Not Methodology)
- Methodology (Structure : Chaos)

PROCESS NATURE (One thing : Another thing)

- Access (Secure : Insecure)
- Anxiety (Anxiety creating : Anxiety easing)
- Data (Storage : Movement)
- Domain (Investigation : Research)
- Engineering (Constructive : Destructive)
- Intellectual (IP critical : Not IP critical)
- Language (Linguistic : Non Linguistic)
- Processing (Processing information : Moving information)
- Retro/Pro (Prospective : Retrospective)
- Sep/Int (Integrated : Separated)
- Strat/Ops (Operational : Strategic)

PROCESS PROGRESS (Forwards : Backwards)

- Progress (Forwards : Backwards)
- Progress (Operational : Strategic)
- Progress (Progressive : Regressive)
- Progression (Progressive : Non-progressive)

PROCESS RESULT (Good : Bad)

- Expense (Cheap : Expensive)
- Output (Deliverables : Support)
- Satisfaction (Satisfactory : Unatisfactory)
- Showstopping (Showstopper : Non Showstopper)
- Success (Usable : Not usable)
- Value (Received : Given)
- Value (Valuable : Not Valuable)

PROCESS SCOPE (More controlled : Less controlled)

Boundary (In institution : Out of institution)
Boundary (Internal : External)
Connectedness (Connected : Disconnected)
Discretion (Within my discretion : Outside my discretion)
Externalisation (Contained, internal : Not contained, external)
Input-Output (Input : Output)
Int/ext (Internal : External)
Out/in (In office : Out of office)
Process (In process : Out of process)
Process (Supports whole lifecycle : Supports only one section of lifecycle)
Reach (Inreach : Outreach)
Resource (Not dependent : Dependent)
Responsibility (My action : Someone else's action)
Responsibility (Received responsibility : Given responsibility)
Specificity (One project : All projects)
Stage (Design stage : Client operations)

PROCESS TIMING (Short term : Long term)
Timeliness (Instantaneous : Delayed)
Timeliness (Timely : Slow)
Timeously (Timely : Untimely)

PRODUCT

PRODUCT BENEFITS (High : Low)
Advantage (Helps : Hinders)
Enablement (Enabling : Disabling)
Facilitation (Succeeds : Fails)
Flexbility (Flexible : Inflexible)
Guidance (Clear : Unclear)
Imp/Use (Implementation : Using)
Satisfaction (Satisfied : Not satisfied)

PRODUCT FUNCTIONALITY (High : Low)
Functionality (Functional : Dysfunctional)
Functionality (Functional : Non-functional)
Functionality (Meets requirements : Does not meet requirements)
Functionality (Works : Does not work)
Platform (Facilitation : Obstruction)

PRODUCT NATURE (One thing : Another thing)
Academic (Academic : Non-academic)
Bespoke (Proprietary : Completely bespoke)
Informational (Information : Not Information)
Modularised (Integrated : Standalone)
Requirements (Fixed : Changing)
Tech/not (Technical : Non-technical)
Technicality (Technical : Human)
Technicality (Technical : Non technical)
Technicality (Technical : Not Technical)

PRODUCT QUALITY (Good : Poor)
Design (Well-designed : Poorly-designed)
Reliability (Reliable : Unreliable)
Requirements (Clearly Defined : Uncertain)

Space (Good use : Bad use)
Usability (High : Low)

SERVICE

SERVICE NATURE (One thing : Another thing)
Academic (Successful : Unsuccessful)
Automation (Automated : Human)
Criticality (Not critical : Critical)
Give/take (Giving : Taking)
Interfacing (Technical : Practical)
Learning (Simple : Complicated)
Multiplicity (Once : Many times)
Need (Familiar therefore low : Novel therefore high)
Repeatability (Repeatable : One off)
Security (Applies : Does not apply)
SERVICE OUTCOME (Effective : Not effective)
Consequentiality (Consequence : NO consequence)
Cost (Low : High)
Outcome
SERVICE QUALITY (High : Low)
Engagement (Listening : Not listening)
Information (Good : Bad)
Reliability (Reliable : Unreliable)
Support (Good : Bad)
Support (High : Low)
Support (Online support : No support)

Appendix 12 **Results from triadic analysis by role**

Summary of Scale Groups mapped to Events according to the IMBOK

The tables that follow provide a detailed analysis of all the triadic data, mapped to the ten domains of the IMBOK, and detailing:

The total count of ratings in each case
The average rating in each case
The average success outcome in each case

These statistics are given under the main scale groups derived from the RepGrid analysis:

MANAGEMENT CHALLENGE (Doable : Not doable)
MANAGEMENT CONTEXT (One thing : Another thing)
MANAGEMENT SCOPE (In scope : Out of scope)
MANAGEMENT SIGNIFICANCE (High : Low)
MANAGING CHANGE (Managed : Not managed)
PROCESS CHALLENGE (Low : High)
PROCESS CONTEXT (Good : Bad)
PROCESS CONTROL (In control : Out of control)
PROCESS METHOD (Traditional : Novel)
PROCESS NATURE (One thing : Another thing)
PROCESS PROGRESS (Forwards : Backwards)
PROCESS RESULT (Good : Bad)
PROCESS SCOPE (More controlled : Less controlled)
PROCESS TIMING (Short term : Long term)
PRODUCT BENEFITS (High : Low)
PRODUCT FUNCTIONALITY (High : Low)
PRODUCT NATURE (One thing : Another thing)
PRODUCT QUALITY (Good : Poor)
SERVICE NATURE (One thing : Another thing)
SERVICE OUTCOME (Effective : Not effective)
SERVICE QUALITY (High : Low)

There are given first for all roles, and then for each of the roles in turn. This tabulation shows visually the limited viewpoints of respondents according to the different roles that they indicated they fulfilled in their work. Sometimes these roles were quite different according to the project that they were working on, or the system they were using.

The gaps in visualisation, between the generally familiar level of Information technology (IT) and Information Systems (IS), and the more strategic issues of benefits and benefits realisation, are quite stark. There are more detailed comments in the body of the thesis, in Section **Error! Reference source not found.**, '**Error! Reference source not found.**'.

