

SoDIS SEPIA – Collaborative Partnerships in Software Engineering Research

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ABSTRACT

The Centre for Information Technology Research (CITRUS) launched in 2002 had the goal of encouraging collaborative research that is industry and community linked, at regional and national levels within the NACCQ sector. The research programme into Software Development Impact Statements being conducted by the Software Engineering Practice Improvement Alliance, (SoDIS SEPIA) represents one model towards achieving this goal. Initiated in 2001, this programme of research has developed increasing momentum from small beginnings, and is beginning to attract funding and a growing body of research partners committed to its goals. Bootstrapping a research programme from scratch is nonetheless a difficult undertaking. This paper outlines the goals of the programme; the strategies applied to build a collaborative network of researchers in educational and commercial organizations in New Zealand, Australia and the United States; reviews the successes and failures in the process so far; and makes some recommendations for developing successful research partnerships.

Keywords

Software Engineering Education, Software Engineering Practice, Project Management, Risk Management, Software Engineering Ethics Research, Teaching-Research Nexus.

1. INTRODUCTION

The Centre for Information Technology Research (CITRUS) launched in 2002 had the goal of encouraging collaborative research that is industry and community linked, at regional and national levels within the NACCQ sector. Williamson and Mann (2002) have described it as “a proposal that defines excellence as a

horizontal, virtual network of co-operation and opportunity driven through a national innovation framework". The Software Engineering Practice Improvement Alliance (SEPIA) is a research programme along such lines, exhibiting the intended CITRUS characteristics of: building a community of ICT researchers; increasing financial support for research activities; increasing the critical mass of new researchers; developing research clusters; developing formal research linkages with other institutions; and leveraging localized partnerships with industry, community and iwi. This programme has developed from existing connections between NACCQ and Professor Donald Gotterbarn, who attended the 2001 conference as a keynote speaker (Gotterbarn, 2001). From his time subsequently as a visiting professor at Auckland University of Technology (AUT) during 2002, the SoDIS SEPIA programme has now developed into an active and dispersed research project.

2. GOALS OF THE SoDIS SEPIA PROGRAMME

The primary aim of the SEPIA research team is to lift the current "state of the art" in software development, through developing, refining and promulgating the practice of applying better and more comprehensive project impact assessments. It is intended that this process, by incorporating a pre-audit component in the development lifecycle, will directly and consistently result in higher quality software. This pre-audit component is conducted through a Software Development Impact Statement process, termed the SoDIS process (Gotterbarn, 2001), which transfers the engineering concept of project environmental risk assessment across to the software development process. This risk assessment extends traditional quantitative risk assessments to include formal assessment of qualitative elements. Traditional views of risk that emphasize financial risks, often lack an underpinning broader ethical framework and tend to trade-off the legitimate needs of other stakeholders. It has been argued that this is a key cause of project failure, and at times has caused considerable harm to users or those impacted by software. The SoDIS process encourages the project manager/developer to think of people, groups, or organisations associated with the project and how they relate to the proposed project and its products or deliverables. The goal of the SoDIS process is to identify ways in which the completion of individual tasks, that collectively constitute the project, may negatively affect these stakeholders. It identifies additional project tasks that may be needed to prevent any anticipated problems and identifies changes needed in some tasks that may prevent any anticipated problems. The resulting Software Development Impact Statement acts as a mechanism for considering all the stakeholders impacted by a software project. It ensures the stakeholders' legitimate needs and interests have been taken into account in the development, and thus produce more robust, and socially acceptable software, with fewer unplanned side-effects. In support of this software process, a computer aided software engineering (CASE) tool (SoDIS) has been developed. Initial trials have demonstrated positive contributions to the quality of software.

The SEPIA programme aims to develop and refine the SoDIS process and supporting tools, working with a broad based group of collaborating partners, involving students, Information Technology companies, Universities, Polytechnics, and Research Foundations throughout New Zealand and across three countries. The process will be refined and disseminated through use in teaching and practice partnerships, through testing in the laboratory and the field, through application to new and emerging development processes, the development of texts, case studies, tutorials, guides and the release of refined and teaching versions of the CASE tool.

