Information Systems Development: A Conceptual Model and a Comparison of Methods Used in Singapore, USA and Europe

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Organizations, big or small, are still plagued with age-old problems of software development: too much backlog, projects being late and costing more than the budget, implemented systems not meeting user needs, and IS maintenance costs continuing to be very high. A conceptual model presented in this article, argues that, within the context of an organization and specific systems development project, optimal deployment of “people” and “methods” has the potential of alleviating these problems. Several researchable issues emerge out of this conceptual model. This paper then focuses on a comparison of IS development methods used in Singapore, USA, and Europe. For Singapore, a survey instrument was developed, pre-tested, validated and administered to 250 member organizations of DPMA in Singapore. For USA and Europe, existing data from previous studies were utilized. Important findings include: (1) large organizations adopt state-of-the-art methods significantly earlier than small organizations; (2) when comparing use of methods across different countries, organizational profile in terms of size, revenue level, and number of employees is an important intervening variable; (3) proactive planning and strategizing by the governments of developing countries can significantly increase the rate of transfer of state-of-the-art IS development methods from the advanced countries; (4) some differences in use of methods can be attributed to cultural and political differences.

Organizations are faced with identified as well as hidden information system (IS) development backlogs (Yourdon, 1989; and Kendal, 1992). Identified backlogs average 30 work-months. When the hidden backlog (users’ plans which are not even submitted) is also taken into consideration, delays of up to four to seven years have been projected (Yourdon, 1989). In-progress IS development projects are generally behind schedule and/or over budget. According to Laudon and Laudon (1991) some development projects can be as much as 30 percent over budget, eventually requiring 50 percent more time than originally estimated. When completed, as many as 75% of all completed large information systems are operating failures that cannot help the organization meet its quality goals (Laudon and Lauden, 1995). Major problems unfold after the system has been developed and implemented. According to Hussain and Hussain (1988), statistics suggest that 50 percent of data processing budgets are allocated to maintenance. Kendal (1992) suggests the maintenance phase consumes up to 70 percent of all programmer effort. Furthermore, 40 percent of the maintenance effort is caused by errors, and not by enhancements (Rush, 1985). Kendal (1992) also suggests that most of these errors result from problems created in phases prior to programming. Yourdon (1989) supports this contention suggesting that 50 percent of errors and 75 percent of the cost of the removal of these errors can be attributed to errors which occur in the analysis phases. Clearly, the later in the Systems Development Life Cycle (SDLC) that an error is discovered, the more it costs to fix (Boehm, 1981).

To come to grasp with alleviating above problems, we present a conceptual model that emphasizes two key resources for development of information systems — people...
and methods. The “people resource” includes IS professionals and IS users. The “methods resource” is comprised of methodologies, techniques, and tools. Dearth of qualified and experienced people and lack of use of state-of-the-art software development methods contribute to IS development problems. We argue that these resources are the key contributors to the productivity of the IS development process and the quality of the resulting IS. IS development methods being a critical resource, the article, then goes on describe the status of IS development methods in Singapore followed by an international perspective comparing Singapore’s utilization of methods with those in USA. For tools, a comparison with Europe is also provided.

The Model

Given an organizational and IS project context, people and methods are the basic inputs to the systems development process. People in this context are IS developers and IS users. IS developers include project managers, systems analysts, telecommunications specialists, database specialists, and programmers. IS users include end-users and managers from different business departments. Methods include methodologies, techniques, and tools. The definitions of these terms are as described in Palvia and Nosek (1993). Methodology is an organized and systematic approach for handling the system life cycle or its parts. It will specify the individual tasks and their sequence. Technique is a means of accomplishing a task in the system life cycle. Sometimes, it may become synonymous with a task. Tool is a computer software package to support one of more techniques. Figure 1 depicts our model showing relationships between the “people and methods” resources, productivity of IS development process, and quality of the IS product. The focus in IS development has shifted from the first generation when detailed technical knowledge of the internals of computer hardware was required, to the current generation when it is possible to specify what is to be done without the knowledge of computer hardware. Furthermore, in this age of end-user and distributed computing, software development occurs everywhere — in the central IS group, in decentralized business groups, on desk-top PCs, or in different countries where subsidiaries of a multinational corporation might be located. This conceptual model is relatively stable and independent of the continual changes in IS development technology, organizational structure, and business scope.

Focusing on “people resources,” it should be noted that the job roles, job descriptions, required and desirable skill-mix of IS professionals and users have been changing faster than the supply side can cope with. The proposed model suggests that a right mix of people skills on the systems development team can contribute significantly towards improving productivity and enhancing the quality of information systems. “The trend for systems analysts/designers is toward increased knowledge of people and problem-solving skills, and away from developing application software.” (Cheney et al, 1989:335). Cheney (1988), indicates that human relations skills seem more important as a result of increased user involvement. “Systems analysts need to have strong interpersonal skills linked with conceptual thinking ability and an inquiring mind.” (Smith, 1988:14). However, Smith’s research results indicate that systems analysts have a strong technical orientation and a very conservative outlook. (Smith, 1988:14). Hunter (1992 and 1993) suggests that, to improve productivity, systems analysts should be

Figure 1: Conceptual Model—Quality and Productivity in IS Development: Role of People and Methods