All respondents

	IMBOK Domain																														
	IT			IT-IS			IS			IS-BP			BP			BP-BB			BB			BB-BS			BS			MAN			Grand Total		
Scale group	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success
MANAGEMENT CHALLENGE (Doable : Not doable)				20	3.82	3.27	9	2.50	2.25	14	2.70	3.40	7	3.86	4.29	1	3.00	5.00				2	2.00	3.50	2	3.00	2.50	16	3.69	3.31	71	3.28	3.30
MANAGEMENT CONTEXT (One thing : Another thing)				3	4.33	5.00				4	5.00	4.50													1	2.00	1.00	3	4.50	4.50	11	4.25	4.25
MANAGEMENT SCOPE (In scope : Out of scope)							1	5.00	5.00	3	4.00	3.50	1	4.00	3.00													5	4.00	2.80	10	4.11	3.22
MANAGEMENT SIGNIFICANCE (High : Low)				7	3.00	3.29	7	1.80	1.20	11	3.33	3.33	2	4.50	4.00							1	4.00	5.00	1	5.00	4.00	13	3.70	3.90	42	3.29	3.29
MANAGING CHANGE (Managed : Not managed)				3	1.67	2.33				2	3.00	4.00	4	2.67	3.33													2	2.50	3.00	11	2.40	3.10
PROCESS CHALLENGE (Low : High)	8	2.25	2.75	16	3.25	3.42	8	2.67	1.83	6	2.33	3.50	6	3.17	4.17				1	5.00	4.00	1	2.00	2.00	2	2.50	1.50	5	1.80	2.80	53	2.70	3.04
PROCESS CONTEXT (Good : Bad)				13	3.43	3.14	1	4.00	3.00	8	3.86	3.43	4	4.00	4.33				2	4.50	5.00							6	3.50	4.00	34	3.73	3.69
PROCESS CONTROL (In control : Out of control)	5	1.00	1.50				2	3.00	2.50	2	1.00	2.00	1	5.00	4.00																10	2.33	2.33
PROCESS METHOD (Traditional : Novel)				23	2.89	3.47	1	1.00	2.00	12	3.40	3.10	4	1.75	4.25										4	3.50	2.50	7	3.29	3.57	51	2.98	3.36
PROCESS NATURE (One thing : Another thing)	5	3.20	3.00	2	3.50	2.00	1	3.00	1.00	8	3.50	3.50	5	2.67	3.67							1	4.00	2.00				10	4.30	3.40	32	3.63	3.17
PROCESS PROGRESS (Forwards : Backwards)	5	3.20	3.20	16	3.57	2.93	3	2.67	1.67	4	2.75	3.50	5	2.00	3.25										1	5.00	5.00	8	1.88	3.13	42	2.90	3.05
PROCESS RESULT (Good : Bad)	5	2.80	2.80	12	3.60	3.70	3	2.67	1.67	15	2.79	3.07	8	2.83	4.17										2	2.00	2.00	12	3.00	3.09	57	2.96	3.18
PROCESS SCOPE (More controlled : Less controlled)	1	1.00	2.00	3	4.33	3.67	7	2.00	4.40	20	3.36	3.64	14	2.64	3.64				4	3.67	5.00	1	2.00	5.00	1	3.00	4.00	10	3.25	3.50	61	3.02	3.79
PROCESS TIMING (Short term : Long term)	3	1.00	1.50	1	4.00	1.00	3	3.67	3.33	2	3.00	3.50	11	3.14	4.29																20	3.00	3.40
PRODUCT BENEFITS (High : Low)	16	3.45	2.64	5	2.40	3.40	8	3.17	3.50	16	3.20	3.40	13	3.63	4.00				4	4.67	4.67							14	2.75	3.42	76	3.22	3.42
PRODUCT FUNCTIONALITY (High : Low)	7	3.80	3.20	1	5.00	3.00	7	2.67	3.50	4	3.50	3.25	8	3.17	3.33				3	4.50	4.50							1	5.00	4.00	31	3.48	3.44
PRODUCT NATURE (One thing : Another thing)	5	4.40	2.60	10	3.20	3.10	4	3.50	2.50	12	3.45	3.82	9	2.67	4.00													13	2.20	3.70	53	3.13	3.41
PRODUCT QUALITY (Good : Poor)	8	3.43	2.86	13	3.36	3.45	7	3.20	2.60	5	3.75	4.00	4	4.00	4.75				2	4.50	4.00				2	4.50	5.00	1	1.00	0.00	42	3.53	3.44
SERVICE NATURE (One thing : Another thing)	2	4.50	3.50	25	3.47	3.32	5	2.80	3.00	4	2.25	4.50	11	4.00	3.89				1	5.00	4.00	1	2.00	2.00				3	4.00	2.00	52	3.47	3.44
SERVICE OUTCOME (Effective : Not effective)										3	2.67	3.33	3	4.33	4.00															6	3.50	3.67
SERVICE QUALITY (High : Low)	4	4.75	2.50	5	4.50	3.75	1	5.00	5.00	4	3.67	3.33	5	3.80	3.80							1	3.00	5.00	1	3.00	4.00	5	4.40	4.40	26	4.17	3.75
Grand Total	74	3.23	2.74	178	3.37	3.32	78	2.80	2.70	159	3.19	3.47	125	3.26	3.94	1	3.00	5.00	17	4.43	4.57	8	2.63	3.50	17	3.29	2.94	134	3.22	3.42	791	3.23	3.37

Figure 1 All roles

Senior manager

	IMBOK Domain																														
	IT			IT-IS			IS			IS-BP			BP			BP-BB			BB			BB-BS			BS			MAN			Grand Total		
Scale group	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success
MANAGEMENT CHALLENGE (Doable : Not doable)				4	2.33	2.33	2	1.00	2.50	1	1.00	3.00	2	3.50	4.00							1	1.00	2.00	1	4.00	1.00	6	3.20	3.20	17	2.53	2.80
MANAGEMENT CONTEXT (One thing : Another thing)																									1	2.00	1.00				1	2.00	1.00
MANAGEMENT SCOPE (In scope : Out of scope)																																	
MANAGEMENT SIGNIFICANCE (High : Low)				3	2.00	1.00	1	1.00	1.00																			7	2.75	2.75	11	2.25	1.88
MANAGING CHANGE (Managed : Not managed)				2	1.50	2.50							1	2.00	3.00																3	1.67	2.67
PROCESS CHALLENGE (Low : High)				5	3.67	2.33	2	4.50	2.50				3	3.00	4.00							1	2.00	2.00	2	2.50	1.50	2	2.00	2.00	15	3.08	2.54
PROCESS CONTEXT (Good : Bad)				8	2.67	3.00							1	3.00	3.00																9	2.75	3.00
PROCESS CONTROL (In control : Out of control)																																	
PROCESS METHOD (Traditional : Novel)				5	2.80	3.00																			3	3.00	1.67	2	3.50	3.50	10	3.00	2.70
PROCESS NATURE (One thing : Another thing)										1	1.00	3.00	2	2.50	4.00							1	4.00	2.00				4	4.00	4.50	8	3.25	3.88
PROCESS PROGRESS (Forwards : Backwards)										1	1.00	3.00																3	2.00	4.67	4	1.75	4.25
PROCESS RESULT (Good : Bad)				2	4.50	5.00	1	1.00	1.00	1	3.00	4.00													2	2.00	2.00	7	3.00	3.00	13	2.92	3.08
PROCESS SCOPE (More controlled : Less controlled)																																	
PROCESS TIMING (Short term : Long term)																																	
PRODUCT BENEFITS (High : Low)																																	
PRODUCT FUNCTIONALITY (High : Low)																																	
PRODUCT NATURE (One thing : Another thing)				3	2.00	3.00																									3	2.00	3.00
PRODUCT QUALITY (Good : Poor)																																	
SERVICE NATURE (One thing : Another thing)										1	1.00	3.00	2	2.00	3.50							1	2.00	2.00							4	1.75	3.00
SERVICE OUTCOME (Effective : Not effective)										1	5.00	3.00	3	4.33	4.00																4	4.50	3.75
SERVICE QUALITY (High : Low)				2	4.50	4.00																						1	5.00	4.00	3	4.67	4.00
Grand Total				34	2.81	2.81	6	2.17	2.00	6	2.00	3.17	14	3.07	3.79							4	2.25	2.00	9	2.67	1.56	32	3.07	3.41	105	2.79	2.95

Figure 2 Senior managers

Operational manager																														
	IMBOK Domain																													
	IT			IT-IS			IS			IS-BP			BP			BP-BB			BB			BB-BS			BS			MAN			Grand Total		
Scale group	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success
MANAGEMENT CHALLENGE (Doable : Not doable)													2	3.50	4.00										1	2.00	4.00	5	3.25	2.50	8	3.14	3.14
MANAGEMENT CONTEXT (One thing : Another thing)																																	
MANAGEMENT SCOPE (In scope : Out of scope)													1	4.00	3.00													2	4.00	1.50	3	4.00	2.00
MANAGEMENT SIGNIFICANCE (High : Low)													2	4.50	4.00										1	5.00	4.00	1	5.00	4.00	4	4.75	4.00
MANAGING CHANGE (Managed : Not managed)																																	
PROCESS CHALLENGE (Low : High)																																	
PROCESS CONTEXT (Good : Bad)																																	
PROCESS CONTROL (In control : Out of control)																																	
PROCESS METHOD (Traditional : Novel)																												1	2.00	0.00	1	2.00	0.00
PROCESS NATURE (One thing : Another thing)																																	
PROCESS PROGRESS (Forwards : Backwards)																												1	1.00	0.00	1	1.00	0.00
PROCESS RESULT (Good : Bad)																																	
PROCESS SCOPE (More controlled : Less controlled)													3	3.33	3.67										1	3.00	4.00	4	3.50	2.75	8	3.38	3.25
PROCESS TIMING (Short term : Long term)																																	
PRODUCT BENEFITS (High : Low)													1	2.00	3.00													3	2.67	2.33	4	2.50	2.50
PRODUCT FUNCTIONALITY (High : Low)																																	
PRODUCT NATURE (One thing : Another thing)													1	3.00	3.00													2	1.50	3.00	3	2.00	3.00
PRODUCT QUALITY (Good : Poor)																												1	1.00	0.00	1	1.00	0.00
SERVICE NATURE (One thing : Another thing)																												2	3.00	0.00	2	3.00	0.00
SERVICE OUTCOME (Effective : Not effective)																																	
SERVICE QUALITY (High : Low)													2	3.00	4.00										1	3.00	4.00	1	4.00	4.00	4	3.25	4.00
Grand Total													12	3.42	3.67										4	3.25	4.00	23	2.95	2.14	39	3.14	2.84