A more general aim of this research has been to assist educators to actively link their teaching and research practice and thereby build a stronger research community within the NACCQ sector, in which this research would act to inform and support teaching on degree programmes. This aim has been essentially informed by the belief that "teaching and research share a symbiotic relationship in a learning community" (Robertson & Bond, 2001).

3. STRATEGIES FOR BUILDING A COLLABORATIVE RESEARCH NETWORK

3.1 Communities of Practice

Clear (2002) has previously argued that given the vital link between theory and practice in this set of disciplines, models of research in ICT "need to acknowledge the importance of communities of practice (Wenger, 1998)". This argument is consistent with the views of Wenger (1998) that "learning involves an interaction between experience and competence", that a "well functioning community of practice is a good context to explore radically new insights" and that "communities of practice are a privileged locus for the

creation of knowledge". Thus in the formation of communities of practice in ICT research we wish to encourage links with industry, be responsive to partnership and commercialization opportunities, teach programmes informed by research active staff and meet international standards of excellence. Under the umbrella of the SoDIS SEPIA programme, an interrelated set of research projects has now been initiated, supplemented by workshops and events and including undergraduate and postgraduate students, educators, novice and experienced researchers and practitioners. It is through the overall programme management that the SEPIA community of practice is being built. This in turn has originated from the unique community of practice that is NACCQ.

3.2 Collaboration in Teaching and Learning

The educational characteristics of the SEPIA programme are guided by the goals of providing students with professional education to international standards of quality, which is research informed, and networked to the relevant practice, research and teaching communities. Primary examples of such collaborations to date are of undergraduate research, within AUT Bachelor of Information Technology Projects including one directly sponsored from the international Software Development Research Foundation; use of the SoDIS process within Software Engineering degree courses at Monash University in Melbourne, Otago Polytechnic in Dunedin and Auckland University, and in project management courses at Western Institute of Technology in New Plymouth. At UNITEC Institute of Technology the SoDIS process is being adapted for use in multimedia and systems analysis and design courses. At Bay of Plenty Polytechnic it has also been used in diploma level ethics, and systems analysis courses. Other polytechnics have expressed interest but have yet to formulate specific projects. The SoDIS process can be generally applied and other institutions are also encouraged to join in the programme with projects suited to their courses and students. This offers students exposure to leading edge techniques in the software process, and use of a specific CASE tool to support their learning in the areas of ethics, requirements analysis, project and risk management. The SoDIS SEPIA programme also offers scope for students to undertake postgraduate study and research in Computer Science Education, or in areas of Software Engineering practice such as project and risk management, with potential thesis opportunities (for instance by retrofitting the SoDIS to past projects to gain metrics on the predictive qualities of the process). A venue for postgraduate level work in usability studies also exists through the Systems Usability Research Laboratory (SURL) at AUT.

3.4 Collaboration in Research

The above examples demonstrate collaborations in Computer Science Education research and in Software Engineering research, where exploration of an enhanced software process, and issues associated with ethics and professionalism have been enabled in an educational or project partnership context. In the area of practice-based research, commercial partners in the programme have participated in trial internal projects. Sometimes for commercial partners, the opportunity to do so with limited resource commitments through student project partnerships is attractive. In one example an AUT student project on behalf of an external client in semester two 2002, used the SoDIS process in a mid-point review of their failing project. Based on this diagnosis, the team identified and addressed key problem areas, shared them with their client and turned their project around.

SoDIS workshops have proven a useful mechanism for sharing knowledge of the process with partners. Two of these workshops have been held, one at the NACCQ conference in July 2002 with educational partners, and one at AUT with educational and commercial partners as attendees. The SoDIS symposium held in November 2002, sponsored by NACCQ and hosted by KPMG, was an opportunity to share experiences and pool ideas for researchers, educators, students and commercial partners. It also provided a useful forum for feedback, providing insight almost in the form of a focus group, for the software company, which has undertaken to produce a commercial version of the SoDIS case tool for educational and professional use.

