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Organizational Responses to the Shortage of IT Professionals: A Resource Dependence Theory Framework

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Abstract

The continuing shortage of IT professionals has become a critical issue for many organizations. The purpose of this paper is to propose resource dependence theory as a conceptual foundation to investigate the responses of organizations to the IT skills shortage. An overview of resource dependence theory is provided, followed by two examples illustrating application of the theory. The first example demonstrates how resource dependence theory could be used to investigate IT professional resource issues related to the implementation of ERP systems. A second example, a strategic choice framework, illustrates how resource dependence theory could be used to develop guidance for management decision-making related to this resource.

Keywords: IT staffing issues, IT professionals, organizational strategies, resource dependence theory, research frameworks

Introduction

The severe shortage of IT professionals that emerged in the second half of the 1990's is expected to continue over the next several years. A survey by the Information Technology Association of America (2000) predicted a demand for approximately 1.6 million new IT workers in the year 2000 and reported that hiring managers foresaw a shortfall of almost 850,000 appropriately skilled workers. Even with the recent IT layoffs at dot-coms and technology suppliers, a recent survey by Meta Group estimates that some 600,000 IT jobs remain unfilled in 2001 (Joachim 2001). The continuing shortage of IT professionals needed to support high priority initiatives such as systems integration and infrastructure development, e-business architecture, customer relationship management software, and wireless application development (Johnson 2001), can significantly impact the ability of organizations to utilize information technology in pursuit of their organizational goals.

A review of the practitioner literature highlights both the high priority of this issue and the diversity of strategies that organizations are employing to address it. Examples of supply-side strategies for the IT professional resource include: high salaries; hiring bonuses; training and redeployment of employees in non-IT positions to IT positions; hiring and training new graduates with non-technical majors such as music; strengthening relationships with universities; offering flexible work schedules and telecommuting; the use of foreign-nationals, consultants, and contract workers; and outsourcing. Other organizational responses target the demand side for this resource, e.g., reducing the number and scope of application projects, delaying upgrades to technical architectures, utilizing the services of application software providers (ASPs), and implementing new tools and methods to improve software productivity.

A review of the academic literature indicates that IS research studies to date have limited the scope of the investigation to a single type of organizational response—such as outsourcing (e.g., Grover et al. 1996; Smith et al. 1998) hiring foreign nationals (e.g., West and Bogumil 2000), or improving the retention of IT professionals (e.g., Jiang and Klein 2000; Moore 2000). While these kinds of studies provide valuable insights into a *particular type of organizational response*, we suggest that a broader perspective is needed in order to develop a more comprehensive understanding of issues and responses by organizations to this shortage. For example, one approach would be to enlarge the scope of the investigation to encompass *all of the responses by a particular organization* to the IT skills shortage. Little is known about the different sets or combinations of responses that are being chosen

by organizations, the source and nature of differences in the choices made, or the outcomes of those choices. A second approach that also takes a broader perspective would be to classify potential actions and responses into more general *categories of management strategies*, and to identify the organizational and environmental factors that may be important to consider when selecting a type of strategy.

The purpose of this paper is to propose the use of resource dependence theory (Pfeffer and Salancik 1978) as a conceptual foundation to develop these broader perspectives on organizational responses to the IT skills shortage. Resource dependence theory has been used in studies to reveal how organizations try to control scarce resources (White 2000) by adopting a varied mix of strategic choices that are contextually appropriate and based on strategic choice (Child 1972). We suggest that resource dependence theory can provide a valuable theoretical framework to examine organizational responses to the scarcity of the IT professional resource. The discussion that follows begins with an overview of resource dependence theory. Next, we illustrate how resource dependence theory could be used to investigate IT professional resource issues related to the implementation of ERP systems. A second example, a strategic choice framework, illustrates how resource dependence theory could be used to investigate and develop frameworks to guide management decision-making related to the IT professional resource.

Resource Dependence Theory: An Overview

Although resource dependence theory was most fully articulated at the organizational level by Pfeffer and Salancik (1978), its theoretical roots are based in more elementary theories of social exchange (Blau 1964; Emerson 1962). According to exchange theory, social relationships are embedded in exchange networks that are characterized by:

- a set of actors
- valued resources distributed among the actors
- a set of exchange opportunities among the actors in the network
- exchange relationships among the actors
- exchange relations connected to one another in a single network (Cook et al. 1983).