Figure 3 Operational management

Champion																																	
	IMBOK Domain																																
	IT			IT-IS			IS			IS-BP			BP			BP-BB			BB			BB-BS			BS			MAN			Grand Total		
Scale group	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success
MANAGEMENT CHALLENGE (Doable : Not doable)																1	3.00	5.00				1	3.00	5.00							2	3.00	5.00
MANAGEMENT CONTEXT (One thing : Another thing)																																	
MANAGEMENT SCOPE (In scope : Out of scope)																																	
MANAGEMENT SIGNIFICANCE (High : Low)																						1	4.00	5.00				1	5.00	5.00	2	4.50	5.00
MANAGING CHANGE (Managed : Not managed)																																	
PROCESS CHALLENGE (Low : High)	1	5.00	5.00																												1	5.00	5.00
PROCESS CONTEXT (Good : Bad)																			1	5.00	5.00							1	2.00	2.00	2	3.50	3.50
PROCESS CONTROL (In control : Out of control)																																	
PROCESS METHOD (Traditional : Novel)																									1	5.00	5.00				1	5.00	5.00
PROCESS NATURE (One thing : Another thing)																																	
PROCESS PROGRESS (Forwards : Backwards)																									1	5.00	5.00				1	5.00	5.00
PROCESS RESULT (Good : Bad)																																	
PROCESS SCOPE (More controlled : Less controlled)				1	5.00	5.00													1	5.00	5.00	1	2.00	5.00							3	4.00	5.00
PROCESS TIMING (Short term : Long term)																																	
PRODUCT BENEFITS (High : Low)	1	5.00	5.00	1	4.00	5.00													1	5.00	5.00										3	4.67	5.00
PRODUCT FUNCTIONALITY (High : Low)	2	5.00	5.00																												2	5.00	5.00
PRODUCT NATURE (One thing : Another thing)																																	
PRODUCT QUALITY (Good : Poor)	1	4.00	5.00																						2	4.50	5.00				3	4.33	5.00
SERVICE NATURE (One thing : Another thing)	1	4.00	5.00																												1	4.00	5.00
SERVICE OUTCOME (Effective : Not effective)																																	
SERVICE QUALITY (High : Low)																						1	3.00	5.00							1	3.00	5.00
Grand Total	6	4.60	5.00	2	4.50	5.00										1	3.00	5.00	3	5.00	5.00	4	3.00	5.00	4	4.75	5.00	2	3.50	3.50	22	4.19	4.86

Figure 4 Champions

Project manager

	IMBOK Domain																														
	IT			IT-IS			IS			IS-BP			BP			BP-BB			BB			BB-BS			BS			MAN			Grand Total		
Scale group	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success
MANAGEMENT CHALLENGE (Doable : Not doable)				1	5.00	5.00	1	1.00	2.00	11	3.29	3.43	2	4.50	5.00													1	5.00	5.00	16	3.58	3.83
MANAGEMENT CONTEXT (One thing : Another thing)				2	4.50	5.00				4	5.00	4.50																3	4.50	4.50	9	4.67	4.67
MANAGEMENT SCOPE (In scope : Out of scope)										2	5.00	5.00																			2	5.00	5.00
MANAGEMENT SIGNIFICANCE (High : Low)				3	4.00	5.00	2	2.00	2.00	9	3.29	2.86																3	4.33	4.67	17	3.57	3.64
MANAGING CHANGE (Managed : Not managed)																												1	1.00	4.00	1	1.00	4.00
PROCESS CHALLENGE (Low : High)										3	1.67	2.33																3	1.67	3.33	6	1.67	2.83
PROCESS CONTEXT (Good : Bad)				2	4.00	5.00				4	4.67	3.67																3	4.67	4.67	9	4.50	4.38
PROCESS CONTROL (In control : Out of control)																																	
PROCESS METHOD (Traditional : Novel)				4	4.00	4.67				10	3.13	2.75	2	1.50	5.00													4	3.50	4.50	20	3.18	3.76
PROCESS NATURE (One thing : Another thing)										1	5.00	3.00																3	4.67	3.33	4	4.75	3.25
PROCESS PROGRESS (Forwards : Backwards)										1	2.00	3.00	1	4.00	5.00													3	2.00	3.33	5	2.40	3.60
PROCESS RESULT (Good : Bad)	1	1.00	3.00	1	2.00	4.00				7	2.14	1.71																3	2.00	3.33	12	2.00	2.42
PROCESS SCOPE (More controlled : Less controlled)				1	5.00	4.00				4	3.75	4.00																1	2.00	5.00	6	3.67	4.17
PROCESS TIMING (Short term : Long term)																																	
PRODUCT BENEFITS (High : Low)										5	3.80	3.80																5	2.40	3.80	10	3.10	3.80
PRODUCT FUNCTIONALITY (High : Low)																																	
PRODUCT NATURE (One thing : Another thing)				3	4.00	5.00				5	3.00	4.25																8	2.67	4.00	16	3.08	4.31
PRODUCT QUALITY (Good : Poor)										2	5.00	5.00	1	5.00	5.00																3	5.00	5.00
SERVICE NATURE (One thing : Another thing)				1	3.00	4.00				3	2.67	5.00	4	4.00	5.00																8	3.29	4.86
SERVICE OUTCOME (Effective : Not effective)										1	1.00	2.00																			1	1.00	2.00
SERVICE QUALITY (High : Low)				2	5.00	5.00				2	5.00	5.00																2	4.00	4.50	6	4.50	4.75
Grand Total	1	1.00	3.00	20	4.06	4.78	3	1.50	2.00	74	3.25	3.31	10	3.67	5.00													43	3.13	4.03	151	3.31	3.83

