Factors Influencing the Success of Computer-Assisted Software Engineering

MARY SUMNER
Southern Illinois University at Edwardsville

The primary objective of this study is to identify the factors that facilitate the successful use of computer-assisted software engineering tools. Both internal integration strategies and external integration strategies are taken into account. Internal integration strategies are related to the compatibility of CASE with current skills, the maturity of software development processes, and support factors. External integration strategies are related to user involvement in systems development activities, user responsibility for project management and control, and alignment of project objectives and business plans. The findings of this study point to the importance of multiple strategies in making the transition to computer-assisted software engineering. Effective communications with users and disciplined software engineering practices are both important factors underlying the success of CASE.

The need to improve the productivity of systems development professionals is one of the motivations for introducing CASE. A number of industry reports show that CASE improves productivity, reduces costs, and results in higher quality software (Perrone, 1988; Orikowski, 1988). One of the major benefits of CASE is the introduction of engineering-like discipline into the systems development process. Another benefit of CASE is the creation of a common repository of design documentation. By providing a single source of project information, CASE enables analysts and designers to coordinate their work more effectively (McClure, 1989).

In summary, CASE tools enable systems developers to build quality, maintainability, and reliability into software. The introduction of design discipline, the standardization of systems development methodology, and the creation of a central repository for design documentation are all major benefits attributed to the adoption of CASE.

With all of the benefits of CASE, most organizations have found it difficult to implement CASE technology. Some of the commonly mentioned obstacles to CASE are cost, resistance by systems developers, and unacceptable learning curve (Yourdon, 1989). Experienced designers feel that highly-structured CASE tools interfere with their job autonomy and creativity (Kull, 1987).

A number of issues, including technology issues, economic issues, cultural issues, and organizational issues complicate the transition to CASE. Successful use of CASE may require changes in the way in which information systems are developed. Managers need to understand the factors which influence the transition to CASE.
Objectives of the Study

The primary objective of this study is to identify the factors which facilitate the successful use of CASE. The factors under review will include “internal integration” strategies and “external integration” strategies.

The internal integration strategies will be related to the maturity of the systems development environment, the overall compatibility of CASE with existing skills, and the internal support of management for the use of CASE. In the analysis of the maturity of the software development environment, the Process Maturity Model will be used as a guideline (Humphrey, 1989).

External integration strategies are related to the extent of user involvement in information systems development activities, the alignment of information systems plans and business plans, and user responsibility for project management and control. Strategies such as Joint Application Development (JAD), rapid prototyping, and the appointment of a user manager as project leader are designed to enhance effective communications with users.

The study will depict the success of CASE in each of four different development environments. These development environments will include four quadrants in Table 1.

The major research question is: What is the success of CASE in each of the four development environments? Do firms with high external integration and high internal integration, for example, make the most successful transition to using CASE in a systems development project(s)? Or does another combination of factors (high internal integration, low external integration) contribute to the successful use of CASE?

Review of the Literature

In the context of this study, the successful use of CASE in a systems development project will depend upon the use of internal integration strategies and external integration strategies. The importance of some of these factors is defined in the research.

<table>
<thead>
<tr>
<th>Internal Integration Strategies</th>
<th>External Integration Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW</td>
<td>LOW</td>
</tr>
<tr>
<td>low int</td>
<td>low int</td>
</tr>
<tr>
<td>low ext</td>
<td>high ext</td>
</tr>
<tr>
<td>HIGH</td>
<td>high int</td>
</tr>
<tr>
<td>low int</td>
<td>high ext</td>
</tr>
<tr>
<td>high ext</td>
<td>high int</td>
</tr>
</tbody>
</table>

Table 1: Four Systems Development Environments

External Integration Strategies

The external integration strategies to be assessed in this study are Integration, Alignment, Effective Communications with Users, and the Role of the User in Project Management.

Integration. An organizational variable which may be related to the adoption of CASE is integration. Lawrence and Lorsch (1967) define integration as the collaboration between technical specialists and line managers in the achievement of functional goals. Shrivastava and Souder (1987) note that successful management of technological innovation requires high levels of integration across departments and levels. In the context of making the transition to CASE, it would seem that a coalition of users, information technology professionals, and general managers are needed to align information systems development priorities with business needs. Strategies which facilitate effective integration are Joint Application Design (JAD) and Rapid Prototyping.

Alignment. An organizational factor which should be related to successful use of CASE is the process of aligning information systems plans with business plans. In organizations in which information technology is being used to achieve a competitive advantage, the need to integrate information systems plans with business plans is critical (Parsons, 1983).

Effective Communications. Effective communications with the user is a critical strategy in information systems development. In a number of studies of effective skills of systems analysts, the ability to create effective communications and to understand user requirements is critical to success (Green, 1989; Vitalari, 1985).

User Responsibility in Project Management. Another set of external integration strategies deals with user responsibility. User responsibilities include: selection of a user as project manager, participation of users on project steering committees, and giving users the responsibility for approving changes in design.

Internal Integration Strategies

Internal integration factors relate to the maturity of the systems development environment and the overall compatibility of CASE with existing work methods and procedures in systems development.

Compatibility. An important factor introducing effective diffusion of innovations is compatibility. Compatibility means the extent to which an innovation is consistent with the existing beliefs, values, and experiences of potential adopters (Rogers, 1983). Effective introduction of a technological innovation depends upon the existence of technical skills available to use the innovation (Utterback, 1974).

Process Maturity. The Process Maturity Model for software provides a framework for assessing the extent of software engineering excellence a firm has achieved (Humphrey, 1989). The model was designed to guide software development organizations in selecting process im-