Pfeffer and Salancik (1978) brought the concepts of exchange relations, exchange networks, resource dependence, and power into organizational analysis. Based on an open systems perspective, resource dependence theory seeks to describe and explain how external environments affect and constrain organizations and how organizations respond to those constraints. An organization's dependence on resources from the environment can constrain its actions and make it more vulnerable. Simultaneously, Pfeffer and Salancik explained the role that many interorganizational strategies played in coping with and managing external dependencies. Strategies such as joint ventures and interlocking boards of directors played a significant role in managing external dependencies, such that overall organizational effectiveness might be influenced by such strategies.

Pfeffer and Salancik (p. 45) identified three factors that are critical in determining the dependence of one organization on another:

1) the importance of the resource—the extent to which the organization requires it for continued operation and survival;
2) the extent of discretion over the allocation and use of a resource possessed by the other organization; and
3) the extent to which there are few alternatives or concentration of resource control.

Based on these factors, Pfeffer and Salancik described organizational strategies for influencing and controlling the social context by adjusting processes, structures, and relationships to minimize uncertainty around critical resources. The objectives of these strategies include *avoidance or reduction of dependencies*, *reducing uncertainty with respect to the resource supply*, and *creation of counterdependencies*. For example, identifying substitutes for the resource and establishing multiple sources of supply are strategies that can be used to avoid or reduce dependencies. Controlling the source of the dependence through acquisition and ownership is a strategy that may be employed to minimize uncertainty with respect to supply. The counterstrategy of mutual interdependence can be created through mechanisms such as joint ventures (Pfeffer and Nowak 1976).

Example 1: Managing Resource Dependence in ERP Software Implementation

In this section, we illustrate how a resource dependence theory framework could be used to investigate IT professional resource issues related to the implementation of ERP systems. The conditions of resource dependence are clearly evident in the relationships that organizations experience with ERP software vendors and consultants. The organization must contract with external parties, who possess valued resources, in economic exchanges within a common network structure. There are three basic steps to creating an understanding of the organization's dependence on external ERP professional resources and the management

strategies available for coping with such dependence: 1) An assessment of the *criticality and scarcity of the resource*, in this case the ERP software professionals upon which organization has become dependent; 2) An assessment of the *environment* of the organization; 3) Identification of *strategies to avoid or reduce resource dependencies*.

(1) Assessing Resource Criticality and Scarcity. Enterprise software professionals are individuals who possess the specialized skills and expertise needed to implement ERP systems and provide ongoing support for them. The competencies that ERP professionals bring to an ERP project span a wide range of technical, business, and organizational expertise. Competencies include programming skills, ERP analysis and design skills, knowledge of specific ERP software packages and the business processes and business rules embedded within them, project management skills, and experience in managing organizational transformations.

In resource dependence theory, criticality refers to the importance of the resource to the functioning of the organization - in this case, the criticality of the ERP software professional resource to the success of the implementation project and the ongoing success of the system once it is operational. Accounts of ERP projects—both failures and successes—illustrate the critical role of enterprise software professionals in these efforts. The high hourly rates for ERP consultants are a reflection of the high value of this expertise to organizations engaged in ERP projects.

Scarcity is an estimate of the availability of the resource. The increasing numbers of companies implementing ERP applications have contributed to the current IT skills shortage, resulting in even more organizations presently competing for the limited supply of ERP professionals. Under these conditions, organizations may find it extremely difficult to secure the ERP professionals needed for their enterprise projects. They are clearly dependent upon a critical and scarce external resource.

(2) Assessing the Environment. Resource dependence theory conceptualizes the organization's external environment as other organizations with which it engages in exchange relationships (Thompson 1967; Pfeffer and Salancik 1978). The purpose of assessing the external task environment is to identify the collective and interconnected set of social actors that comprise the exchange network and to evaluate the distribution of the resource as well as exchange opportunities. Power and dependence relationships are contingent on factors such as the potential of environmental actors to be sources and/or competitors for the resource; the ability of these actors to support or interfere with the organization's resource exchanges; and the organization's ability to establish countervailing power over these actors. Figure 1 illustrates the type of interorganizational chart that might be created to represent the position of an organization within its external task environment. As shown on the figure, other organizations can be both potential sources and competitors for a resource.

(3) Identifying Strategies for Avoiding or Reducing Dependencies. Once the two types of assessments described above have been completed, resource dependence theory provides specific strategies that can be used to manage the dependencies that have been identified. Table 1 lists some examples of the strategies and actions that might be employed by the organization to reduce ERP project risk related to enterprise software professionals.