Figure 5 Project managers

Technical roles

	IMBOK Domain																														
	IT			IT-IS			IS			IS-BP			BP			BP-BB			BB			BB-BS			BS			MAN			Grand Total		
Scale group	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success
MANAGEMENT CHALLENGE (Doable : Not doable)				15	4.29	3.43	5	3.00	1.50	1	2.00	5.00	1	4.00	4.00													1	5.00	5.00	23	3.79	3.14
MANAGEMENT CONTEXT (One thing : Another thing)				1	4.00	5.00																									1	4.00	5.00
MANAGEMENT SCOPE (In scope : Out of scope)																																	
MANAGEMENT SIGNIFICANCE (High : Low)				1	3.00	5.00	4	2.00	1.00	2	3.50	5.00																1	3.00	5.00	8	2.71	3.29
MANAGING CHANGE (Managed : Not managed)				1	2.00	2.00				2	3.00	4.00	1	2.00	2.00													1	4.00	2.00	5	2.80	2.80
PROCESS CHALLENGE (Low : High)	5	2.00	2.80	9	3.29	4.00	4	1.50	1.00	3	3.00	4.67	3	3.33	4.33				1	5.00	4.00										25	2.86	3.57
PROCESS CONTEXT (Good : Bad)				3	4.00	1.50				1	4.00	4.00																			4	4.00	2.33
PROCESS CONTROL (In control : Out of control)																																	
PROCESS METHOD (Traditional : Novel)				14	2.64	3.36	1	1.00	2.00	2	4.50	4.50	1	2.00	2.00																18	2.73	3.33
PROCESS NATURE (One thing : Another thing)	5	3.20	3.00	2	3.50	2.00	1	3.00	1.00	3	4.33	4.00																			11	3.55	2.91
PROCESS PROGRESS (Forwards : Backwards)	5	3.20	3.20	12	3.30	2.90	2	3.00	1.50	2	4.00	4.00	4	1.33	2.67																25	3.05	2.91
PROCESS RESULT (Good : Bad)	4	3.25	2.75	9	3.57	3.29	1	5.00	1.00	7	3.50	4.50	3	3.67	3.33													1	4.00	2.00	25	3.59	3.36
PROCESS SCOPE (More controlled : Less controlled)				1	3.00	2.00							3	2.67	3.33																4	2.75	3.00
PROCESS TIMING (Short term : Long term)				1	4.00	1.00																									1	4.00	1.00
PRODUCT BENEFITS (High : Low)	6	3.40	2.60	3	2.00	3.33				2	1.50	4.00	3	4.00	4.33				1	4.00	4.00										15	3.00	3.43
PRODUCT FUNCTIONALITY (High : Low)	1	2.00	2.00	1	5.00	3.00	1	2.00	2.00				2	5.00	5.00				2	4.00	4.00										7	3.60	3.20
PRODUCT NATURE (One thing : Another thing)	4	5.00	2.75	4	3.50	1.75	2	3.00	1.50	2	4.50	4.00	2	2.50	4.00																14	3.86	2.64
PRODUCT QUALITY (Good : Poor)	1	1.00	2.00	11	3.56	3.78	2	4.50	2.00	1	5.00	5.00	2	4.50	5.00				2	4.50	4.00										19	3.82	3.71
SERVICE NATURE (One thing : Another thing)				21	3.47	3.07	1	5.00	2.00				2	5.00	3.50				1	5.00	4.00										25	3.79	3.11
SERVICE OUTCOME (Effective : Not effective)										1	2.00	5.00																			1	2.00	5.00
SERVICE QUALITY (High : Low)	1	5.00	2.00	1	4.00	2.00							1	4.00	4.00													1	5.00	5.00	4	4.50	3.25
Grand Total	32	3.23	2.77	110	3.38	3.15	24	2.90	1.45	29	3.50	4.39	28	3.31	3.69				7	4.50	4.00							5	4.20	3.80	235	3.37	3.21

Figure 6 Technical roles

Users

	IMBOK Domain																														
	IT			IT-IS			IS			IS-BP			BP			BP-BB			BB			BB-BS			BS			MAN			Grand Total		
Scale group	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success
MANAGEMENT CHALLENGE (Doable : Not doable)							1	5.00	5.00	1	1.00	2.00																3	4.50	3.50	5	3.75	3.50
MANAGEMENT CONTEXT (One thing : Another thing)																																	
MANAGEMENT SCOPE (In scope : Out of scope)							1	5.00	5.00	1	3.00	2.00																3	4.00	3.67	5	4.00	3.60
MANAGEMENT SIGNIFICANCE (High : Low)																																	
MANAGING CHANGE (Managed : Not managed)													2	4.00	5.00																2	4.00	5.00
PROCESS CHALLENGE (Low : High)	2	1.50	1.50	2	2.50	3.00	2	2.00	2.00																						6	2.00	2.17
PROCESS CONTEXT (Good : Bad)							1	4.00	3.00	3	3.00	3.00	3	4.50	5.00				1	4.00	5.00							2	2.50	4.00	10	3.44	3.89
PROCESS CONTROL (In control : Out of control)	5	1.00	1.50				2	3.00	2.50	2	1.00	2.00	1	5.00	4.00																10	2.33	2.33
PROCESS METHOD (Traditional : Novel)													1	2.00	5.00															1	2.00	5.00
PROCESS NATURE (One thing : Another thing)										3	3.00	3.33	3	3.00	3.00													3	4.33	2.00	9	3.57	2.71
PROCESS PROGRESS (Forwards : Backwards)				4	4.25	3.00	1	2.00	2.00																			1	2.00	1.00	6	3.50	2.50
PROCESS RESULT (Good : Bad)							1	2.00	3.00				5	2.00	5.00													1	5.00	4.00	7	2.60	4.40
PROCESS SCOPE (More controlled : Less controlled)	1	1.00	2.00				7	2.00	4.40	16	3.20	3.50	8	2.20	3.80				3	3.00	5.00							5	3.33	4.00	40	2.69	3.85
PROCESS TIMING (Short term : Long term)	3	1.00	1.50				3	3.67	3.33	2	3.00	3.50	11	3.14	4.29																19	2.93	3.57
PRODUCT BENEFITS (High : Low)	9	3.20	2.20	1	2.00	2.00	8	3.17	3.50	9	3.25	3.00	9	3.75	4.00				2	5.00	5.00							6	3.25	3.75	44	3.31	3.24
PRODUCT FUNCTIONALITY (High : Low)	4	4.00	3.00				6	2.80	3.80	4	3.50	3.25	6	2.80	3.00				1	5.00	5.00							1	5.00	4.00	22	3.37	3.42
PRODUCT NATURE (One thing : Another thing)	1	2.00	2.00				2	4.00	3.50	5	3.40	3.40	6	2.67	4.33													3	1.50	3.50	17	2.92	3.54
PRODUCT QUALITY (Good : Poor)	6	3.80	2.60	2	2.50	2.00	5	2.33	3.00	2	2.50	3.00	1	2.00	4.00																16	2.92	2.77
SERVICE NATURE (One thing : Another thing)	1	5.00	2.00	3	3.67	4.33	4	2.25	3.25				3	5.00	3.00													1	5.00	4.00	12	3.64	3.45
SERVICE OUTCOME (Effective : Not effective)																																	
SERVICE QUALITY (High : Low)	3	4.67	2.67				1	5.00	5.00	2	3.00	2.50	2	4.50	3.50																8	4.25	3.13
Grand Total	35	3.04	2.24	12	3.33	3.08	45	2.92	3.50	50	3.07	3.14	61	3.16	4.00				7	4.00	5.00							29	3.57	3.43	239	3.16	3.36

Figure 7 Users

By Principal Component Analysis
(for Reference Model)

	IMBOK Domain																														
	IT			IT-IS			IS			IS-BP			BP			BP-BB			BB			BB-BS			BS			MAN			Grand Total		
Scale group	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success	Count	Rating	Success
!Capability	26	2.83	2.61	79	3.36	3.44	36	2.79	2.58	62	3.09	3.41	39	3.35	3.87	1	3.00	5.00	6	3.50	4.75	1	3.00	5.00	8	3.00	2.14	55	3.21	3.18	**313**	**3.15**	**3.26**
!Means	12	3.25	2.58	29	3.67	3.86	10	2.89	3.44	37	3.88	3.88	7	4.20	3.80				5	3.67	4.67				2	4.50	5.00	22	3.07	3.53	**124**	**3.51**	**3.63**
!Need				13	3.70	3.20	1	5.00	2.00	1	4.00	4.00	11	3.00	3.70							3	3.33	3.00	2	5.00	4.50	7	3.57	3.43	**38**	**3.56**	**3.44**
!Outcome	26	3.50	2.61	22	3.50	2.63	19	2.79	2.64	25	3.18	3.47	46	3.15	3.88				4	4.67	4.33	2	2.50	3.50	1	3.00	4.00	21	3.38	3.69	**166**	**3.27**	**3.27**
!Service transaction	2	1.00	4.00	30	2.94	2.83	17	2.20	2.20	27	3.41	3.59	16	2.79	4.07	1	5.00	5.00	1	5.00	5.00	2	3.00	3.50	3	3.33	3.33	26	3.22	3.22	**125**	**3.02**	**3.29**
Grand Total	**66**	**3.14**	**2.63**	**173**	**3.40**	**3.27**	**83**	**2.74**	**2.66**	**152**	**3.34**	**3.55**	**119**	**3.19**	**3.88**	**2**	**4.00**	**5.00**	**16**	**4.00**	**4.64**	**8**	**3.00**	**3.50**	**16**	**3.53**	**3.20**	**131**	**3.25**	**3.37**	**766**	**3.25**	**3.34**

