Selecting a Systems Development Methodology: A Contingency Framework

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Uncertainty and complexity are inherent characteristics of a new information system. They occur at the beginning of the project and with different intensities during development depending on the system’s type. Based on a review of the literature, it is argued that uncertainty and complexity can be used to derive the most suitable development strategy for a given project. A framework integrating system types and their corresponding development strategies is offered and justifications supplied. General guidelines concerning the application of the framework are provided for the practicing managers.

There is no dearth of systems development strategy selection frameworks in the literature. There has always been an attempt to classify systems development strategies according to their inherent specificities. Before and during the 1970s, there had been only one variety of methodologies commonly referred to as the “traditional approaches” (Murdick, 1970) or the System Development Life Cycle (SDLC). As advances in technology and management were made, new opportunities occurred allowing more complex and more sophisticated systems to be developed. It then appeared that the traditional approach did not respond to the expectations of the time. The unsuitability of the traditional systems development methods naturally brought about modern approaches.

Whereas research has focused on either the selection of a development strategy given certain project characteristics (Burns and Dennis, 1985; Davis, 1982; McKeen et al., 1979; Naumann and Davis, 1978; Naumann et al., 1980), organizational attributes (Gorry and Scott Morton, 1971), or intrinsic attributes (Zmud, 1983) of the system, there is no trace of an attempt to integrate both systems types and systems development methodologies except that of Burns and Dennis (1985).
In this article, we seek to present an integrated conceptual framework through which systems development strategies may be selected on a systematic basis. A new typology of systems is first proposed followed by a review of development methodologies. Development methodologies are then mapped into the systems typology to form a systems development contingency framework. We justify the framework and its implications on the basis of characteristics of both systems and strategies found in previous research.

A New Systems Typology

We propose to classify system types according to two dimensions: project uncertainty and project complexity. Project uncertainty and project complexity have been widely recognized as key project characteristics that have a direct impact on the development process (Davis, 1982; Ginzberg and Ariav, 1986; Naumann et al., 1980).

Project Uncertainty

Uncertainty is defined as the difference between the amount of information needed to perform a task and the amount of information available (Galbraith, 1973). McFarlan (1981) defines uncertainty as the extent to which one fails to understand a problem and its probable solutions.

In an early version of their information requirements determination strategy selection model, Naumann and Davis (1978) proposed project uncertainty as a basic criterion for matching project types with development strategies. It is therefore asserted that project uncertainty is a major determinant of development strategy selection. According to Naumann and Davis (1978), project uncertainty can have four dimensions: (i) project size, (ii) project structuredness, (iii) user-task comprehension, and (iv) developer-task comprehension. McKeen et al. (1979) proposed a list of measures to operationalize project uncertainty through these four contingencies.

Project Complexity

Complexity in systems development arises from a large number of technologies, development tasks and routines, interactions among developing team members, and interactions between developing team members and the users. The necessary combination of skills from numerous departments for example may increase development complexity.

Burns and Dennis’ (1985) notion of project complexity includes project characteristics such as the volume and complexity of new information generated by the system. It is also believed that the number of system users and the project size contribute more to complexity than they do to uncertainty (Burns and Dennis, 1985).

Systems Types

Various system classification schemes have been proposed in the literature (Davis, 1982; Gorry and Scott Morton, 1971; Zmud, 1983). The Gorry and Scott Morton framework will be used here as the basis for system identification and classification. However, one of the most significant phenomena to occur in the information systems field in the last decade is End-User Computing (Benjamin, 1982; Rockart and Flannery, 1983). The growing trend of End-User Computing in the field is suggestive of an emerging alternative system development strategy as well as a new breed of systems. These systems use newer technologies and may be considered as totally different applications. The resulting categorization includes:

Transaction Processing Systems (TPS) support procedural activities that do not necessarily require making choices between alternative courses of action. Their goal is to process routine transactions in a cost efficient manner (Gorry and Scott Morton, 1971; Zmud, 1983).

Information Reporting Systems (IRS) specify organizational directions and redirections by focusing on directing attention, providing clues, and reviewing past performance (Gorry and Scott Morton, 1971; Zmud, 1983).
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