Information Systems Research Maturity: UCOL as a Case Study

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ABSTRACT

The importance placed on Science and Technology for New Zealand's future competitiveness, has enforced government policy changes reinforcing that institutions with degree programmes must have a solid and firm research base for funding of EFTs. Polytechnics considering new government policy must adopt research capability maturity programmes. Further speculation and opinion is that the new government is to insist upon the research to a greater degree than its predecessor did. This paper will describe the history of Information Systems research at the Manawatu Polytechnic trading as UCOL. This study utilises recent literature surrounding the area of polytechnic research. Modern management paradigms will be described which foster the development of the research culture. The paper will then focus on the minutia of one research management tool: the personal 'Research Development Plan' and resulting appraisal.

1. INTRODUCTION

This paper describes recent changes made at UCOL to support the continued growth of the research culture. Recent institutional changes along with the IS section's changes will be described. With this in mind, this paper describes the history of information systems research at UCOL, the actual changes made and some of the major research projects. The research management process and policy will be described. The future of IS research will be described from many perspectives.

The chief executive must support any organisational cultural shift. One way of proving commitment to the development of a mature research culture is to produce an institutional research strategic plan from which policies can be developed.

A brief description of the major Information Systems research projects undertaken at the institution will be described. The original research culture will be described. In recent years the research culture has changed. The current research outputs of the Information Systems team have shown that a small incremental change in culture can increase research maturation. However, the development of the 'correct' research culture ensures the acceptance of the said research culture – one way of doing this is the development of a quality assurance 'research management process'. The Information Systems team has undertaken recent research projects. These projects will be described.

The capability maturity of research in polytechnics must be sustained using policies of continuous improvement and support.

This also implies that personnel must not come solely from the Information Systems industry; academics and scholars must be recruited to increase research capability. The recruitment method coupled with the aforementioned 'research management process' allows for continuous feedback control of individual and group research capability.

The future of Information Systems research at UCOL will be described from the viewpoint of: research strategy, research management and research recruitment. Ensuring a policy of research capability will increase acceptance of a research culture as well as increasing the quantity and quality of research outputs.

2.   HISTORY

The BAppIS degree at UCOL gained accreditation in 1994. In the first few years of the degree the staff produced high quality research outputs and undertook several research projects. There was a steady amount of research outputs produced by the IS staff, at the then Manawatu Polytechnic. However, in 1998 there was a decrease in research outputs. In 1998 a Professor of Information Systems joined the team as well as experienced researcher. The seeds of the research efforts of that year came to fruition in 1999. In the year 1998, there was some enthusiasm for research this was magnified by the new recruits. This enthusiasm has increased further still. The new recruits' enthusiasm for research was supported and encouraged by the administrative leader of the group. In the year 1999, managerial changes were made to support the research culture: this was supported by a commitment of the Chief Executive in the form of the Research and Diffusion Strategic Plan. The gains of the implementation of the strategy have yet to be documented. The research capability maturity model is currently undergoing pilot testing on behalf of UCOL in the Faculty of Business and the Information Systems Section.

3.   RECENT CHANGES

As mentioned above the chief executive made the commitment to research via the Research and Diffusion Strategic Plan. This documents the vision and mission of research at UCOL. The document provides three strands of research: institutional, degree based and technology transfer. The institute has hired one additional professor and two associate professors to implement the strategic plan, as well as, a Research Co-ordinator and the Technology Transfer Co-ordinator. The professors and associate professors head research projects.

4.   MAJOR RESEARCH PROJECTS

The major research projects in the Information Systems Section are the Business Simulation Project and the Human Computer Interfaces Research Project. The Business Simulation Group has lost a significant number of members over the past two years. The Human Computer Interface Group (HCIG) is a recent group created by the information systems team and headed by the Professor. The HCIG has five members: David McCurdy, Bridie Atkins, Michael Smith, Ying Chen and Professor Haynes. The HCIG has four major projects: HCI Software and the Disabled, HCI Hardware and the Disabled, HCI Web-Based Project Management, and HCI Business & Ethics.