Figure 8 By Principal Component Analysis

Appendix 13 **A summary of four representative standards**

Analysis of availability and applicability	ISO/IEC 12207 'Systems and software engineering — Software life cycle processes'	COBIT: 'Control Objectives for Information and related Technology')	ITIL: 'IT Infrastructure Library'
This table summarises the characteristics of the three chosen 'standards' and then maps some of their properties to the standardisation requirements (as seen through the higher-level scale groups from the previous chapter).	A very hierarchical treatment with a strong focus on process, little on product, and few actual guidelines. Good detail to pick from at the bottom level. Notes the need for agreement about supply of basic IT requirements and managing the infrastructure Useful attention to the needs of project, information, risk, and quality management Makes clear the need for assessment and control of projects Considerable attention to the hierarchy of processes, activities and tasks Separates out the system and software lifecycles – fulsome details about each, including implementation, testing, maintenance, support and disposal Adds in the possibility of re-use Tantalising reference to 'portfolio management' Some reference to managing the (technical) people Recognises and advises on the need for tailoring	A multi-faceted view with rich detail and good explanations. But challenging so that time would be needed to adopt and adapt. Soundly grounded in the needs of stakeholders Argues for a 'cascade' of goals from stakeholders down to the enterprise, down to IT, down to 'enablers' Aims for complete coverage of the organisation Aims for a singular approach Separates out governance and management High-level view of roles, activities and relationships Claims a knowledge base (members only?) to integrate other standards and guidelines Offers a 'family' of COBIT products: Enabler guides (e.g. enabling processes and information) and Professional guides (eg implementation, security, assurance and risk) 'Enablers' have dimensions as a foundation for measurement	A mature approach based firmly on service management. Seems to have suffered from some fragmentation as a result of multiple authorities. Promotes a cycle of service strategy, design, transition, operation and maintenance A focus on ownership, management and measurement Multiple processes are defined, moving on to functions and roles Interesting processes include management of availability, capacity, continuity, change, incidents, security Includes a service portfolio view, and relationship management Supported by software tools Recognises the need for design co-ordination Identifies the components of service: catalogue, service desk, evaluation measurement, portfolio and reporting Includes supplier management and technology considerations Difficult drift has been observed in the different ITIL published volumes, the different sources of expertise that have contributed, and over time
PROCESS			
Lifecycle	ISO/IEC 12207 provides an encyclopaedic overview of lifecycle activities, at the system and software levels. There is no particular explanation or interpretation of different methods, however, and there are now 'how-to' details to help with implementation.	The COBIT process reference model is organised according to 'Align, plan and organise' (with 13 sub-processes), 'build acquire and implement' with 10 sub-processes) and 'deliver service and support' (with 6 sub-processes). This is good detail to have at hand.	In ITIL the principal lifecycle is the service lifecycle, which is important but rather limiting. It takes the attention away from some of the core technical activities, but places a very useful focus on the management of the relationship with 'users'.

Analysis of availability and applicability	ISO/IEC 12207 'Systems and software engineering — Software life cycle processes'	COBIT: 'Control Objectives for Information and related Technology')	ITIL: 'IT Infrastructure Library'
Control	Within that detail there are clear indications of the need for control but no examples – reference would be needed to companion standards that are cross referenced therein.	Governance and management being separate ensures that the differences between strategic thinking and goal-setting is not confused by the more mundane issues of operational planning, implementation and control.	Control is seen principally as the management of relationships and service levels at the contact point between the business and the IT function, both organisationally (when system development projects are being executed) and technically (when systems are being used).
Progress	In so far as this standard provides copious detail about activities, it would assist in determining progress in so far as activities have been initiated and completed, or are stalled because of problems.	By placing a strong emphasis on stakeholder needs, the COBIT approach grounds things firmly in the reality of what must be done, organisationally, in order to make sure things are done for good reasons and with good outcomes.	Progress is probably seen most obviously at the level of the quality of service – How many incidents have there been this week? How many problems are not resolved? How many requests have not been fulfilled?
PRODUCT			
Complexity	ISO/IEC 12207 provides a very one-dimensional view of systems and software development, which does not accommodate the complexity of the interaction between process, and data, and context within which systems have to work.	This high-level view of governance and management is helpful in reaching above the complex details that can be so troublesome. There are no specific sections that deal with complexity, but there is clearly a much better opportunity to use this standard and adapt it to local needs.	Sensing the fragmentation of some of the precepts of ITIL over the years risks that it contributes itself to complexity, and at least one respondent made it clear that the implementation of ITIL created difficulty with 'virtual' roles. Such additional complexity needs to be avoided.
Functionality	Testing activities are clearly indicated in this standard, but there is little specific detail on how to test functionality, for example by means of test scripts.	The optimisation of business functionality is one of the high level considerations in COBIT. Enablement and usability are high on the priorities.	If service management indicates that everything is good, then perhaps functionality can be assumed, but ITIL does not have strong reference to the way that good design and coding delivers functionality.

Analysis of availability and applicability	ISO/IEC 12207 'Systems and software engineering — Software life cycle processes'	COBIT: 'Control Objectives for Information and related Technology')	ITIL: 'IT Infrastructure Library'
Nature	The one and a half pages dealing with 'tailoring' of the standard fall far short of providing direct assistance in adapting it to the nature of the system or software that is needed.	COBIT makes the benefits from IT-enabled investments and services a portfolio management issue and repeatedly comes back to the need for, and possibility of, adaptability. There is however reference to the maturity model that originated from Carnegie Mellon, that has become quite widely accepted in a number of different realms, not just in software and systems engineering.	At the level of the service operation and its management, ITIL recognises that there is a need to adapt to need, but there is no in-depth treatment of the different ways that different kinds of system can be dealt with. ITIL also refers to the maturity model idea.
SERVICE			
External	There is no explicit treatment of the external boundaries with suppliers and customers where service management might be applied, other than a passing treatment of the need to achieve agreements with suppliers, and to support customers.	COBIT provides very strong and appropriate advice for dealing with the needs of the external world, starting with stakeholder needs (as noted).	A service culture is of course driven by the needs of the interface with the customer, and in that sense ITIL does well. Part of it focuses particularly on business relationship management and demand management, and there is attention to events, incidents, problems and requests. At the supply side of the model, there is attention to supplier management.
Internal	The detail of the processes and activities that are (or might) be needed given in this standard provides the possibility of well-defined activity boundaries within a project plan.	At the internal level, there are process models that provide adequate detail with which to manage internal boundaries and the quality of service provision.	ITIL has a wide range of topics dealing with planning and technology management, and it does deal with the roles that have to be fulfilled. It is not immediately clear whether it has more than a passing reference to the product, or material, or resource that is passed from one organisational function to another.
Scope	There is little reference to the means whereby a product might be scoped, although there is copious material that would assist in setting out work breakdown structures in planning and managing projects.	There are copious references to scope, but the specific idea of service level agreements is not dealt with at the overview level.	The issue of service management is dealt with in great detail, including the development and deployment of service level agreements.
MANAGEMENT			

