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Abstract

This paper compares the results of industry surveys of system development practices undertaken in Australia in 1994, and the United States in 1993 as part of an international IS quality benchmarking exercise sponsored by Ernst & Young. The paper reports on the penetration of leading practices and development technologies, and the perceptions of their value. It concludes that while there are many similarities between the two countries, Australian organizations are adopting most practices at a slower rate than US organizations. The exceptions are Business Process Re-engineering, Relational Database and Client Server Architecture which are taking off very quickly in Australia. In both countries practices providing the most value are use of a systems development methodology, structured development methods, cross functional teams, and prototyping. The least valuable are software engineering and software process assessment practices, although the use of these is growing significantly in a subgroup of American organizations, where they are perceived as quite valuable.

Introduction

A number of recent studies of the most important issues facing Information Systems (IS) managers have indicated that the quality and productivity of systems development processes are primary concerns (Broadbent, Butler and Hansell, 1994; Niederman, Brancheau and Wetherbe, 1991). Consequently, an issue of critical interest to both IS practitioners and academics is which of the many competing practices and technologies are most effective in bringing about improvements in the delivery of information systems.

The IS discipline has a history of producing new methods or techniques which are heralded as the solution to ongoing problems and the so-called software crisis (Arnott and O'Donnell; 1994, Brooks, 1987). Many of these IS process innovations have failed to live up to their original promise (Fichman and Kemerer, 1993). Consequently the risk of adopting new practices or technologies is high. Few of the methods offered to industry have ever been empirically validated, and even when methods have been evaluated, the nature of the validation process means that conclusions are often applicable only to narrowly defined situations (for examples see Verschoor and Low, 1994; Dekleva, 1992; Jenkins, Naumann and Wetherbe, 1984; Vessey and Weber, 1984). There are also many factors working against large scale validation of practices, including the fact that to run projects or activities in parallel so as to vary the method used in a scientific way is rarely possible.

An alternative approach to empirical evaluation is to survey IS managers about their perceptions of which IS practices and technologies are most likely to lead to improved quality and productivity. Further information can be obtained by asking which are the ones respondents themselves have chosen to employ; and what impact these practices have had on their systems development activities. This is the approach adopted in the studies reported in this paper.

Our paper reports on the experiences of senior IS managers in Australia and the United States (US). It is based on a national survey of Australian system development practices conducted by the authors in 1994, and on a corresponding survey conducted a year earlier in the United States (Ernst & Young/SIM, 1994). Both surveys were undertaken as part of an international benchmarking exercise sponsored by Ernst & Young's IT division.

Surprisingly there have been few studies of this nature published in the academic IS literature. One of the problems in getting responses to surveys of this kind is that the IS technologies and practices used by an organization are a very important aspect of its competitive strategy. For this reason, many organizations may not wish details of their practices, or more importantly their *success* with these practices, to be divulged. Consequently although a number of consulting organizations such as the Gartner Group and Butler and Cox do conduct such surveys, their findings are only available to particular subscriber organizations.

The literature does include a number of surveys canvassing IS manager's beliefs about the key strategic issues facing them (for example Watson, 1988; Niederman, Brancheu and Wetherbe, 1991; Badri, 1992; Doukidis, Smithson and Naoum, 1992; Pervan, 1994; Wang and Turban, 1994), but by definition these are predominantly concerned with high level, and long-term issues, and the relationship between the IS division and its parent organization. It is only in passing that they

address what Boynton, Zmud and Jacobs (1994) refer to as the *operational level* of system development practices. Some information about IS practices can be gained from surveys of this kind, though. For example Broadbent, Butler and Hansell (1994) have indicated that client server technology is seen as one of the most important IS technological developments by Australasian IS managers, and that BPR is considered one of the top four important management trends by the same group. In a similar vein, Doukakis et al (1992) reported that only 30% of Greek companies used specific IS development methodologies.

The IS literature also includes a number of investigations of the extent to which individual practices or technologies have been adopted (for examples see Necco, Tsai and Holgeson, 1989; Doke and Myers, 1987) but these don't usually consider the practice or technology in relation to the range of others which compete for IS management's attention.