5.   RESEARCH CAPABILITY MATURITY

Polytechnics have been striving to create Research Cultures to support their degree programmes. Tutors engaged in research mainly teach degree programmes. An editorial board of the NACCQ decided at the annual conference in 1996, that to perpetuate the growing research cultures of polytechnics that they would publish a referred journal.

Previous research initiatives by Polytechnics have focused on increasing staff research outputs and developing support mechanisms to achieve this. Brown (2000). This is philosophically flawed. Brown suggests that research cultures based on this have met with varying amounts of success. To develop research skills and maturity, research must be process rather than output driven. After all the NZQA, definition of research suggests that degree programmes are predominantly taught by lecturers engaged in research. Brown also suggests that more is needed than the funds and resources. The complete culture must change and as already suggested above this must come from the CEO and be propagated throughout the polytechnic culture.

Bridgeman (1997) highlights two measurements made upon a research culture that is the level of the institution and the level of the individual. The level of the individual requires motivation, incentive and

education. UCOL has hired in two researchers in recent times and is educating and encouraging staff to engage in research. UCOL supports cross faculty research projects under the new managerial structures. There is now support and encouragement from research leaders and administration. Researchers are recognized institution wide and are the subject of internal and external press. There are many resources to support staff engaged in research: computers, rooms, some instruments, research-training materials, research education seminars, and research assistance.

There are two distinct elements to a research culture in polytechnics: inclusive and exclusive. The exclusive model must be avoided at all costs. When creating a research culture the model of the university may be welcomed: however, this is flawed and inappropriate for the polytechnic culture: the university model must be modified significantly.

Bridgeman (1997) identifies the following areas for increasing individual research maturity:
1. Research Mentor Scheme
2. Research Teams
3. Collaboration
4. Training and Education
5. Assistance for Funding
6. Academic Writing.

There is a misconception that research is different to other business processes. However, if one goes back to the basics of management, then it is evident that research can benefit from those same managerial processes. The six functions of management detailed by Allen (1995) are establishing objectives, organizing, motivating, developing people, communicating & measurement and analysis.

Research management is one thing; nevertheless, integral to any research culture is the leadership aspects. Leadership as opposed to management is described in Dubrin (1997). Research leadership and mentoring forms an excellent foundation for increasing individual and institutional maturity in research. The key attributes of a good research leader are:
1. Ability to lead by example: produce, conduct and be successful in research;
2. Ability to provide creative inspiration in research;
3. Ability to delegate research activities and not micromanage;
4. Ability to educate junior researchers in the research process;
5. Ability to generate a co-operative vision and mission for research.

Given a free choice of who should be in our research teams: whom should we pick? How should we go about selection? Should we pick all the greatest minds and put them together? Anecdotal evidence suggests not. During a recent conversation with an experienced professor, he said that during one of his employs he had the pleasure to work with two scientists in complementary fields: the sole intention to fuse the two fields together: this did not work. This think tank approach does not work in many research situations: but it does in others.

When forming research teams it is important to understand the nature of membership. One particular problem observed is the elective homogeneity: this refers to a collection of a group of factors, which causes election into a group or successful employment into a company. This may result in the forming of quasi-pure teams. Several experiments have been made with pure teams, Belbin (1981). The resulting performance characteristics of the pure teams provide areas and strengths and weakness. When leading and managing these teams one must cater for their deficiencies and magnify their strengths. Team creativity is highly important in the continuous development of the research culture. In general, it is perceived that one cannot be creative in research until one has gone through the initiation ceremony or rite-of-passage that is the Ph.D. However, this is an inference and as such must be ignored. Injecting creativity can be used using a variety of techniques; one such technique is documented in McCurdy (1999). Creativity must be pooled and utilized for research. The creative researcher will usually be an experience researcher. However, a novice researcher in a team with experienced researchers can inject much creativity.

