Information Systems Development Practice in New Zealand

Hazel Taylor

Information Technology Department
The Waikato Polytechnic
Hamilton, New Zealand
ithat@twp.ac.nz

ABSTRACT

Systems analysis and design textbooks present a variety of techniques that may be used in the development of information systems. Most of these textbooks focus on the use of some sort of system development methodology to govern the procedures and phases of the systems development process. But are any of these methodologies being used in New Zealand? Over the past four years students in a third year undergraduate systems development course have investigated the real-life practice of a variety of New Zealand organizations involved in software development with a view to determining how closely New Zealand organizations apply the textbook prescriptions of systems development methodologies.

The results show that New Zealand software developers tend to take a fairly ad hoc approach to systems development. While most organizations studied did adhere to an overall framework similar to the traditional waterfall model, none followed a prescriptive methodology "to the letter". All the developers contacted regarded the traditional SDLC as a useful guide, to be varied according to the context of the development, the type of project, and in particular, the client's budget.

1. INTRODUCTION

With the growing demand for high quality information systems in organizations, strategies for the development of these systems have become increasingly important. A review of the literature reveals a growing concern among overseas researchers that current development methodologies have been based on a misguided attempt to systematize development practices before we have fully understood the nature of the processes involved (Avison & Fitzgerald, 1995). This concern has led to calls for more research into actual practice, to investigate how *real* information systems are developed in *real* organizational situations. (Bubenko, 1986; Wynekoop & Russo, 1995; Wynekoop & Russo, 1997). Here in New Zealand, Pastor Urban and Whiddett (1996) have reviewed the use of various development methodologies reported by New Zealand firms, but have discovered little about the actual practices and techniques our practitioners apply to cope with the rapidly changing nature of systems and organizations.

This paper presents the findings of a preliminary, exploratory investigation of actual system development practices in New Zealand organizations. Systems developers from 32 organizations, mainly in the greater Waikato area, have been interviewed over a four-year period, with the aim of investigating their use of

information system development methodologies, CASE tools, and diagramming techniques.

2. INFORMATION DEVELOPMENT METHODOLOGIES

The use of information system development methodologies (ISDMs) has been strongly advocated in a number of areas. *Standard textbooks*, both for management and computer system students promote the use of a systematic, methodological approach for the development of information systems (Hoffer *et al*. 1996; Laudon & Laudon, 1996; Whitten *et al*.1994). *Researchers* have promoted the use of methodologies for improved project management and control, better quality product, reduced maintenance costs of the completed system, standardization of the development process, and opportunity for re-use of programs and code (Avgerou & Cornford, 1993). *Governments and regulatory bodies* also contribute to the drive towards the use of methodologies. US and European governments require or strongly recommend the use of established development standards or methodologies for systems development in public and private sectors (Avison & Fitzgerald, 1995; Fitzgerald, 1996). In NZ, a guide to best practice in the provision of information systems produced by the State Services Commission states that "all IS organizations undertaking systems development should have a systems development methodology" (P A Consulting Group, 1992).

With such a major 'official' emphasis on the use of ISDMs, we might expect that formal methodology use is widespread. However, the picture in practice is somewhat different. Despite the growing body of literature promoting the use of ISDMs, their application has been relatively slow. The use of commercially marketed ISDMs both overseas and in New Zealand is still limited, although many organizations claim to follow their own 'in-house' methodologies (Hardy *et al*, 1995; Pastor Urban & Whiddett, 1996). We also know little about how ISDMs are actually used in practice (Wynekoop & Russo, 1995; Wynekoop & Russo, 1997). Studies on methodology use have typically identified the *extent* of methodology usage, rather than *how* methodologies are used (Wynekoop & Russo, 1997). For example, overseas and New Zealand studies (Hardy *et al.,* 1995; Jenkins, Naumann, & Wetherbe, 1984; Pastor Urban & Whiddett, 1996) report extensive customization of methodologies, but shed little light on how, when or why such customization takes place. Indeed there is evidence to suggest that many organizations adopt methodologies more in form than in substance, and the actual development process follows a much more ad-hoc route (Fitzgerald, 1996; Fitzgerald, 1997; Hsia, 1993). Baskerville *et al.* (1992) go even further, and argue that information systems development, in practice, is becoming "amethodical" i.e. developers continually modify their practices during the development process to accommodate the emergent and therefore changing nature of the organization they are working with.