3.5 Collaboration in Practice

Industry linked research represents a continuum, which may begin with very small steps, such as: student work placements and projects, where the research dimension may be very small, to major international projects, where it looms rather larger. The SoDIS professorial breakfast in November 2002 sponsored by Eagle Technology and AUT's School of Computer and Information Sciences, was jointly promoted through the NZ Computer Society and gave a further opportunity to expose practitioners to the SoDIS process. Many new practitioner participants in the programme have been identified through this breakfast event and some have already started using the CASE tool to support their software process. Current practitioners associated with the programme come from the following organizations: KPMG, Eagle Technology, Peace Software International, Southern Cross Medical Insurance, Software Development

Research Foundation (Boston), and Software Improvements Pty. (Canberra). Several other individuals have expressed interest in the software and the programme is expected to continue expanding.

3.6 Programme and Project Management

A key to the success of a research programme such as this is having dedicated project management resources, and a structure from which to drive the research programme. Professor Roger McHaney, a visiting academic from Kansas State University at AUT and co-author of this paper, has taken on the task of managing the several sub-projects within the programme. Coordinating events, chairing minutes, recording proceedings, distributing software, managing mailing lists, communicating progress between members of the programme, supervising student project work, enlisting new members to the network, communicating software bugs or issues, are typical tasks to be managed. Overall programme management has been a team effort jointly undertaken by Professor Gotterbarn, Tony Clear and Professor McHaney.

3.6 Communication and Regular Events

Likewise sustaining this diverse network, of often quite isolated researchers and practitioners, has required regular communication and updates on progress of the research programme. This has built momentum towards events such as local working group meetings, workshops and symposia, at which updates on progress of the work have been shared by members.

3.7 Funding

Much of this work to date has been supported by voluntary efforts, or by support from host institutions. However some external funding has been achieved. NACCQ has provided \$2000 to support Professor Gotterbarn's visit for the symposium, NACCQ conference attendees paid \$100 each for the SoDIS workshop, Eagle Technology sponsored the professorial breakfast and KPMG kindly hosted and catered the symposium in their board room. AUT has supported Professor Gotterbarn's visits, and Professor McHaney's project management role in this research. Bay of Plenty Polytechnic has provided time relief for a staff member to work on the project. Individuals and institutions have supported travel within New Zealand by their members to scheduled events such as working group meetings and the symposium. Submissions for funding both within AUT, to Kansas State University, and to the Foundation for Research, Science and Technology - Impacts of New Technology Fund have been generated.

4. SUCCESSES AND FAILURES

4.1 Activities

While much momentum has been generated, the research programme remains a little fragile and dependent upon energy and coordination from the centre to keep the activity levels up, and prevent the enthusiasm from flagging. Nonetheless the timeline shown in table one represents a number of successful activities, which have been undertaken to date.

Date	Location	Event
July 2002	NACCQ Conference Hamilton	SoDIS workshop
July 2002	AUT	SoDIS workshop
July 2002	AUT	SoDIS SEPIA Programme launched with Professors Gotterbarn, McHaney and Tony Clear as programme managers
July 2002	AUT	Professor McHaney appointed project manager for SEPIA projects
July 2002	Western Institute of Technology	Seminar for project management students conducted by Professor Gotterbarn
July 2002	Victoria University Wellington	Seminar for School of Information Management given by Professor Gotterbarn
August 2002	SEPIA Partners – Various NZ and Australian Institutions	Projects underway
September 2002	AUT	First SEPIA working group meeting held
October 15, 2002	AUT	FRST Impacts of New Technology Grant Application Submitted
November 26, 2002	AUT	Eagle, School of IT, NZCS, Professorial Breakfast held
November 26, 2002	AUT	Presentation to Research Development Symposium "Developing Effective Research Partnerships With Industry" Clear and Gotterbarn
November 27, 2002	KPMG Auckland	Inaugural SoDIS SEPIA Symposium held

November 22, 2002	AUT	Business Faculty Contestable Research Fund
– Grant Application Submitted		
December 20, 2002	AUT	Business Faculty Contestable Research Fund
– Revised Grant Application Submitted		
January, 2003	AUT	FRST Impacts of New Technology - Grant
Rejection Notified		
February 20, 2003	Kansas State University	President's Faculty Development Awards
(FDA) Application Submitted		
March 11, 2003	AUT	Business Faculty Contestable Research Fund
– Grant awarded: NZD\$13500.		