Analysis of availability and applicability	ISO/IEC 12207 'Systems and software engineering — Software life cycle processes'	COBIT: 'Control Objectives for Information and related Technology')	ITIL: 'IT Infrastructure Library'
Strategy	The word strategy is used frequently, but generally to refer to the planning choices at the working level. There is no reference to strategy as a main topic for the attention of management	There is a careful focus on strategic issues such as stakeholder management, which are fundamental to the top-down view. Although a full treatment of strategic management would provide much more detail, there is no risk of incompatibility. An organisation that knows what it wants to do would benefit greatly from taking COBIT as a 'plug-in' to its strategy formulation and implementation processes.	There is quite an extensive treatment of who stakeholders are, the importance of their needs, and the way that this feeds into planning and implementation. However, the general treatment of strategy seems lightweight – there is one process (in some versions of ITIL) that is 'Strategy generation'.
Planning	There are quite detailed tabulations of activities that are involved in planning systems at the systems level, the means to make sure that plans are properly developed, and that they must deal with risk, information and configuration management.	The multiple dimensions adopted ensure that planning within a COBIT environment will be fulsome and – one would expect – reliable. Being driven by goals and identifying enablements is a good way of making sure that a plan does not merely fit the form, but it has the content that will address actual organisational needs.	The need to plan implementation and transition to new systems is recognised, and there are copious references to the need for planning, monitoring and control.
Operations	Equally, there are quite detailed tabulations of activities that are involved in operating systems, together with maintenance and retirement.	Operational issues are featured but not emphasised to any great extent.	There are copious references to *service* operations, and that does of course imply the routine day-to-day matter of running systems that serve organisational needs.

Appendix 14 **Analysis of 14 cases**

In the table that follows, there is an analysis of 14 such cases, focusing on the ways in which they illustrate the seven points of interest (above), and pointing to the kinds of standards that would assist.

Case	**Commentary**	**The need for and potential of standards**
Yeh, they did tell us we have got to use it, and add these plans or schedules or whatever you want to call them on the system, how to allocate the marks on the marks allocation system, and then what people would do to overcome the marks allocation system you would have your own marks system on your Excel, but to prevent yourself from entering the marks here, entering it again on the marks administration system you would just enter the final mark. But we would like to know every month how the student is doing - that type of thing - but we have got so many small examination systems that you don't feel like entering all of that into this very laborious system. It's much easier to enter it as a combined mark. [RES 00 - Pilot 1, University B, 2014/02/11]	MANAGEMENT is clearly compelling certain here in the PROCESS that is marks administration, but there is no evidence of the NEEDS of the institution, only of the user. The SCOPE of this system is confused – is it for the whole institution, or just for the user? It seems that two scopes are at hand here. The TRANSACTION is to load marks in a way that satisfies the unexpressed needs of both the institution and known needs the user. The CAPABILITY is not there, and so the user is driven to invest time and effort in developing something with Excel – the MEANS - that satisfies the local needs and achieves the desired local OUTCOME.	This problem would be solved if there were standards that required a proper analysis of the SCOPE of the marks administration system, including the human and the automated components, and a proper MANAGEMENT assessment of the academic rule book.
I think initially some of the things around marks administration are dependent on the user, the way staff administer their marks, personally, for example myself. When we started with this whole marks administration I would find people giving me marks on pieces of paper, with incorrect student numbers, a star here would mean something, a stripe there, and what the system did was tidy up a lot of that. I think having a system in place introduced certain standards and it gave one grounds to say to staff 'the way you're working is not acceptable, you have to do it like this', and so I think it improved the integrity of our marks. [RES 09 - IT Facilitator, University C, 2015/05/15]	This gives another view about marks administration, from another institution. The problem again centres around the NEED for rules whereby marks are allowed to be entered into the system, and this is a matter for the TRANSACTION – and the PRODUCT that is exchanged must be structured properly. There are clear institutional requirements that determine the required OUTCOME – no uncertainly and no errors in marks administration. There are no CAPABILITY issues here other than those originating marks must have a PROCESS providing the capability to do them correctly, and MANAGEMENT must make sure that it is done in the right way.	This problem would be eased if there was an accepted standard for the definition of data requirements, for data entered into the marks administration system. This is a PRODUCT standard.

Case	**Commentary**	**The need for and potential of standards**
As far as information goes, one of the things that really is difficult here is the marks administration system. At one stage I had a real problem with the marks administration system so I went off to see the Registrar and spoke about it. Eventually the registrar admitted to me it was not actually a marks administration system, it was a rules enforcement system! And then I realised of course why I was having such trouble. It's called a marks administration system but in fact it's not, it's a rule enforcement system. [RES 32 - Lecturer, University B, 2015/09/03]	Yet another tale of marks administration. This one differs because the complainant had the authority, or the courage (let's call it the CAPABILITY) to approach the registrar directly. It is the same PROCESS – marks administration – but it brings a focus to another PRODUCT – the academic rule book that seems to be being ignored. It looks like MANAGEMENT won the arguments in this case.	The same idea of a PRODUCT that defines how marks are to be administered is needed, but this example raises the bar somewhat – the respondent here talked forcibly about the principles of academic freedom, which begins to raise questions about the high-level TRANSACTION that is an employment contract.
We appointed a guy who took the responsibility for developing an online learning system, and [an implementer] based in Franschhoek who developed a system for us which was interactive. He and I had many arguments, because he said you can't have it interactive because it will need a person sitting behind a computer and I said that's fine, I don't mind having someone sitting behind a computer ... Anyway, he eventually came around to my way of thinking and we got a system that was relatively OK in place. And we ran it, and it was OK. [RES 11 - Education activist, Entrepreneur, 2015/05/16]	This case is concerned with uncertainty about the capability of a system (and the underlying technology) to deliver the NEED – an interactive system. The activist (who at the time of the story was the CEO of a private South African Hotel School) did not have the CAPABILITY nor the MEANS; the PROCESS was to engage someone who had. The SCOPE is not really an issue – that is clear – but the arrangements between the contractor and the senior MANAGER are very loose and so the TRANSACTION was not at all clear. In the event the outcome was not satisfactory – the contractor emigrated and left the client with no support.	This problem would be solved if there was a standard that set out an enforceable contract, or other secure arrangement between the contractor and the client. It is a matter of having the right details in place for the TRANSACTION.
And so, the whole system that we had, of just running down the passage and getting Hilda to write that cheque, it just changed very quickly. A whole process just to get an ink cartridge and it now took four days, you know - those sorts of things. I think where you feel it most is where those things affect our course offerings. You need notes, but there's no ink, and someone didn't know the system and they didn't order paper and now there's a delay and you have to go back to the students and say no, I'll give it to you next week because there was no ink, or whatever this might be. [RES 09 - IT Facilitator, University C, 2015/05/15]	The NEED here is very mundane – the assurance that basic supplies can be quickly acquired by a simple PROCESS. A simple TRANSACTION has become bogged down in needless inter-departmental procedures. The MEANS to get an ink cartridge are changed so that additional approval is needed. What was a narrow SCOPE has become extended and the CAPABILITY of Hilda to release stock has shifted to persons unknown. The SCOPE of the system is extended unreasonably, and MANAGEMENT need to redefine the parameters of the transaction.	At the heart of this problem is the issue of CAPABILITY – Hilda was once mistress of the PROCESS that could do this, and now she has not. If the capability was defined appropriately, then the other issues could be resolved.