3. DIAGRAMMING AND DOCUMENTATION TOOLS

In parallel with the 'official' emphasis on ISDMs has been an increasing promotion of the use of various diagramming techniques, and CASE tools for developing system specifications and documentation, and in some cases generating program code (Avison & Fitzgerald, 1995). Once again the use of such techniques is prescribed as a standard development approach by major textbooks for information systems, computer science and management students (Hoffer *et al.,* 1996; Laudon & Laudon, 1996; Pressman, 1992; Whitten *et al.*, 1994). Most commercial ISDMs specify a set of diagramming techniques, often utilizing a CASE tool, for modeling information requirements and developing specifications for design and implementation of the new system (Finkelstein, 1992). These diagramming techniques typically include context diagrams, data flow diagrams, entity relationship models, and structure diagrams, supported by comprehensive documentation in the form of data dictionaries and requirements and design specifications. However, as with the application of ISDMs, the use of these techniques in practice is not as clear. Researchers report varied use of the most common techniques included as standard in major textbooks, and in New Zealand, Pastor Urban and Whiddett (1996) found most organizations reported a use of diagramming tools which was not consistent with the ISDM they claimed to have adopted.

With such strong 'official' sanction for the use of formal ISDMs and associated diagramming techniques, and with such a confused picture of their actual application in practice, there is clearly a need for in-depth investigation of what is actually happening in practice and why. Such an investigation will contribute to a better understanding of the information systems development process, and the factors influencing practitioners in their choice and application of ISDMs. This improved understanding will be a first step towards making improvements both in practice and in the teaching of

systems development processes. The present study is the first step in such an investigation, and as such, is designed to shed some light on actual development practices in New Zealand and how these compare with textbook prescriptions.

The remainder of this paper is presented as follows. First a description is given of the method followed for this investigation, and then results are reported. These results are discussed in the final section together with comments on the limitations of the present research and suggestions for future areas of research.

4. THE STUDY

System developers from New Zealand organizations carrying out software development were interviewed by students studying a third year undergraduate course in systems development, analysis and design, The purpose of the interviews was to investigate what use is made of formal development methodologies, diagramming techniques and CASE tools in New Zealand organizations involved in software development. The students were required to identify a suitable firm, and a contact within the firm, and arrange an interview. The interviews were semi-structured, with students planning their own interview protocols, along guidelines provided by the instructor. In all cases the students asked their contact to start by focussing on the last major project that he or she was involved with, and to describe the steps taken to complete this development. The students then broadened the focus of the interview to establish whether this was a typical project, and whether the processes described for this project were representative of the usual software development process followed by the organization.

A total of 26 organizations have been interviewed over a four-year period. Most of the organizations (17) have been in the greater Waikato region, with the remaining 9 being situated in the Auckland (6) and Wellington (3) regions.

Of the 26 organizations interviewed, 17 were software development houses, while the remaining nine were internal departments servicing the IS function of their organization, as shown in Table 1. The software development houses can be loosely broken down further into the following categories: five were firms focused on supporting and enhancing existing vertical market software packages; six specialized in custom consulting and development work; three specialized entirely in web site development; and the remaining three were developers of highly specialized technical software. None of the firms can be considered large by international standards. However one of the custom consulting firms

Table 1: Reported use of methodologies

Type of Firm	Type of Development	Methodology			Total
		Formal	Informal	None	(reported)
	Support/enhance vertical market s/w packages	1	1	2	4
S/W Development House	Custom consulting and development	1	6		7
	Web site development	1	2		3
	Specialized technical s/w development		1	2	3
Internal IS Department		4	5		9
TOTALS		7	15	4	26

was a New Zealand branch of an international software and hardware development organization, and four of the internal departments supported national manufacturing or service organizations. At the other end of the scale each of the categories contained one very small firm or department consisting of four or fewer staff in total.

5. FINDINGS

5.1 Use of methodologies

Seven of the 26 firms were reported as having a formal methodology (see Table 1). These seven comprised the NZ branch of the international firm, which used the ISDM prescribed by its head office in the United States; all four of the internal departments supporting national organizations, one of which used a purchased commercial methodology, while the other 3 used 'in-house' methodologies; one of the vertical market software houses, and one of the web site developers, both of which had developed 'in-house' methodologies. The extent to which these formal methodologies were actually strictly followed by the developers within the organization varied considerably. All six firms reported some variance depending on the project type and complexity. However, two of the internal departments appeared to pay 'lip service' only to their in-house methodology. The interviewee from one of these firms reported that the normal instruction to a new staff member was "read the book and then throw it away". In the other internal department, the in-house methodology had been developed and was prescribed by the IT General Manager, supervising three information technology sections. The interviewee, who was the software development manager of one of the three sections, reported he was 'focussed on outcomes, not the processes to achieve them" and did not support or encourage the use of the methodology by his staff (Table 1).

Of the remaining 20 organizations, all except three reported using some kind of informal framework to guide their development processes, usually involving an adaptation of the waterfall model, and heavy reliance on prototyping. In particular, two of the custom consulting software houses reported they would use methodologies as requested by their clients, and that the clients' willingness to pay was the ultimate determinant in whether, and the extent to which, a particular methodology, and its related documentation requirements, would be followed. All of these 20 firms reported a very ad-hoc approach to the development process, depending on the client's requirements, the complexity of the project, and

the time frame. In all of these cases, although an informal framework was used to guide the processes followed, there was very little attention paid to any documentation, either of the processes or of the system being developed. Usually a requirements specification would be developed, although four of these organizations reported their requirements specifications as being 'very informal'. Any diagrams used during the analysis and design stages were generally brainstormed on a whiteboard, and not recorded. All of these 20 organizations appeared to rely on the program code itself to provide final documentation of the system, and any user documentation was only developed if requested by the client.