As mentioned above, institutional and individual are two facets of research that can be measured. The Capability Maturity Model of the Software Engineering Institute of Carnegie-Mellon University (this can be used for this purpose, when transferred into the research subject domain).

Research Capability Maturity: Individual
1. **Initial.** At the Initial Level, the researcher typically conducts research in an *ad hoc* fashion. The benefits of good research practices are undermined by ineffective planning and reaction-driven processes.
2. **Defined.** The researcher defines the research project, the methodology followed is defined, the management timeline is defined, milestones are identified and expected outcomes are defined.
3. **Repeatable.** Following from the defined process, research projects are repeatable owing to the

application of the defined process. The researcher must avoid falling into the *ad hoc* trap.

4. **Managed.** Following from the defined process and repeatable process a research leader or mentor, monitors the progress of each researcher, allowing each researcher to reflect on their progress. Meeting times and quantifiable milestones are agreed. This allows the researcher to reflect in a structured and controlled manner.

5. **Optimising.** The researcher reflects upon their own research management practices and research practices, for optimisation purposes.

Research Capability Maturity: Institution

1. **Initial.** At the Initial Level, the institute typically does not provide a stable environment for conducting research. When an organization lacks sound management practices the benefits of good research practices are undermined by ineffective planning and reaction-driven research.

2. **Defined.** All research projects are described, the methodology followed is documented and expected outcomes are negotiated.

3. **Repeatable**. Following from the defined process, research projects are repeatable owing to the application of the defined process. The institute must avoid falling into the *ad hoc* method.

4. **Managed.** Following from the defined process and repeatable process a research leader or mentor, monitors the progress of each researcher, allowing

each researcher to reflect on their progress. Meeting times and quantifiable milestones are agreed upon, this allows reflection.

5. **Optimising.** The management processes can be optimised. At the Optimizing Level, the entire organisation is focused on continuous process improvement. Innovations that exploit the best research practices are identified and transferred throughout the organisation.

6. MANAGERIAL APPROACHES

In the first instance, the development of a research culture should manifest itself in the vision and mission statement of the institute as regards research. This vision and mission statement should be thoroughly supported by the CEO. The vision and mission statements are integrated and, extrapolated from this, is the strategic plan of research for the whole institute. From the strategic plan, the policies and procedures are produced to foster research in the institute. The institute should seriously consider re-engineering the research policies and creating all policies from scratch. Modern management paradigms should be considered whilst constructing the policies and procedures as to remove as much valueless-added bureaucracy and process as possible.

The central essence of implementing the research strategic plan should be utilisation of the Business Process Re-engineering tactics. The central core of re-engineering is to define process not function.

The opposing strategies of business process redesign.

	Continuous Process Improvement	Business Process Redesign
Change	Incremental	Quantum Leap
Focus	Current Practice	Start again
Frequency	Continuous	One shot
Scope	Narrow within function	Broad, cross functional
Participation	Bottom-up	Top-down
Risk and Reward	Low-to-moderate	High
Type of Change	Work design	Structure, culture and roles
Role of IT	Work design	Key enabler
Aids	Ideas and suggestions	Methods and tools

Source: Clarke & Clegg (1998).

A process is considered a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer. Process modeling can abstract the re-engineer from the usual process operations of an organisation and in the case of research allow the re-engineer to develop a temporal quasi-perfect process or collection of processes. The customers are concerned with end-to-end processes, which produces goods or services. What does customer focus have to do with research? The customers of a research culture are the researchers themselves. The development of a research culture must be mindful of this philosophy when developing the research culture. In addition, the polytechnic should be mindful of its core-competencies when developing research cultures. The research must underpin the degree programmes, as well as the pedagogical nature of the institute. For example, the business simulation research programme supports the BAppIS degree's business units. This addresses the pedagogical core-competencies of the institute. Other core-competencies must be addressed in the research strategy and associated implementation.

One way of stimulating participation in the research culture, which also benefits the core-competencies of the institute is to encourage continuous process improvement in the programme itself.