Of the few more general surveys of industry practices in the academic literature, several which were undertaken in the 1980's are now, because of the rate of change in IS process innovations, becoming dated (for example Kievit and Martin 1989; Necco, Gordon, and Tsai, 1987; Carey and McLeod, 1988; Jenkins, Naumann and Wetherbe, 1984). One recent survey was undertaken though by Jones and Arnett (1993), who administered a questionnaire in 1992 to US systems analysts working in 'complex large-scale systems development projects'. Their survey (with 91 respondents) found that the most predominant tool used by surveyed analysts was still flowcharting. Jones and Arnett also found that only 36% of analysts used structured analytical tools like DFDs extensively, noting that this was still an increase over the findings of the earlier studies by Keivit and Martin, and Carey and McLeod. Another pertinent finding was that in 1992 only 30% of respondents were using CASE tools, despite the promises made for this development technology. Jones and Arnett noted that this was consistent with other studies.

Clearly the diffusion of system development methods and technologies into mainstream practice is an area worth investigating further.

Adoption of New Practices or Technologies

The focus of the studies reported here is the extent to which a range of practices and tools have been adopted in the two countries, and the benefits, if any that are accruing from these. New practices or tools are not always adopted at the same pace, and some promising new tools never move out of a niche market into general practice (Fichman and Kemerer, 1993). A development innovation is always competing with alternative practices and technologies, in the same way that a product competes with alternative products that meet the same needs.

A new IS innovation will normally exhibit the characteristic S curve of the product life cycle, usually referred to as the adoption curve (shown in Figure 1 over page). In the early stages the benefits or values of a practice or technology are still unknown, and there is a high risk involved in adopting it. However early adoption can often reap major strategic benefits, so there are usually pioneering organizations willing to take this risk. As pioneers and early adopters gain experience with a new practice, evidence accumulates about its benefits. Where the benefits are positive, the adoption rate for a successful practice or technology will increase, until it has been adopted by the majority of organizations. It then becomes a predominant practice (or technology), and the rate of adoption slows until all but the most resisted have embraced it. The difficulty for many organizations is to know when the benefits of a new practice are real, and when they are illusory. Arnott and O'Donnell (1994) warn that in the early stages of the IS method life cycle curve there is considerable prosetylising and hype, with many promises made that will often never be realized. This was an issue also canvassed by Brooks in his classic 'no silver bullet' paper (Brooks, 1987).

Whether a practice or technology makes it through all the phase of the adoption curve to become institutionalized will depend largely on the extent to which it delivers benefits over and above those delivered by its competitors: known as its *relative advantage* (Utterback, 1994). This will also affect the rate of adoption, demonstrated by the steepness of the adoption curve. But there are other factors besides relative advantage involved in the extent to which a practice or technology is adopted (Rogers, 1983), including its *compatibility, complexity, trialability* and the extent to which its benefits can be seen (its *observability).* Relative advantage is, however, the most powerful factor, and practices that provide relative advantage, and that have been around a long time will have the greatest penetration amongst organizations. Practices that offer very high levels of relative advantage will also be adopted much more quickly, and hence will show a steeper adoption curve.

Several adoption curves are illustrated in Figure 1 (over page), taken from Everett Rogers' work on diffusion of innovation. From this figure we can see that Innovation I is being adopted at a much faster rate than Innovations II and III.

Survey Method

The Australian study involved a self-report questionnaire developed from the one used in the US study. A pilot survey had been undertaken in 1992 amongst US companies asking them to report on the practices and technologies they considered to be leading ones. "Leading" was defined as those practices or technologies likely to result in higher levels of system quality or