Table One: SoDIS SEPIA Programme Timeline of Activities

4.2 Symposium

The list of institutions attending the inaugural symposium in November 2002 further indicates the level of activity generated within the research programme. Table two provides a list of involved academic representatives and table three lists industry partners.

Institution	(* Apologies)	Academic Units
East Tennessee State University		Dept of Computer and Information Sciences Centre for Software Engineering Ethics Research
Auckland University of Technology		School of CIS: Postgraduate Student (PhD) School of CIS: Systems Usability Research Laboratory School of CIS: Undergraduate Students (2) (B. InfoTech)
Auckland University		Dept of Computer Science
Kansas State University		Management Information Systems
UNITEC Institute of Technology		School of Computing and Information Technology
Otago Polytechnic		School of Information Technology and Electrotechnology
Bay of Plenty Polytechnic		Dept of Business Studies Undergraduate student (National Diploma in Business Computing)
NACCQ		Centre for Information Technology Research (CITRUS)
Western Institute of Technology *		Dept of Information Systems
Monash University *		Dept of Computer Science and Software Engineering

Table Two: Academic Partners

Organization	(* Apologies)	Location
KPMG		Auckland
Software Development Research Foundation		Boston
Software Improvements Pty.		Canberra
Peace Software International *		Auckland
Eagle Technology *		Auckland

Table Three: Industry Partners

One of the exciting aspects of this project has been the melting pot of users and researchers that has been assembled. The group's far-reaching backgrounds and diverse set of work experience has resulted in a synergistic environment that produces unexpected observations and produces outcomes that couldn't have been anticipated in advance. The group includes educators from various institutions of all levels; students

ranging from those in undergraduate to postgraduate programs; assorted researchers filling the spectrum from senior-level international figures to those starting with junior-level local experience; and, industry users of the software, ranging from those who are currently experimenting with the process to those developing commercial and educational versions of the software. The symposium resulted in a learning process for the students present and provided an exemplar of research-informed teaching and learning, with the two interacting in the “symbiotic relationship” advocated by Robertson and Bond (2001). The industry dimension was heightened by the atmosphere and views from the KPMG boardroom, the commitment to leading edge practice, and the presence of a software development company commissioned to develop a commercial version of the SODIS CASE tool. Together with the academic component, this symposium demonstrated a model of research that had both value and relevance and is expected to provide a footing for future endeavor.

4.3 Symposium Insights

The symposium was designed to bring all partners and their experiences together to enable successes to be shared, failures to be exposed so they wouldn't be repeated, and future possibilities explored. Unfortunately not all participants could gain the financial support to attend, demonstrating the need to build a stronger funding base for the programme. Symposium discussions were conducted in a variety of styles ranging from traditional meeting type reports to a role-playing session. The use of various formats stimulated conversation and revealed several innovative ideas and future directions for SoDIS.

4.3.1 Successes

Donald Koh of UNITEC, upon hearing reports of how other academics were using SoDIS, commented that he would like to use SoDIS to encourage students to ensure all aspects of their multimedia projects were considered through a target audience profile process, prior to building the software. With the group's encouragement, Donald explained his ideas in some detail and showed how the SoDIS process could relate to a storyboard-based development cycle. This eventually led to the realization that his application idea could be extrapolated and used to support an agile development methodology.

