Refining the SoDIS® Process in the field: A COTS Project as a context for Risk Analysis

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ABSTRACT

In this paper we review the findings from an Industry collaborative research project. Software Development Impact Statements (SoDIS) have been applied to risk reduction and quality improvement in a software project using commercial off-the-shelf software (COTS). The paper demonstrates how through two different applications of SoDIS inspections in the field, a "better practice" model for SoDIS inspections has resulted. Use of the SoDIS process has served to highlight critical risk management issues for consideration by both project managers and clients, even when implementing established commercial software. The metrics gathered demonstrate the viability of the SoDIS Inspection process as a risk assessment and quality improvement strategy even for COTS projects.

Keywords

Software Development Impact Statements, COTS, Requirements Engineering, Risk Management, Software Engineering Ethics Research, SoDIS Analysis, Collaborative Practice Research.

1. INTRODUCTION

Research into the use of Software Development Impact Statements under the umbrella of the Software Engineering Practice Improvement Alliance (SEPIA) (Clear *et al.*, 2003) in New Zealand has been ongoing since 2001.

SoDIS research has developed into an active programme involving academics, researchers, industry partners, software developers and those affected by software in New Zealand. Industry partners have assisted with testing and refining the SoDIS concept and its associated inspection process (Gotterbarn, Clear and Kwan, 2004; Clear, McHaney, & Gotterbarn, 2003).

In this paper, the development of the SoDIS process through collaborative research undertaken with two industry partners in NZ is reported. The first project undertaken with a company called NZ* (for reasons of anonymity) has been reported in Gotterbarn *et al.*, (2004) and will be described only briefly. The second project involved implementing a commercial off-the-shelf (COTS) application in the Healthcare industry. This project will be reviewed here in more depth. The results of both projects clearly demonstrate that the application of the SoDIS process can improve the quality of the project scoping, requirements analysis, project management and risk assessment processes. This research supports the key SoDIS premise (Gotterbarn, 2001) that a preliminary SoDIS analysis can alert project managers to a broader range of stakeholders and expand the range of risks considered for these stakeholders, leading to a more thorough risk assessment. The SoDIS Inspection process has been progressively refined in the field. The metrics collected from the second industry collaboration project here indicate, that a SoDIS inspection can be successfully conducted within a short duration and in a cost-effective manner, addressing concerns raised by some industry partners.

2. THE RESEARCH APPROACH USED

Both projects used a form of "practical action research" (Carr and Kemmis, 1983), aimed at