In this section, we have used a hypothetical case to illustrate how resource dependence theory can be used to assess the criticality and scarcity of a resource, to assess the environment, and to develop strategies for avoiding or reducing dependencies. Although this example focused on a particular organization, the same approach could be used, for example, as a framework for comparative case studies to investigate the different strategies and actions of two or more organizations implementing ERP systems and the sources of those differences and outcomes.

Table 1. Example Strategies for Avoiding or Reducing Resource Dependence

Strategy	Example Action
1. Reduce the need for the resource	• Use the enterprise software with minimal customization
2. Reduce the length of time that the resource is needed	• Skip some upgrades to new versions of the enterprise software
3. Identify a substitute for the resource	• Train non-IT professionals, such as users, to perform the configuration tasks
4. Minimize uncertainty with respect to the resource supply by establishing multiple sources of supply	• Use multiple providers of enterprise software services rather than a single vendor
5. Create counterdependencies by establishing reciprocal dependencies with resource providers	• Create an alliance with the ERP software vendor by becoming a "showcase" site or test site for new releases of the software

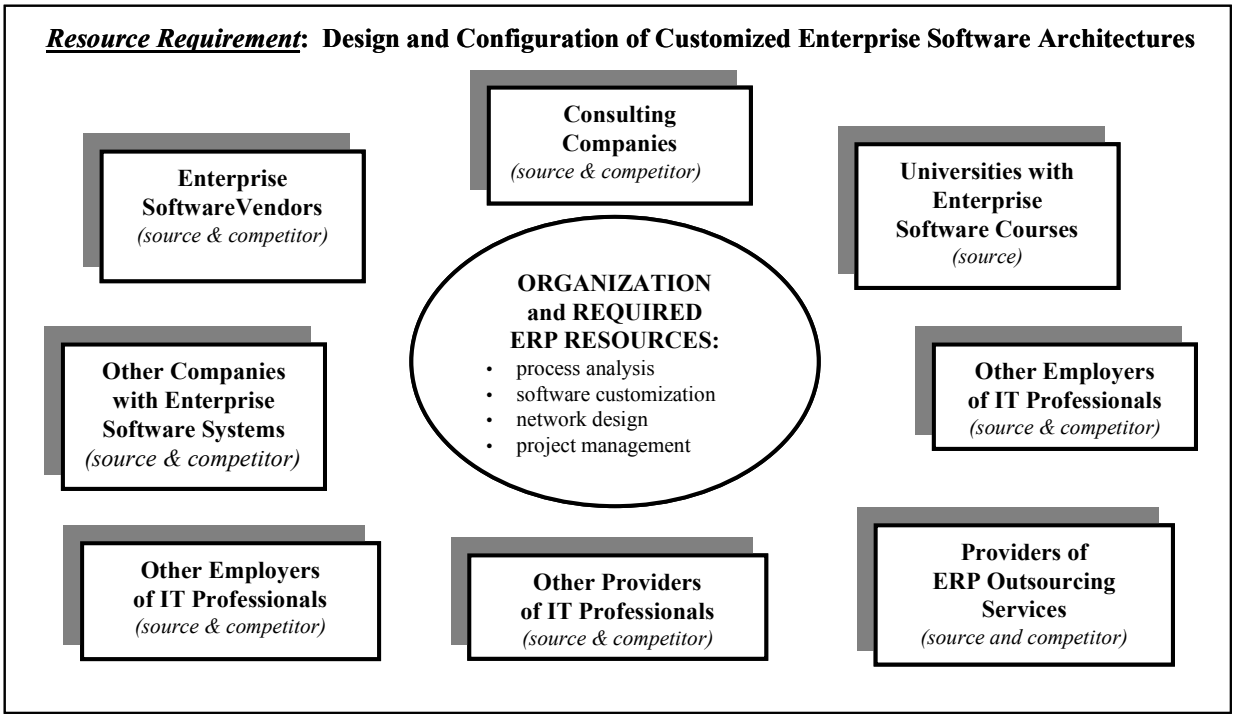

Figure 1. External Task Environment for Example Case

Example 2: A Strategic Choice Framework

In this section, we illustrate how a strategic choice framework based on resource dependence theory could be developed to provide guidance for management decision-making related to the IT professional resource. In the previous example, a set of potential strategies was identified that the organization could choose from to avoid or reduce resource dependence. A strategic choice framework provides additional guidance on the choice of specific strategies among those that are available.