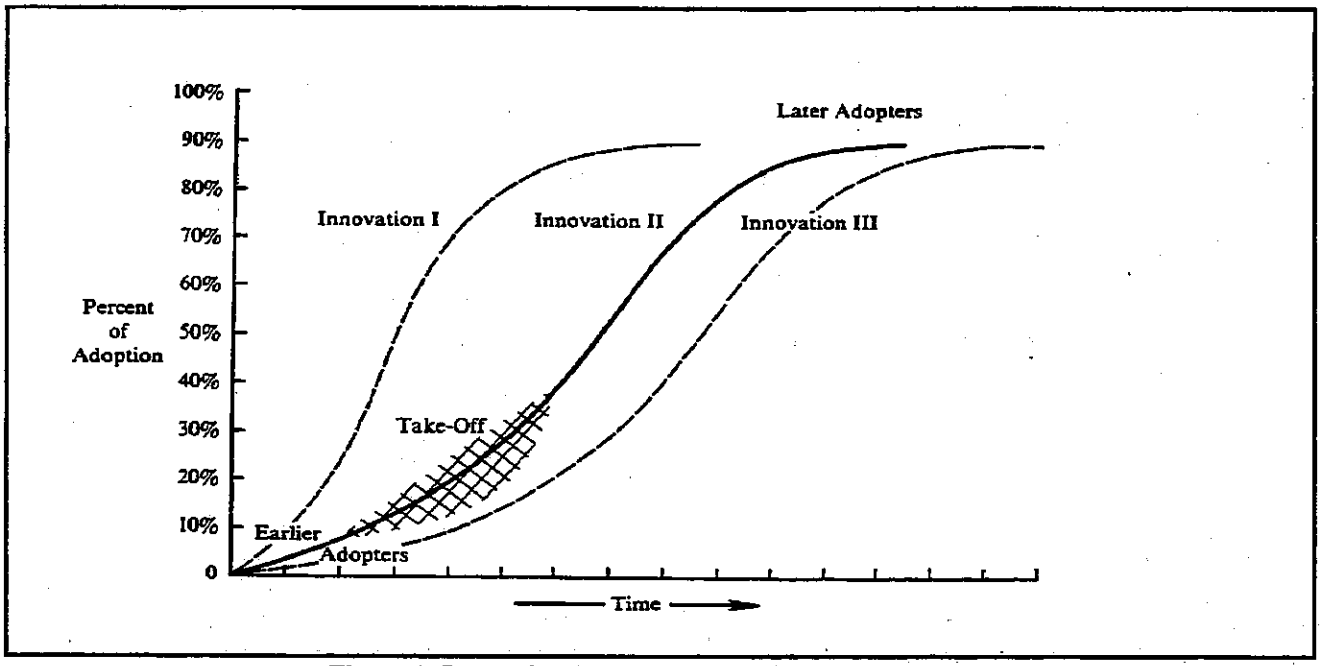

Figure 1: Innovation Adoption Curves (after Rogers, 1983)

productivity, that also had a high level of adoption. This might be adoption within the systems development community generally; within the respondent's industry; or within his or her own organization.

Using this list as a starting point, a survey was developed which asked respondents to provide details about their use of 22 leading practices or technologies, and the significant benefits or improvements, if any, that the practice had provided. Although the survey actually had eighteen questions, the wording of the one most related to the results reported here is shown in Figure 2 below. Respondents were also given the opportunity to add additional practices or technologies not included in the original list. To help increase the reliability of the survey, the questionnaires included a glossary of terms defining what was meant by the various practices or technologies. Researchers interested in the complete survey can obtain a copy from the authors.

The survey also included questions about the relationship between respondents' Information Systems division or department, and the organization it served, as well as a range of demographic questions. Although the Australian questionnaire was based on the US one, there were some minor changes between the two countries, so results for some questions cannot be reported for the US organizations

Respondents

A total of 76 organizations responded to the surveys, 38 in the US and 34 in Australia. The person completing the survey was normally the most senior IS officer within the organization (ie the Chief Information Officer). In

A number of Systems Delivery practices and tools are listed below (see attached glossary for definitions). For each item, please indicate the length of time it has been in use, the percent of current projects that are using it, and the contribution it has made to the performance improvement goals indicated in the columns to the right. **Check the "Value/Improvements" boxes only if the practice has been of significant benefit to this business unit in that particular area.**

			<—— nature of improvements or benefits ——> (check those that apply)					
Practice or Tool	**Number o Years In Use**	**Percentage of Projects Using It**	**Fewer Defects**	**Improved Customer Satisaction**	**Reduced Development Time**	**Reduced Development Cost**	**Reduced Rework/ Waste**	**Other *see Note**
JAD			❑	❑	❑	❑	❑	❑
Client Server			❑	❑	❑	❑	❑	❑
etc			❑	❑	❑	❑	❑	❑

Figure 2: Survey Question on Use of IS Practices and Technologies (Edited)