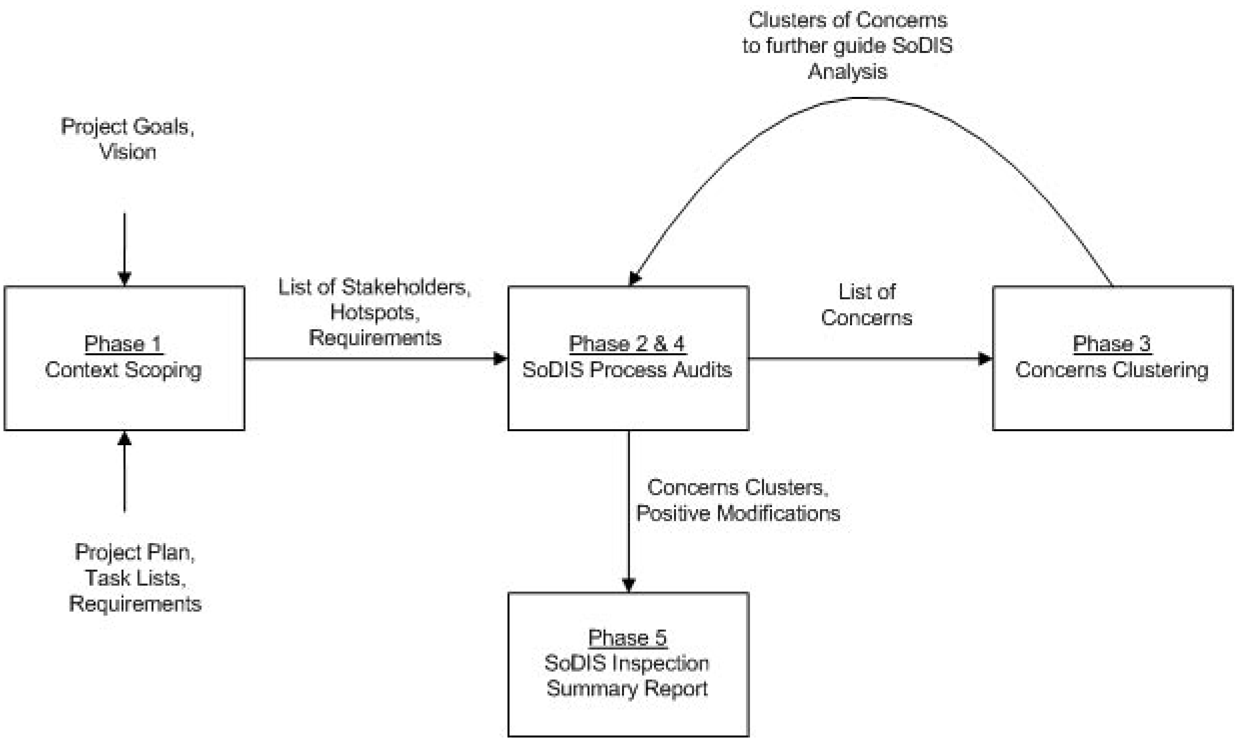

Figure 1. The SoDIS Inspection Process

improving software engineering practices. An action research model aims to improve the practices of individuals or groups of practitioners, and to develop practitioners' understanding of their practice and of the situations in which practice occurs. The research has proceeded along a four-step cycle of planning, action, observation and reflection. At the completion of each cycle researchers take stock of progress with practitioners, reflect upon lessons learnt and feed those through into design of the next action cycle. This research model has much in common with the "collaborative practice research" of Mathiassen (2002), in which practice studies of interesting or surprising cases provide insights. Such studies are "both practice and research driven and they serve general knowledge interests as well as knowledge interests that are specific for the participating organisations" (Mathiassen, 2002).

3. THE FIRST INDUSTRY PARTNER COLLABORATION PROJECT

The first collaborative research project was undertaken in late 2003 with an industry partner whom we will refer to as NZ*.

NZ* wanted to revamp its core statistical collection and reporting system as well as redesign its web based interfaces for use by both internal staff and external customers.

The team commenced work in Dec 2003 and completed the analysis in Mar 2004.

For the NZ* project, the team proceeded by looking at the key tasks within the overall project plan of NZ*. A prototype version of the SoDIS Project Auditor (SPA) CASE tool was used. This case tool is available for downloading from the Software Development Research Foundation website (SDRF n.d.).

The SoDIS Inspection process, first used in the NZ* analysis and repeated for the second project, consists of 5 phases (Gotterbarn, Clear & Kwan, 2004), cf. Figure 1. The actions taken under each of the five phases will be described under the Second Industry Collaboration Project.

3.1 RESEARCH INSIGHTS FROM THE FIRST PROJECT

The SoDIS analysis in the NZ* project yielded a total of 29 significant concerns and 10 minor concerns. The concerns clusters identified included Data Integrity, Database Design, Project Management, User Interface, and System Design. The analysis also identified several additional stakeholders who were not factored into the overall project plan and requirements analysis by the project manager. Several of the previously unnoticed items identified had the potential to harm their customer base. As a result of these findings, the Project Manager altered the overall project development strategy to deal with the concerns raised. The findings for NZ* demonstrate the efficacy of the SoDIS process in practice. The project manager expressed surprise that the team could come up with such a specific set of findings, given that we had limited information to work from.

4. BARRIERS TO SODIS USE IDENTIFIED FROM FIELD TRIALS

From the first industry collaboration and other field trials applying the SoDIS process, some issues had been identified which constituted barriers to its take-up by practitioners and its viability in a practice context.

The general reluctance of software development practitioners to undertake solid risk assessments or build them into their development lifecycles in other than a cursory manner, was a key barrier. Thus the SoDIS process had to be easy to understand and use, relatively efficient and deliver demonstrable benefits.