Case	**Commentary**	**The need for and potential of standards**
I'm not really touching on the systems apart from the support - I don't really use some of the systems at the university, all we do is research. We focus on competitiveness in industry, trying to understand and facilitate the interface between people and technology. Normally in business you would look at your infrastructure: you invest and then the result is you've got all technologies and things and whatever, it will result in performance better. But this lot, it's very much dependent on the interface and the capacity to make it work. So this is what we are focusing on: the interface. What is the capability that is required to do this? So that is what we do here. And system-wise, not really … there aren't any systems in the university that can support us in terms of social innovation. [RES 12 - Project manager, University B, 2015/05/04]	This research project is working on an interface design for a new system aimed at social engagement. The respondent is frustrated because her business experience tells her what should be done, and that would be much more than an interface. This is a SCOPE issue, and the NEED is really to make do with the MEANS that are at hand, to deliver an experimental OUTCOME. The project is somewhat hampered by the CAPABILITY of the students developing the system. The PROCESS is not actually clear, the focus has come to the PRODUCT that is a specification and demonstration of an interface, for the public to use when they are 'engaging' in an unknown PROCESS.	This is an innovative and tentative project, which promises more in terms of team learning than of utility for the general public in some unexpressed activity of engagement. Hence, there are issues with OTUCOME and the project needs to be MANAGED in a way that maximises the learning at the same time that – hopefully – it provides some kind of a public service.
When it came to content creation, things like what data structure or what data interchange format authoring tools to use, there was an overwhelming majority of them leaning towards XML, because of namespace management, a case of moving from one system to another and 'pick a name space', change the name space, name space support … also we didn't want something that is really bloated and XML is bloated. So we also looked other interchange formats. Most people are looking now at JSON and Java - Java Script Object Notation. It's less bloated, it's an Oracle thing. [RES 16 - Masters student, University D, 2015/05/22]	This is about choosing the best technology for the job. It is a research project, and so it is a long way away from the formalised core operational systems that are, in a sense, far more important. However, this student was working in a research context where others had made clear that only some software components were 'available', and so this is about MEANS. The PROCESS is a masters project and the PRODUCT will be a mobile app. The NEED is for something that will fit in his limited resources. The student did not lack CAPABILITY, he just needed to execute a TRANSACTION to download and install the free software of his choice. He is free to undertake his own MANAGEMENT.	This is a situation where a postgraduate student has the NEED to explore all their options and maximise their learning about building small apps. The one nice-to-have standard might be one that clearly defined the MEANS whereby they were expected to do their work. What actually happens is that students learn from each other, and by browsing web sites such as stackoverflow.com, where there is endless help to be had.

Case	Commentary	The need for and potential of standards
What I have here is very expensive capital equipment. And it hasn't ever been used since it was purchased, for more than five years. The original invoice that should be here is nowhere to be found. I think it never came into a good control system. Where it's purchased, and the system knows it's purchased, and it goes to someone on the ground who is responsible for all the parts. Five years is a long time so I think the computer might have been given to IT, just one of the normal computers it's such an old one that by now all those computers have been phased out, [but] it was part of this system! So that was a bit sad not to be able to find it, but then I phoned the supplier and got what I needed and got it working. I had to get a PC for it, but it was a lot easier than I imagined, to get the PC up and working. [RES 24 - Research Lab technical specialist, University B, 2015/07/30]	This technical specialist had just taken managerial control of an innovation lab, and found equipment that seemed to have never been used. On the one hand the NEED was for a system that would have managed the assets, so that the OUTCOME would have been a rapid re-vitalisation of the lab and an innovation PROCESS. The institution seemingly had no CAPABILITY to manage its assets, or no MANAGEMENT discipline to make it happen. The TRANSACTION that solved his problem was to simply buy a new PC – the PRODUCT - and fit it into the bespoke laboratory equipment. There are no SCOPE issues here from the lab point of view, although the institution might be advised to define the scope of its asset management and provide systems that made asset management work properly.	The standard that would ease this problem would be a high-level procedural standard for the MANAGEMENT of assets. This would relate to the rules for executing purchasing PROCESSES at the institutional level.
There is a specific project that I work on. On a year by year basis the users change for that project. Every year there are new ideas and at this point the project there are bits from dozens of people, everyone with different ideas about how the system should work. [RES 34-38 - Technical Team B, University A, 2015/10/01]	This is a maintenance and upgrade issue: the PROCESS is one of submitting suggestions for improvement; The PRODUCT is the 'bit' (surely there is a better term? – 'suggestion'?) and the CAPABILITY is the facility to submit suggestions. The OUTCOME is an improved system, based on the very simple TRANSACTION that is the submission of a suggestion. The MEANS to do this are not clear, but may be no more than an email sent to a defined addressee.	The problem here seems to be simply one of volume – but the respondent does not linger. All that is needed is a PRODUCT standard that will make sure that the suggestions are properly articulated with all the required details to allow impact assessment and prioritisation.
Perhaps we must put up one of our big applications. I don't know if we want to separate the big one, the online application, but we can call it the whole application system, there are challenges keeping it operating. Everything! [But actually] compared with others it's quite good. We get [and process] 40,000 applications every year … and not that many problems. [RES 34-38 - Technical Team B, University A, 2015/10/01]	Again, the problem is somewhat unfocused, but there are some operational issues that are taking time and effort. The TRANSACTION is an incident report, the PROCESS is incident management, the CAPABILITY is the skilled staff who know how the system works, and the MEANS are no more than the time and miscellaneous resources (including machine time) that is needed to code and test fixes, as needed. The OUTCOME is a system that works a little better than it did.	The emphasis here is on the PROCESS. A standard that lays out a reliable PROCESS for dealing with incidents will provide clarity. There are issues of SCOPE – will the PROCESS standard be for inconvenient incidents, or will it extend to major breakdown?

Case	Commentary	The need for and potential of standards
The project I'm currently working on is 3-D printing, the science of 3-D printing. What do you need for that? The resources around it? What technology or underlying hardware that it needs to sit on? What program software needs to sit on that stack of hardware, to give the ability to build 3-D models. That's what I'm busy with now and I've got a workshop next week ... [RES 21 - Help desk manager, University D, 2015/07/09]	The PROCESS is analysing and designing a complex configuration of hardware and software that would serve the NEEDS of postgraduate student learning. The TRANSACTION was no more than a loosely expressed agreement with the head of department that he would do it, he clearly had the personal CAPABILITY. The PRODUCT was assembled individual components of the system; the MEANS were no more than his own ability to trawl the Web for information, to discuss the possibilities with sister institutions. The OUTCOME was good, but the students soon broke the printer …	This can be seen as a case of CAPABILITY – this help desk manager was much more than the role implies, and if there were a standard for the capability of people in these situations there might be much more progress in higher education learning.
I was frustrated with the online learning systems … they made you read a text book, answer some questions and, if you got a certain percentage for answering those questions, then you could go on to the next section. That was the extent of online learning. I went to this conference and listened to all sorts of people talking about interactive online … [RES 11 - Education activist, Entrepreneur, 2015/05/16]	It is not only the technical folk who get to design systems. The NEED here was for this activist (who at the time of the story was the CEO of a private South African Hotel School) to understand the potential of online education from a lay-person's point of view. He did not have the CAPABILITY and so he attended a conference – this, essentially, was the PROCESS and the conference was the MEANS. The hotels he worked with were delighted – it allowed their junior staff to undertake study without leaving their place of work – a very happy OUTCOME.	The key standardisation issue here is CAPABILITY – as CEO this respondent did not have to ask anyone for permission, he could just do it.
If you have no documentation and only one person (on a project) then you've got a problem! If you've got knowledge in various people, that are not all together, no documentation to ensure that you are not dependant on people, plus you've got a highly distributed system various people distributed around with no knowledge and no documentation … ? We are not good with monitoring, we only hear about it when the users complain – [then you have to be] reactive but you want monitoring [in place, so as] to be proactive [RES 34-38 - Technical Team B, University A, 2015/10/01]	This relates to one problematic project – the SCOPE. The NEED was for sustainability and the TRANSACTION that was sought was shared knowledge that would allow others to take over where this 'one person' left off, for whatever reason, requiring a PROCESS of knowledge exchange and a PRODUCT comprising documentation. A good OUTCOME would be the completion of documentation about the design and operation of the system and a considerably lessened risk of systems failure and un-maintainability. The MEANS here are less clear – lean harder on the 'one person'? Hire someone to undertake a third-party review and prepare documentation?	A PRODUCT standard, indicating clearly what documentation is needed to back up and support core operational systems, is what is needed.