7. IMPLEMENTATION

The following items are developed
1. Initial vision and mission statements
2. Development of discussion document of the research strategic plan
3. Formulation of the research committee
4. Development of discussion document of the terms of reference of the research committee
5. Development of the procedures and policies to foster research and research capability maturity.

The final item can be implemented using the research management plan and the research appraisal. The research management plan contains the following information:
- the researcher's details and responsibilities;
- the research project name and basic overview;
- the major milestones;
- the future meeting dates;
- the anticipated outcomes of the project; and
- the actions to be taken during the research project of the research manager and the researcher.

During the research project, meetings are held between the research manager or leader and the researcher to discuss the progress or lack thereof. These meetings allow the research manager to mentor the researcher. The research leader or manager must provide inspiration to the researcher in the research management meetings:
- encourage researchers who are unsure of their progress
- allow other issues to be raised in the research management meetings
- compliment outstanding efforts as well as results
- provide individualised attention to the project
- do not provide all of the answers allow the researcher to discover for themselves
- the leader must be innovative and find ways around certain problems
- the leader must lead by example
- the research leader should be heavily involved in the cultural maturity from the development of the vision and mission statements through to the policies and delivery
- the research leader should foster the self-fulfillment of staff and encourage researchers to develop their own interests into the research programme.

The research appraisals are conducted on an annual basis. However, one must not consider this a terminating and summative application. Research projects are in general

8. RESEARCH MANAGEMENT PROCESS

One way of making research an integral part of the degree-lecturers job is to develop a research management process. Although, staff not teaching on degree programmes and non-teaching staff could develop a personal research plan.

The policy is designed to increase institutional and individual maturation. By giving staff performance expectations, the institute must support in producing challenging but achievable expectations in research, give continuous feedback about performance, and developing a personal research plan. The process must adhere strictly to protocols of the institute, in particular the privacy act of 1993. The research manager must provide training and continuous feedback, the research manager is ultimately accountable.

Any intellectual property policies surrounding the researcher and the research process must be defined so the institute and individual know the boundaries of their knowledge. Clauses of confidentiality form part of the process. Some confidentiality clauses go beyond the institute-individual relationship.

As all new academic staff , who are expected to conduct research, develop a 'Research Work Plan': the benefits of research-job integration are noticed. The rational of developing the plan is that: (a) there are agreed research expectations, (b) providing feedback on performance, and (c) promoting individual and personal growth.

The work plan identifies
1. Identifies one research mentor
2. Describes major research findings
3. Contains at least three quantifiable milestones
4. Describes the expected research outputs for the proposed research project.

The workplan can be changed if mutually acceptable.

The research appraisal addresses:
♦ Research carried out by the staff member
♦ The research outputs, quality and quantity
♦ The lessons learned: how can they improve their own research process
♦ Recommendations of staff member
♦ Recommendations of the Research Manager
♦ The research work to be carried out in the future

The findings of the appraisal used in the next iteration of the research management process.

9. REFLECTIONS

Many alternative management paradigms can be used in research management. The research management process has worked for many staff members. Most researchers have conducted work in a structured fashion and have emancipated themselves from the *ad hoc* days of old. The research management process will reach the appraisal stage in January 2001. At that stage more conclusions maybe drawn as well as further enhancements to the research management process.

Polytechnics should develop research strategic plans with the complete support of the Chief Executive Officer. The management approaches for the aforementioned culture should adhere to new management paradigms. Polytechnics should be apprehensive, adapting the university model of research can be inappropriate.

10. FURTHER WORK

Much work is needed to develop the New Zealand Polytechnic Research culture and identity. The Research Capability Maturity Model should be investigated to foster and encourage research cultural maturity. Finding the attributes to measure cultural maturity for both institutional and individual maturation will foster the development of the Research Capability Maturity Model. A thorough ethnography will assist in the optimisation of any research culture. The model can be used to optimise the training and educational programmes of the staff. The resulting documentation could also be used for accreditation purposes.

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