Four more specific barriers to use were identified:

1. The large number of stakeholders, tasks and questions involved in a project of any size generated an enormous number of questions for the analysts to iterate through

2. The process of answering the questions posed by the SPA tool required too much elapsed time to conduct

3. The audit phase of the Inspection process was tedious – "intellectually numbing" - (Gotterbarn, Clear & Kwan, 2004) and demanded too much of the analysts, so it could only be conducted in brief analysis sessions

4. The overall process required too much work effort and thus would prove too costly for a risk assurance consultancy to implement and "sell" to its clients (this view was shared at the December 2004 SoDIS symposium in Auckland)

The field trial of the SoDIS process discussed below attempted to address these barriers. It sought to quantify the issues above, while seeking to improve the inspection practices, and investigate ways to implement a SoDIS inspection in a relatively 'lightweight' form.

5. THE SECOND INDUSTRY PARTNER COLLABORATION PROJECT

5.1 Project Terms of Reference

The qualitative risk analysis (SoDIS inspection) was commissioned in early December 2004 by Stuart Simpson of Eagle Technology, on behalf of their client Baptist Action Trust (BAT). The SoDIS inspection was conducted by AUT researchers, in conjunction with Stuart Simpson (a co-author of this paper), in a form of "collaborative practice research" (Mathiassen, 2002).

The system was to automate Homecare rosters, time and travel payments for Homecare workers, the billing of Homecare clients, rostering of Healthcare workers at two Hospitals and a Rest Home, wage payments to staff at these sites by timesheet entry and electronically transmitted to the Datacom payroll processing Bureau, other client billing, and the transfer of General Ledger transactions to the BAT corporate system.

5.2 The SoDIS Inspection Process

We will now describe in detail the analysis performed and the actions taken during each of the 5 phases of the SoDIS inspection process.

5.2.1 Phase 1 - Context scoping

In this first stage of the inspection process, initial discussions were followed by two relatively brief interviews with Stuart Simpson, supplemented by follow-up email correspondence for clarifications. Miscellaneous project related materials were provided, (flowcharts, brochures, draft project plans, proformas for business fit analysis, schedules of services, copies of paper forms for interviews, consents, authorities, payments, service plans, and agreements). These were perused by a team of analysts in deriving the initial context for the project risk assessment. The AUT risk assessment team did not sight a full project charter, a requirements specification document, or documentation outlining the detailed functionality provided by the application packages which BAT had already selected. There may have been significant gaps in the knowledge possessed by the team. The risk assessment inspection process was introduced rather later in the project than would normally have been the case as a solution for the BAT requirements had been selected, and with implementation planning already underway.

The process followed in this stage comprised;

- A preliminary meeting with Stuart Simpson and the Online Business Management (OBM) project development team to discuss the proposed implementation schedule. OBM was engaged to implement a packaged software solution in this project.
- A meeting between the AUT risk assessment team and Stuart Simpson to discuss a SoDIS audit, with a follow-up session by the risk assessment team to debrief and clarify the notes taken at the meeting. During the meeting, Stuart presented his vision of the system and how he saw it working.
- A further meeting between the AUT risk assessment team and Stuart Simpson to clarify the context and requirements.
- A follow up session by the AUT team to strategise. The team went through a re-cap of Stuart's vision, laid out strategies on how to do the analysis, as well as a process of involving Stuart to double check whether the interview team had 'heard him right' and had correctly analysed his vision.
- A session to discuss the context of concerns and to develop a stakeholder list.

The result of this stage of the analysis was a "Context of Concerns" document. This document served to identify potential "hotspots" or areas worth special attention in the SoDIS audit phase. These 'hotspots' were further categorised, and cross-referenced with the BAT requirements.

5.2.2 Phase 2 - SoDIS Process Audit

The input to the SoDIS audit phase was the context scoping document, the set of project requirements and the grouped list of stakeholders with an interest in the project, developed by the risk assessment team. Stakeholders and stakeholder groupings included:

- The customer (BAT)
- 13 stakeholders in the stakeholder group 'User'.
- Three in the stakeholder group for BAT clients
- One in the group 'Volunteers'
- Two in the group 'Concerned Parties'
- Five in the group 'Funding Agencies'
- Three in the group 'Community'
- Three in the group 'Vendor'
- Three in the group 'Project Team'
- Two in the group 'Support Services'

The stakeholders and requirements were entered into the requirements analysis section of the SPA CASE tool. Analysis proceeded by the team, working in pairs or threes. Like pair-programming, working in teams helps to focus attention and reduces errors of omission (Cockburn & Williams, n.d). The team cycled through a series of ethical questions presented by the CASE tool driven by each requirement statement, and considering the potential impacts on each stakeholder in turn. The "Context of Concerns" document guided this audit by enabling the team to focus on a small subset of the requirements; one overall project perspective, and four key requirements.

