Global Information Technology Architectures

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Changes in the environment of international business and advances in information technologies have limited the usefulness of existing information systems paradigms. Consequently, there is a paucity of both conceptual and empirical research focusing on information technology systems in a global context. In response, the overall goal of this paper is to develop a uniquely broad perspective on global information systems by establishing the concept of a global information technology architecture. Although the concept of an information technology architecture has existed for some time now, this study is among the first to move beyond anecdotes to embrace statistical testing and validation of a finite number of architectural types that may serve as a surrogate for capturing overall information technology capabilities. It is hoped that a parsimonious, architectural modeling of international information technology capabilities can serve as a map to guide and document the information systems decisions for globally competing organizations.

Overview of Global Information Technology

Until recently, information systems research has been conducted with inadequate consideration of the global environment. Some anecdotal and case study evidence has surfaced concerning the role of information systems in global firms (e.g., Freedman 1985, Carlyle 1988, Pantages 1989, Davenport et al. 1989, Reck 1991, Roche 1992), but few rigorous empirical investigations have been conducted. Both the international business and the strategic management disciplines have tended to ignore information systems issues and, as Neo (1991) observed, the literature from the information systems field on the role of information technology has implicitly or explicitly focused on competition in a domestic industry. A limiting factor in previous efforts to conduct global information technology research had been the absence of a conceptual model of sufficient scope and abstraction to tie together the various schools of thought and their research.

A decade ago, Buss (1982) concisely defined a global information system as a distributed data-processing system that crossed national boundaries—suggesting that components of systems developed for the domestic needs of American firms could be subsequently forced, unchanged, upon foreign subsidiaries. More recently however, Karimi & Konsynski (1991) stressed the overly simplistic nature of this definition by demonstrating that crossing national boundaries creates wide variations in business environments, resource availability, and regulatory constraints. Increasingly, published warnings (e.g., Roberts and Hickling 1989, Hopper 1990) have appeared suggesting that the global information systems community must change existing systems
to comply with overall corporate goals within the context of a single world market.

For the purposes of this study, the task of relating information technology to international concerns was made tractable by accepting Mandell’s (1975) premise that foreign subsidiaries constitute a basic building block of the organizational structure of a global firm, and his related assertion that it was therefore appropriate for researchers to focus on the interface between headquarters and foreign subsidiaries to determine the nature of international information systems. Mandell and Grubb (1979) conducted an empirical study of American multinational firms to determine the nature of the headquarters-subsidiary information systems relationship. Their results suggested that the development of an integrated worldwide system was dependent on the overall size of the parent firm, its industry, and the nature of the foreign firm’s extent of internationalization. The focus of this study was limited to the headquarters-subsidiary dyad as the unit of analysis. Thus, it was possible to alleviate confounding concerns related to organization size and the complexity resulting from the occurrence of a variety of information systems within a single firm. This approach was supported by Håkansson & Snehota’s (1989) endorsement of a dyadic research approach that was based on their observation that organizations often operate in business environments that could be fully characterized by a limited number of interrelated, identifiable entities.

**An Architectural Approach**

In separate publications, Fertuck (1992) and Best (1990) each differentiated between the information technology architect as a designer with concerns for effectiveness and the software engineer as a builder with concerns for efficiency. Clearly, the architect’s definition of overall scope, specific frameworks and logical structure must precede the physical programming tasks in the development of an information system. This suggests that the achievement of an overall integrated structure for the information system is better understood by an architectural analogy than an engineering analogy. In like manner, Allen and Boynton (1991) reported that their research, case writing and consulting experiences illustrated the importance of the information systems architecture for globally competing firms.

The adoption of an architectural approach to information systems development has been recognized by several researchers (e.g., Brancheco & Wetherbe 1987, Latham 1990, Keen 1991, Moran 1992) as a key issue for information systems researchers during the next decade. In fact, Zachman (1987) contended that the increasing size and complexity of information technology implementations required that some logical construct be used for defining and controlling the interfaces and integration of the system components. Further, he suggested that the construct of an information technology architecture naturally emerged for the creation of such a descriptive framework. However, the search for a useful definition of an information technology architecture revealed not one, but several. Not surprisingly, there were nearly as many different definitions as there were studies of the topic. The popular use and frequent misuse of the term “architecture” have produced much ambiguity in the information systems research literature.

Sullivan (1982) suggested that an information systems architecture emerged slowly over time as organizations committed to some level of integration with an appropriate mix of form and context. As such, firms choose to concentrate, consecutively, on one of the information systems components: processing, data storage, communications or applications. Subsequent researchers chose to structure their approaches by targeting only one of these four components. Mano (1982), Ein-Dor & Segev (1982), and Aken (1989) defined the architecture strictly in terms of computing. Langefors & Sundgren (1975), Spencer (1985), Inmon (1989), and Meador (1990) focused on the data architecture. Barrett & Konsynski (1982) and Ahuja (1988) chose communications to define the architecture. Finally, Venkatraman (1991) and Keen (1991) defined the architecture in terms of applications.

More recently and perhaps most usefully, Karimi & Konsynski (1991) defined the corporate information systems architecture for a global firm as a high-level map of the information and technology requirements of the entire firm, composed of network, data, application and technology sub-architectures. This study extended their definition to incorporate planning, organization, and control techniques that Earl (1989) suggested would enable a complete information technology architecture to serve as a proactive forum for worldwide interaction.

Table 1 portrays six existing conceptual frameworks for information technology architecture classification that served to clarify and to justify this research framework for international information technology architectural capabilities.

By comparing these six frameworks, widespread support was found for describing information technology architectures by physical and logical component parts or elements. Also, compelling reasons emerged for
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