Managing IS Development: A Contingency-Growth Approach

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Since Nolan had proposed a growth stage model for information systems (IS) development, the term has become very popular in IS research areas. The research model proposed has made significant contributions to the IS field. For IS managers, this model provides a guideline to build and manage information systems effectively. For researchers, it has been used as an important tool controlling the confounding effects of the different information systems. Many researchers have made efforts to access the model’s validity and plausibility. Overall, these efforts have not been supportive to Nolan’s stage model. This paper will review Nolan’s growth stage model and its subsequent related research. Changes that have occurred during the last ten years in the IS area will be investigated. Based on a review of literature and our experience, a new conceptual framework for managing IS resources will be proposed.

Richard Nolan’s stage model is the best known and most widely cited model for describing and managing the growth of information systems. In 1973, Nolan proposed a model for the stages of growth of computer usage in organizations. Nolan elaborated on this model in the 1979 version in which the original four stages were expanded to six. Because of the model’s clarity in explaining growth patterns, it soon gained popularity with practitioners and researchers and became a widely cited model of computer evolution in organizations.

There are two main areas where growth stage models have been applied. The first application, as Nolan himself specified, is to provide a guideline to managers in explaining and analyzing the complex nature of IS development and to aid them in planning and managing IS resources.

The second application is to use the growth stage model as a confounding variable in designing IS research. IS research has been criticized for its inability to control confounding variables which influence the typical dependent variable - IS success. IS maturity, also called system complexity, has been known as an important confounding variable, but many times ignored by researchers. Several researchers recognized this problem but used it as a wrong measure. Delone
(1981) and Raymond (1985) in his critical success factor study in small business information systems included system maturity as an intervening variable to success, but age was used as an operational measure for this variable. It is not insightful to use age as a surrogate measure since it is based on the assumption that as time passes, a system becomes more mature: this assumption is not realistic. A better way is to use a growth stage model to control the intervening effects since the stage model can classify a specific IS into a stage not by the time factor but by many characteristics of the IS and its usages. Kim (1988) used Nolan’s stage model to control the maturity variable in his research.

As it gained fame, subsequent efforts have also been made to assess its empirical validity and plausibility (Benbasat et. al., 1984; Drury, 1983; King & Kraemer, 1984; Lucas & Sutton, 1977). Overall, several subsequent empirical studies have not been supportive of Nolan’s stage model although these studies have confirmed some value of the stage model. In this paper, various stage models including Nolan’s and the following criticisms are reviewed and investigated. Finally a new development model is suggested for the effective management of IS for practitioners and for the effective control of confounding variables for researchers.

Growth Stage Models

Nolan’s Stage Model

A model for the stages of growth of computer usage in organizations was proposed by Nolan in 1973 and is the best known growth stage model (Gibson & Nolan, 1974; Nolan, 1973; Nolan, 1979). After an extensive case study of three companies, he uncovered that the pattern of growth for the computer budget had shown a crude S-shaped curve behaviour. He proposed that the computer budget curve would serve as a useful surrogate for representing the growth phenomenon for use of computers in organizations and that the tasks such as planning, organizing, and controlling were closely aligned with the growth of the computer budget. Thus, the major tasks in the management of computing can be identifiable in stages along the growth path of computing use. Based on these arguments, he proposed a four-stage model.

In 1974, Nolan and Gibson claimed that the S-shaped curve is driven primarily by changes in computing technology. They asserted that particularly database management systems would be the driving force for the shift to the next stage. Nolan elaborated on his earlier model in the 1979 revision in which the original four stages were expanded to six with some accompanying changes in names: initiation, contagion, control, integration, data administration, and maturity. Three new concepts are incorporated in this paper: the growth in knowledge and technique, organizational control, and the shift from management of computers to management of data resources.

1) Burgeoning of Knowledge: Organizational learning and movement through the stages are pushed by changes in external and internal environment. Changes in external environment are such as the emergence of new technologies and the knowledge of how to use them. Changes in internal environment are what managers, specialists, and operators learn firsthand as the system develops.

2) Control and Slack: Two alternative strategies can be adopted by organizations according to stages. They are “control” and “slack” environment. In the control environment, all financial and managerial activities are controlled to ensure that DP activities are effective and efficient. In the slack environment, sophisticated controls are absent, and instead, incentives to use DP in an experimental manner are present. Rapid growth of IS expenditures occurs in this slack environment.

3) Shift in management emphasis: In the expanded six stages, at some point in stage 3, an important shift occurs in orientation from management of computers to management of data resources pushed by an increased use of data base technology. This shift in orientation is, in other terms, a shift from emphasis on consolidation and coordination in the DP activities, operational con-
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