5.2.3 Phase 3 - Concerns Clustering

The list of concerns arising from the SoDIS audit was then clustered into their main groupings. This process, following the Delphi pattern (cf. Addison, 2003) tested on the NZ* project, consisted of each team member independently deriving clusters or detailed coding with partial clusters identified, then meeting to reconcile their findings and produce a combined list. The primary clusters identified are listed in the following section 'SoDIS Inspection Outcome'.

The culmination of this phase was a list of concerns presented in a Cluster Breakdown Structure and ordered by criticality.

5.2.4 Phase 4 - Cluster-guided SoDIS Process Audit

The clusters of concerns were briefly inspected to identify any potential omissions or areas warranting additional focus, and to enable a decision to be made whether a further cycle of audit was warranted. Given the extensive analysis already undertaken, the team felt that the risk assessment was relatively robust and should contribute to the project as it stood without the delays that a further cycle might incur. Given the imminent commitment to the implementation it was important to provide a rapid but robust result.

5.2.5 Phase 5 – SoDIS Analysis Summary

On completion of the cluster guided SoDIS audit, a final list of clustered concerns and a set of positive project modifications were collated and an inspection report was finalised. The final report was delivered to Stuart Simpson and the Eagle team at the close of that same week.

5.3 SoDIS Inspection Outcome

The team had identified 16 critical concerns, 106 significant concerns, and 2 minor concerns for the project to take into account. A few of these concerns were more in the nature of questions where the team lacked local knowledge to make a judgment as a site visit was not undertaken.

The team categorised the concerns into four main clusters as follows:

- Overall project cluster. For example; issues concerning the overall project implementation and the needs of all stakeholders; issues that may result in Supplier, Consultant, or Developer intervention; issues to do with clarity of the scope of project goals; issues that may cause confusion to all stakeholders; and issues that may cause support service intervention, additional installation and processing costs, or additional work to stabilise business processes in the event of project breakdown.
- Administrative, legal or regulatory cluster. Such as; issues concerning administrative processes, legal requirements, and conformance to regulations and professional standards; issues that may cause potential loss of control of operation and service; issues that may cause significant overtime and expenditure; and issues that may cause conflicts and inaccuracies in time rosters and time payment errors.
- Data security, privacy and accuracy cluster. Issues concerning security, privacy, and accuracy of data within both data storage and data transmission, and issues concerning data integrity and reconciliation and the possible resultant downstream effects.
- Quality of end user service delivery cluster. Issues relating to interruptions to or degradation of service delivery caused by possible conflicts and contradictions within the proposed solution and its implementation, and issues relating to user dynamics, professional responsibility, and the critical nature of service delivery to BAT clients.

Where the AUT risk assessment team were able to derive solutions for concerns, or positive modification suggestions, these were presented in the report. For example:

- Ensuring a managed data conversion process with careful plans for checking data accuracy and completeness
- Ensuring that adequate security protocols are in place and that the technology supports BAT policies and procedures
- A clear procedure for off-line adjustments to the automated business processes and ensuring total accuracy within both automated and off-line processes
- Confirmation that the application meets regulatory constraints and will detect clashes in the rostering
- Ensuring that business processes are designed to complement automated systems (and vice-versa), and the change process is adequately managed

5.4 Customer Response to the Risk Assessment Report

The initial response by Stuart Simpson and the team at Eagle Technology was that they were “blown away” by what the AUT risk assessment team had delivered, especially without a site visit to any of the user sites. While a number of changes to the project and its context had occurred in the meantime, the results of the

Table 1. Metrics Related To Each Of The Identified Issues

Issue Identified	Metrics from the Inspection	Finding
Enormous number of questions to iterate through	36 stakeholders 29 requirements 32 ethical questions (max no. questions = 33,408) 5 requirements (17%) analysed (questions <= 5,760)	Considerably reduced by context of concerns scoping (1 overall + 4 requirements) Considerable further reduction by auto repeat of some questions for each stakeholder, and by having an 'all' stakeholder option & some copy & paste of answers
Excessive elapsed time	2/12/2004 – 23/12/2004 3 weeks	Quite acceptable, given need to constitute team, become acquainted with the project and conduct analysis
Excessive work effort & cost	61.5 analyst work hours $6,150 @ $100/hr	Acceptable in the overall project context (3.8% of project budget)
Tedious	Detailed analysis sessions (3 over a total 7.5 hours in pairs & threes)	Sessions may be a little tedious, but can be limited, and are not the core of the inspection process. Many of the tedium related issues leveled at the usage of the CASE tool will be eliminated once the CASE tool moves from prototype to commercial product.