Case	**Commentary**	**The need for and potential of standards**
We struggle along and we find ways around this kind of thing, of course. Information at this university is in general poorly disseminated. There are newsletters and lots of emails, but the email system at this university is abysmal, it's absolutely appalling. We have the tiniest [allowance], a couple of megabytes, you really can't even keep one term's worth of emails. [RES 32 - Information systems lecturer, University B, 2015/09/03]	This very tech-aware lecturer voiced considerable frustration with the quality of the systems and services that were provided, and focused on the email service. The PROCESS is one that will provide the level of service he NEEDS. The PRODUCT is an installed email client that works. The CAPABILITY is missing – the IT function needs to listen and understand. The SCOPE is simple at the personal level, although at this institution different email systems were in place for different kinds of people. The OUTCOME is also simple, this senior academic simply needs to be able to do his work.	If we can see the email service as a PRODUCT, then it is a PRODUCT standard that is needed.

Appendix 15 **Letter of introduction**

This is an example of a letter of introduction and request for a meeting:

Dear <name>,

Request for a meeting about researching IT management in education

I am writing to ask if you can spare time to discuss my personal research, concerning the way that we manage IT in higher education. My proposal has been accepted and I have ethics clearance for the study. Meeting you would be the first in a number of interviews within UWC (and its IT partners, as may be appropriate).

The objective of the study is to learn more about the nature of the individual steps or *transactions* that deliver information technology and information systems into education. That means talking to all those involved: IT suppliers, systems integrators, managers and end-users (academics and administrators). The study will not be confined to e-learning although I expect that e-learning will be a major feature of the projects that are examined. Knowing more about the way that *transactions* are perceived by those involved, I anticipate being able to draw conclusions about the sorts of *standards* that will ensure greater success in the future.

I think that I would need about two hours of your time. The discussion would be in three parts:

- First, an open discussion about the technologies, systems and projects known to you, with the intention of identifying about eight to ten instances of specific *transactions* that you have been involved with.
- Second, a structured examination of the differences between those eight to ten transactions, using the repertory grid method (Kelly, from the 1950s).
- Third, a ranking or ordering of those differences for their significance, according to your personal experience and professional opinion.

At the heart of the research that I am doing, I will be characterising the *qualities* of transactions as seen by those involved, going well beyond cost alone, to consider any characteristics or qualities that are seen as important to my respondents, especially those related to the benefits that we achieve at each stage of the cycle of acquisition and implementation. The idea of the transaction is useful to identify the level at which the analysis will take place, and gives me a unit of analysis that has guided the design of the study.

But enough of your precious time for now. I hope you will be able to make time for me, I look forward to hearing from you.

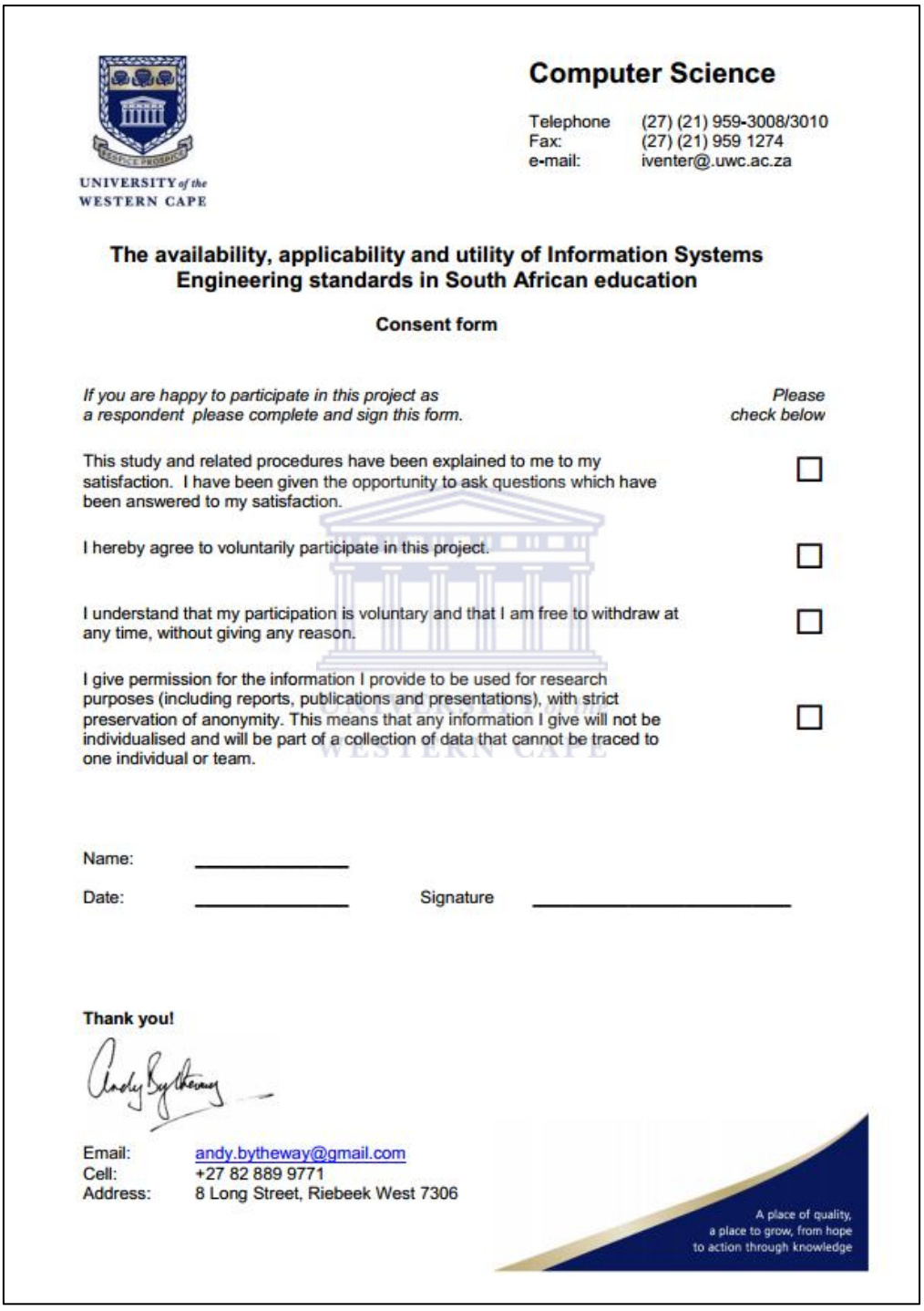
Warm regards,
Andy

Andy Bytheway | Doctoral Programme, Computer Science, UWC | andy.bytheway@gmail.com | +27 82 889 9771

The detail varied according to the kind of addressee, and the nature of previous contact with them.

Appendix 16 **Ethics management**

This is the ethics consent form that was discussed and signed by all respondents before commencing interviews.



UNIVERSITY of the WESTERN CAPE

Computer Science

Telephone (27) (21) 959-3008/3010
Fax: (27) (21) 959 1274
e-mail: iventer@.uwc.ac.za

The availability, applicability and utility of Information Systems Engineering standards in South African education

Consent form

If you are happy to participate in this project as a respondent please complete and sign this form.	*Please check below*
This study and related procedures have been explained to me to my satisfaction. I have been given the opportunity to ask questions which have been answered to my satisfaction.	☐
I hereby agree to voluntarily participate in this project.	☐
I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason.	☐
I give permission for the information I provide to be used for research purposes (including reports, publications and presentations), with strict preservation of anonymity. This means that any information I give will not be individualised and will be part of a collection of data that cannot be traced to one individual or team.	☐

Name: _____

Date: _____ Signature _____

Thank you!

Email: andy.bytheway@gmail.com
Cell: +27 82 889 9771
Address: 8 Long Street, Riebeek West 7306

A place of quality, a place to grow, from hope to action through knowledge