The four firms that reported having no methodology at all comprised two of the vertical market software package suppliers, and two of the technical software developers. Students interviewing one of the technical software developers noted that even though their contact reported following no methodical process, his description of the development at his firm loosely followed a typical waterfall model with prototyping. However the other technical software development firm reporting no methodology, appeared to indeed follow no process at all. This firm was focussed on obtaining patents for new and creative applications, and staff were encouraged to proceed in whatever way they felt comfortable. The only management directive appeared to be: "get the work done as fast as possible and as cheaply as possible". The two vertical market software suppliers with no methodologies also appeared to be focussed on developing new releases of their packages as quickly and as cheaply as possible. One of these firms had a policy of providing no documentation at all – either written or on-line – instead relying on telephone support to deal with all client problems. The justification for this approach was cost effectiveness. The other vertical market software firm had an over-riding imperative of achieving a new release of their package every six months, and this time frame was considered incompatible with any methodical approach to development.

It is interesting to note that all of the four firms/departments identified earlier as being very small (less than four staff) reported using an informal framework to guide their development processes.

Use of CASE tools and diagramming techniques

Only two organizations (both using formal methodologies) reported using a CASE tool for full support of the development process, including some code generation. 12 other firms reported using a CASE tool occasionally as a drawing aid.

Firms generally appeared to use diagramming techniques on a very ad-hoc basis. Twelve organizations (less than half of those investigated) reported using data flow diagrams, and of these twelve, eight reported using data flow diagrams only occasionally during brainstorming sessions on a whiteboard. In these cases no formal record was kept of the diagrams developed. There was a more extensive use of entity relationship diagrams with 17 organizations (nearly two thirds) using these diagrams. Again however, 11 of these firms only used entity relationship diagrams during brainstorming sessions and did not formally record their diagrams. Other diagramming techniques reported included flow charts (five firms) and structure charts (eight firms).

In general, as might be expected, the firms with formal methodologies also reported a more formal use of diagramming tools. However only the New Zealand branch of the international development firm appeared to use a consistent set of tools associated with their methodology on a regular basis.

6. DISCUSSION

This paper reports the results of a preliminary investigation into the actual practices of New Zealand software developers. The results suggest that New Zealand organizations tend to follow an ad-hoc and pragmatic approach to software development. The results support to some extent Pastor Urban and Whiddett's (1996) findings that ISDMs are more likely to be used by larger organizations. However the findings in the present paper raise questions about the extent to which developers even from the larger organizations actually follow their prescribed methodologies. The "lip-service" approach reported in two of the firms with prescribed in-house methodologies supports the suggestion made by Baskerville *et al* (1992) that the real picture of software development is changing and emergent, to allow flexibility to adapt to the unique characteristics of each project. Here in New Zealand, developers' use of methodologies seems to be particularly contingent not only on the type and complexity of the project, but also on the client's expectations and willingness to pay.

Since this research is only the first, very exploratory stage of an on-going investigation, it is not surprising that it raises more questions than it answers. A strong reluctance to use methodologies as a prescription for software development was noted by several of the student interviewers. The comments reported from some of the developers are illuminating:

"Formal methodologies get in the way of getting the work done - you spend hours following them which is a waste of time." (Custom consulting firm specializing in mid-size corporate and government applications.)

"Methodologies won't achieve what I want - people who think first and look for alternatives." (Internal department supporting national manufacturing firm.)

"We work on the fire-fighting basis - wait till the fire breaks out and then put it out." (Vertical market software firm supporting/enhancing existing package.)

"Costs of documentation outweigh the benefits to the client." (Specialized technical software development firm.)

"Entity relationship diagrams and data flow diagrams limit feedback." (Internal department supporting national manufacturing firm.)

ISDMs were advocated as the answer to problems that had been identified with the systems development process, including cost and time overruns, customer dissatisfaction, high maintenance, and inadequate documentation, (Pressman, 1992), and so more support among developers for ISDMs might have been expected. Since New Zealand developers apparently do not find that ISDMs address these problems, we are still left with questions about what strategies, if any, our developers use to address these problems. Further in-depth research is planned to investigate how systems developers in New Zealand deviate from the ISDM recommended by their organization, and what alternative actions they take to achieve desired results. In particular, in-depth case studies are planned with the organizations that have been reported here to have some inconsistencies between their prescribed methodology, and their actual application of it, to investigate why the developers deviate from the recommended ISDM and what impact these deviations have.

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