The strategic choices made by firms regarding decisions on how to respond to an impending crisis of IT staffing is led by the strategic logic—the proposed sequence of actions congruent to organizational objectives and capabilities (Stacey 1996)—articulated in resource dependence theory. Using a systematic approach to developing a strategy that matches the conditions stipulated by the proximal environment, proactively developed strategic logic could help leverage this environmental uncertainty into a competitive advantage for a firm, not only by adapting to a changing environment but also innovatively exercising change in their own environments (Hamel and Prahalad 1989; Weick 1979). With the environment exhibiting severe shortages of IT professionals, a proactive approach may be critical element to the business performance of a firm.

The strategic responses for firms in handling the issue of shortage of IT professionals must grow from the resources themselves, i.e., the strategic logic determining organizational response or strategic choice should be a function of the attributes of the complementary resources. IT professionals, as a complementary resource, create resource dependency for organizations based on two attributes: their importance as a resource (criticality) and their volatility. First, resource dependency theory finds that the importance of a resource in an organization correlates to sustenance and growth by creating core competencies from which a firm can derive competitive advantages. Secondly, resource dependence bears a correlation to resource volatility as a volatile resource is extremely sensitive to change and not likely to stay captive to a single firm, as is common for existing IT professionals who continuously shift loyalties. In light of resource dependence, the framework for the responses or strategic choices made by firms can be incorporated in a 2x2 matrix as shown in Figure 2. The four strategic responses shown in the framework are described as follows:

- *Reduce Resource Dependence*: If the IT function does not bear a significant importance as a resource in the organization and is less volatile to changes in the environment because of a large degree of standardization or availability of ready alternatives, the strategic choice for a firm in face of IT shortages is to reduce dependencies on the IT function by automating the process or finding non-IT replacements for its operation.

- *Train Existing Workforce*: If IT professionals have a high degree of resource importance in the organization even though the IT function is not highly sensitive to environmental shifts, the strategic choice faced by firms is to devise ways to retain their current workforce by training, motivation and reward mechanisms.

- *Create Strategic Alliances*: The top right quadrant embodies problems that many technology firms are facing as the IT skills shortage continues. In these organizations, the resource importance of IT is high and the IT function is also volatile and sensitive to environmental shifts. This means that such organizations are continuously replenishing their workforce as they adopt or even create newer technologies. IT, therefore, is a source of competitive advantage for them and a part of their core competence, necessitating the adoption of new technologies as soon as possible. In such a context, the creation or involvement of the firm in a strategic alliance seems to be cogent strategic choice. The move towards such a strategy alleviates the overt dependence on immediately internalizing technology while gaining access to the needed technology and IT resources from a pool, thus saving itself the investments and costs of acquiring both the technology and the associated personnel (Williamson 1991).

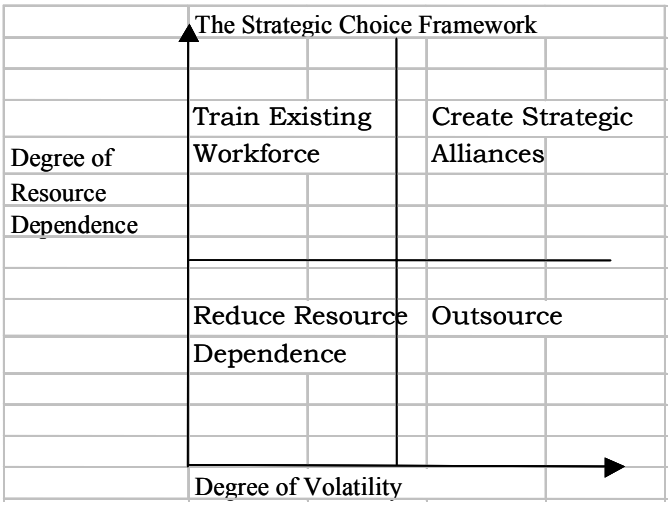

Figure 2. Strategic Choice Framework for the IT Professional Resource

- *Outsource*: Outsourcing becomes a viable strategic choice when the organization faces a volatile IT function but the resource importance of IT is not highly critical. This means that IT is used not to secure core competence but for generating operational efficiencies. This scenario would find outsourcing to be an advantageous strategic choice for the firm in creating a competitive advantage. Outsourcing shifts the onus of keeping up with the technological flux by moving it into the realms of external organizations and individuals who specialize in acquiring new technologies for ad-hoc enterprise tasks and act as solution providers. The organization can therefore satisfy its need for using the latest technologies without any explicit commitment, therefore reducing its reliance on the personnel needed to harness the new technologies. Outsourcing has also been seen as a pragmatic strategy in times of flux by reducing costs and risks, while leveraging their presence by utilizing new technologies without worrying about the personnel shortage around the corner (DiRomualdo and Gurbaxani 1998). This quadrant also indicates a low degree of importance of IT resources, so that an outsourcing decision is not likely to compromise their competitive advantage as IT resources do not constitute core competencies (Antonucci et al. 1998).