In another example Irene Davies from Bay of Plenty Polytechnic demonstrated with one of her undergraduate students how he had developed a workflow diagram for the SoDIS process. She suggested this be made available to a student project team at AUT that are creating a tutorial software package to accompany SoDIS. Irene further suggested her students at Bay of Plenty Polytechnic might test the completed tutorial.

This type of cooperative, synergistic research with sharing of insights advances the deployment of the SoDIS process without duplication of effort. All parties involved are able to learn from each other and offer mutually beneficial support within a framework of cooperation.

4.3.2 Redirections

In addition to reporting successful outcomes, the symposium provided a venue for problems to be discussed. Desired outcomes for this activity were two-fold: 1) to ensure others wouldn't have the same experience; and 2) to provide possible redirections that would enable success in the future.

In one example shared at the symposium, the process of bringing SoDIS into a large classroom environment and then successfully deploying it for use among all the students became a logistical nightmare. The group at the symposium discussed the situation and reflected on possible mechanisms that would ease the problems experienced. The academic instructor that led the large class also provided the group with an example installation and help guide that could be used in other classroom settings.

Another setback experienced by the group occurred when a grant proposal written for the Foundation for Research Science and Technology (FRST) in the Impacts of New Technologies was declined. Surprisingly, in the words of the evaluation committee, “the proposal was not considered central to this portfolio.” The feedback further stated that the grant did not provide evidence of connections to the wider community. This comment was particularly disheartening because the SoDIS tool is focused on bringing about more responsibly designed software, that considers a wide set of stakeholders and ensures the community at large is protected from faulty and irresponsible software deployment. So, a new job for SEPIA is to make the utility of the SoDIS process more transparent.

Despite the puzzling feedback, the material developed for the FRST grant has formed the basis for several other grant applications, which the group is optimistically investigating. One grant via AUT's Faculty of Business Contestable Research Fund, has recently led to securing NZD\$13500.

5. RECOMMENDATIONS FOR FOSTERING EMERGENT RESEARCH NETWORKS

While the development of an emergent research network is neither a simple, nor easy process, it nonetheless is one that offers enormous payback, both in terms of student learning and academic knowledge transfer. The experience of the SEPIA programme has resulted in several observations that are worth communicating to others in the inaugural stages of creating a multilayered research programme. Among these are: 1) players from all levels of academia, industry, and learning are essential to provide a variety of insights from diverse perspectives; 2) having a group that shares common interests but desires to use the research platform in different ways can result in synergistic cooperation; 3) regular communication and face-to-face gatherings are a necessity; 4) sharing of outcomes, tools, and materials can result in rapid strides for the entire group; 5) dedicated and consistent project management; 6) developing a programme infrastructure led by at least one key researcher of international standing; 7) leveraging contracts, raising profile, and making small gains in securing institutional support, sponsorship, and funding; and, 8) extrapolation of new ideas will result from understanding applications that may be very different from an individual researcher's specific domain area.

6. CONCLUSION

The SEPIA programme had as its primary aims to develop and refine the SoDIS process and supply supporting tools while working with a broad group of collaborating partners and companies. Currently, this process is being refined and disseminated through teaching, practice partnerships, laboratory testing, and field use. This collaborating group of partners has begun to apply SoDIS to new and existing software development processes, has incorporated its concepts into the development of classroom material and tutorials, and has actively linked teaching and research practice within and beyond the NACCQ sector. So it is argued that the SoDIS process has been successful in developing synergy in the trinity of teaching, research, and practice. Scholars have noted the complex environment within which industry, government, and academia interact and have investigated a variety of approaches for this interaction (Anderson, 2001). These researchers have concluded, in the words of Slaughter and Leslie (as quoted in Anderson, 2001), that while "the magic mix of basic, applied, and commercial [may be] elusive," the SEPIA programme appears to have hit upon a research model that, while not yet perfect, is working to bring these three divergent areas together with mutual benefit for all partners involved.

7. ACKNOWLEDGEMENTS

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8. INVITATION

The authors wish to emphasise that this is an open research programme, and interested parties who share the aims of the SODIS SEPIA initiative are very welcome to join, by contacting any of the authors.

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