risk assessment were considered a valuable and highly useable contribution to the success of the BAT project. Stuart indicated that Eagle Technology would be happy to apply the process to subsequent projects.

5.5 Reflections on the Process by Members of the AUT Team

It is fair to state that not all of the AUT team had previously undertaken a complete SoDIS Audit. Hence, more time was taken up on training tasks during some stages than would otherwise be the case for practitioners experienced in this process. Even so, the number of person-hours accumulated was not excessive given the constraints of time and other commitments. A total of 61.5 person-hours were spent on the project by the various members of the AUT team.

The team also encountered some minor issues with the SoDIS tool that can be fed back to the SoDIS development group, along with the team's comments and suggestions for the overall improvement of the tool and its development for commercial use.

The AUT team holds the view that risk assessment is mandatory for any implementation project, and that the SoDIS inspection process works, and works well. The team also holds the view that the SoDIS process and the Inspection model, together with the SPA Case tool, with appropriate modifications arising from the field trials, is an excellent risk assessment analysis method.

6. METRICS

The total time spent on the project by the SoDIS analyst team was 61.5 person-hours. This translates, at a nominal $100 p/hour charge-out rate, into a cost of $6,150. The overall cost of the Healthcare project is in the order of $160,000. Therefore in percentage terms, the amount of effort spent on the SoDIS analysis of the project is 3.8%. This figure is generally considered to be modest compared to the typical amounts charged by certified consultants for formal risk assessment of IT projects. One study indicated that in the financial industry sector, the amount spent on risk assessment is as high as 9% (Kalita, 2003).

Table 1 maps actual quantitative metrics from the BAT project to the qualitatively perceived barriers to adoption of the process identified in earlier SoDIS analyses.

The metrics gathered from the second industry collaboration project indicate that it is possible to conduct the SoDIS Inspection in a lightweight manner to directly address concerns of industry partners that the SoDIS inspection can be too lengthy and hence too costly to undertake. It should be noted that the metrics presented above are quantitative measures on the time and effort of conducting a SoDIS Inspection. They represent the cost side of a typical cost-benefit analysis. The benefits of SoDIS Inspections in identifying the risks at an early stage of a product development life cycle and mitigating the effects of those risks, have been demonstrated in these cases by the range of concerns able to be surfaced early in the project development, and the positive feedback from the project managers in each case. The interest in further use of the SoDIS process at Eagle Technology is further confirmation of its value. A fuller cost benefit analysis for the process awaits the results of further research (McHaney, 2004).

7. CONCLUSIONS

Given that the teams in both projects have very limited domain knowledge of the two development projects and could produce a reasonable and actionable risk assessment, the results above demonstrate the value of a SoDIS inspection as a relatively 'lightweight' risk analysis technique. The metrics highlighted above have quantified the actual effort involved in a SoDIS inspection, which in themselves contain some overhead reflecting a learning curve on the part of the analyst team.

These findings further serve to refute the previously raised barriers to the SoDIS inspection process. With careful scoping during the context of concerns phase, and the use of a project requirements list as input to the inspection process, the number of questions to be addressed may be considerably reduced. Obviously this reduction must be carefully undertaken, but there is scope during the inspection process to incorporate additional requirements considered to harbour project risks. In practice the detailed exposure to the project impact at a stakeholder level which arises from a SoDIS inspection, will lead the analyst team to any areas in which risks may have been overlooked. So the process of focussing on a subset of questions does not detract from the overall rigour of the process and keeps the analyst team focused and sharp. If there is concern that mission or safety critical issues may be missed a full SoDIS audit can be commisioned.

The authors are now more confident in the efficacy and relative efficiency of the SoDIS inspection process, and believe it is reaching a stage of stability where it can be productively applied in a variety of commercial software projects, and specifically COTS projects as highlighted in this study.

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