This strategic choice framework illustrates how the insights provided by resource dependence theory can provide the basis for management decision-making related to the IT professional resource. The validity of this type of framework would need to be tested in empirical studies. In addition, although resource dependence theory emphasizes the proactive strategic responses of firms, the strategy choices available to an organization are also constrained, both by macro environmental factors and organization-specific factors. Research would also be needed to examine the macro organizational context, including trends.

Conclusion

In this paper, we have proposed resource dependence theory as a theoretical foundation for examining organizational responses to the shortage of IT professionals. While the two examples provided in the paper illustrate two very different applications of resource dependence theory to this topic, both examples demonstrate how the broader perspective offered by resource dependence theory can complement and extend research studies that focus on a particular type of organizational response.

References

Antonucci, Y. L., Lordi, F. C., and Tucker III, J. J. "The Pros and Cons of IT Outsourcing," *Journal of Accountancy* (185:6), 1998, pp. 26-31.

Blau, P. *Exchange and Power in Social Life*, New York: Wiley, 1964.

Child, J. "Organizational Structure, Environment & Performance: The Role of Strategic Choice," *Sociology* (6), 1972, pp. 1-22.
Cook, K. S., Emerson, R. M., Gilmore, M. B., and Yamagishi, T. "The Distribution of Power in Exchange Networks: Theory and Experimental Results," *American Journal of Sociology* (89), 1983, pp. 275-305.
DiRomualdo, A., and Gurbaxani, V. "Strategic Intent for IT Outsourcing," *Sloan Management Review* (39:4), 1998, pp. 67-80.
Emerson, R. M. "Power-dependent Relations," *American Sociological Review* (27), 1962, pp. 31-41.
Grover, V., Cheon, M. J., and Teng, J. T. C. "The Effect of Service Quality and Partnership on the Outsourcing of Information Systems Functions," *Journal of Management Information Systems* (12:4), 1996, pp. 89-116.
Hamel, G., and Prahalad, C.K. "Strategic Intent" *Harvard Business Review* (4), 1989, pp. 63-76.
Information Technology Association of America, "Bridging the Gap: Information Technology Skills for a New Millennium," Arlington, VA, 2000.
Jiang, J. J., and Klein, G. "Supervisor Support and Career Anchor Impact on the Career Satisfaction of the Entry-Level Information Systems Professional," *Journal of Management Information Systems* (16:3), 2000, pp. 219-230.
Joachim, D. "IT Labor Crunch Persists, Study Says," *InternetWeek*, April 24, 2001, available at http://www.internetwk.com.
Johnson, M. "Got Good People?," *Computerworld* (35:1), 2001, p. 22.
Moore, J. E. "One Road to Turnover: An Examination of Work Exhaustion in Technology Professionals," *MIS Quarterly* (24:1), 2000, pp. 141-168.
Pfeffer, J., and Nowak, P. "Joint Ventures and Interorganizational Interdependence," *Administrative Science Quarterly* (21:3), 1976, pp. 398-418.
Pfeffer, J., and Salancik, G. R. *The External Control of Organizations: A Resource Dependency Perspective*, New York: Harper & Row, 1978.
Smith, M. A., Mitra, S., and Narasimhan, S. "Information Systems Outsourcing: A Study of Pre-Event Firm Characteristics," *Journal of Management Information Systems* (15:2), 1998, pp. 61-93.
Stacey, R. D. *Strategic Management & Organizational Dynamics*, London: Pitman Publishing, 1996.
Thompson, J. *Organizations in Action*, New York: McGraw-Hill, 1967.
Weick, K. *The Social Psychology of Organizing*, Reading, MA: Addison-Wesley, 1979.
West, Jr. L. A., and Bogumil, Jr. W. A. "Foreign Knowledge Workers as a Strategic Staffing Option," *The Academy of Management Executive* (14:4), 2000, pp. 71-84.
White, S. "Competition, Capabilities, and the Make, Buy, or Ally Decisions of Chinese State-Owned Firms," *Academy of Management Journal* (43:4), 2000, pp. 324-341.
Williamson, O. "Comparative Economic Organization: The Analysis of Discrete Structural Alternatives," *Administrative Science Quarterly* (36), 1991, pp. 269-296.