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IT PERSONNEL SOURCING DECISIONS IN IT PROJECTS

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Chapter 1. Introduction

The evolutionary growth of information technology, during the past few decades, has created the impetus for change in the organizational workplace from a focus on narrow and specific tasks, carried out by individuals, to a focus on collective efforts reflected through IT project teams (Nonaka 2001). With the increased abundance of IT project teams operating within and between organizations in the current business environment (Bolan 2001; Abdel-Hamid 1992 and 1989), a number of academic studies have focused on identifying the critical success factors for effective IT project success. Researchers in IT project management have pointed to the importance of IT personnel sourcing as a critical success factor (e.g. Nonaka 2001; Bolan 2001; Abdel-Hamid 1992).

The issue of appropriate project IT personnel sourcing decisions has gained recognition as one of the core factors behind effective software project management (Agarwal & Feratt 2002, and Abdel-Hamid 1989). Some studies have in fact shown that the utilization of appropriate sourcing decisions does increase the likelihood of completing IT projects on time (Abdel-Hamid 1992) and within budget (Bolan 2001). While highlighting the importance of appropriate IT project sourcing as a key component for successful IT project management, these studies highlight a need for understanding how IT project personnel sourcing is determined. The purpose of this research study is to take an initial step towards understanding the "how" of project IT

personnel sourcing decisions by developing and testing an IT personnel sourcing model for IT projects, based on theoretical and grounded perspectives.

1.1 Research Question and the Context of Study

The research question addressed in this study inquires: *How do resource factors and project factors affect the decision to in-source or outsource the IT human capital associated with a specific IT personnel resource needed on a specific IT project?*

The context of this proposed study is the IT personnel sourcing decision(s) an IT project manager faces when charged with completing an approved IT project. The organization (upper management) has deemed it important to retain project management control of the approved IT project. In this given context, the project manager must make a series of sourcing decisions by deciding whether to utilize internal or external IT personnel. The research model that is developed in chapter 3 reflects the issues that an IT project manager must consider when making a sourcing decision for a specific IT project. The model looks at a specific sourcing decision for a particular IT personnel resource. The next section of this chapter will briefly summarize details in each chapter of this dissertation study.

1.2 Proposal Outline

The subsequent chapters of this dissertation study will discuss the details behind the proposed research study. Chapter 2 reviews literature pertaining to IT

project management and IT personnel hiring and retention. The review of these two literature streams will highlight the importance of the project IT personnel sourcing question and reveal important issues that will need to be considered in developing the research model.

Chapter 3 develops the theoretical foundations behind the proposed model. The various constructs in the proposed model are defined and the relationships among these constructs are laid-out. The development of the constructs and their relationships are framed by an integration of three complementary theories. The three theories utilized in motivating the development of the model are internal labor market theory, knowledge-based theory and transaction cost economics. As part of the model development process, chapter 3 will also discuss the interviews conducted with IT project management professionals as a way to ground the research model. The grounded approach undertaken with the interviews helped further validate and refine the model.

Chapter 4 will lay out the methodology and design that was utilized for testing the research model. The development of the scenarios and questionnaires for testing the model is discussed in chapter 4. The results of the pre-test studies, that were done to help refine the instrument, are presented and discussed. The chapter concludes with a discussion on how the instrument is administered and presents the methodology that is utilized for analyzing and testing the research model.

Chapter 5 begins with a description detailing the data collection process and issues that arose from this process. This chapter will then discuss the results of the

preliminary analysis performed on the collected data. This initial set of analyses looks at the integrity of the data collected. The results from the set of data integrity analyses lead to revisions in the research model (v2.0). The revised research model is presented and discussed in the final section of Chapter 5.

Chapter 6 presents the path analyses performed on the revised research model. The issues that arise from the analysis are detailed and discussed. Additional anlaysis is performed to help understand the results achieved from the initial path results. These results combined with the initial path analytic results are used to create a more appropriate research model (v3.0). The proposed hypotheses from Chapter 3 and 5 were then tested with the v3.0 research model.

The final chapter of this dissertation study will conclude with a discussion of the implications drawn from the final path analysis. Chapter 7 will also present suggestions for future research and practice. The chapter concludes by drawing together the main contributions that have emerged from this study.

Chapter 2. Literature Review

A review of current literature dealing with IT project management and IT personnel staffing is presented in chapter 2. The purpose of this literature review is to understand the various facets of IT project management research that have been undertaken in prior studies. The first part of chapter 2 deals with IT project management research. The areas of research have been categorized into: project control studies, project commitment studies, project management process improvement studies, and project personnel studies (see Table 2.1). The importance of the IT project personnel to the success of an IT project leads to an examination of IT personnel staffing literature in the second part of chapter 2. The chapter will conclude with a summary of the important issues raised from IT project management and IT personnel management studies.

2.1 Project Management Literature

The evolutionary growth and proliferation of technology has instilled a need for modern organizations to become more agile and responsive in the current technologically competitive marketplace (Porter 1998, and Drucker 1988). This has led to the emergence of project-driven, knowledge intensive work in many organizations. A major portion of this project-driven work in organizations relates to information technology (Starbuck 1992).

Many firms now operate with multiple IT project teams concentrating on new or innovative solutions to enhance current business strategies (Porter 1998, and

Nonaka & Takeuchi 1995). This has driven a great deal of interest in the area of IT project management. The use of project management models and techniques has greatly proliferated since coming into popular attention during the late 1950's on the back of high-profiles endeavors such as the Manhattan project and the Apollo space programs (Bonke & Winch 2000).

Recently, project management has established a strong presence in the field of information technology from its' traditional base sectors of engineering and heavy industry (Hodgson 2004). The strong interest in project management comes from its claim to deliver 'one-off' assignments 'on-time, to budget, to specification', by relying on careful planning and the firm control of critical variables such as resources, productivity, schedule, risk, and quality (i.e. Walker 1998, and Hodgson 2004). This interest has lead to the emergence of project management practices in the areas of IT project management design and development. A stream of literature from MIS has emerged in conjunction to the growing interest found in perfecting IT project management practices. The following subsections segments the IT project management research stream into the following four categorizations: planning and control studies, managerial commitment studies, management process improvement studies, and project personnel studies.

2.1.1 IT Project Management: Planning & Control Studies

IT project management is focused on the effort to manage the design, development, and implementation of information systems (Austin 2001, and Kirsch

1997). An important part of managing IT projects lies with the planning and control required to carry out development efforts. Management and control studies have examined how effective coordination mechanisms (Nidumolu 1995) and effective planning (e.g. McCombs & Smith 1991, Ryan 1990, and Brooks 1988) can enhance project management success. Studies in management and control have also delved into the use of different modes of control (e.g. Nidumolu & Subramani 2004, Zmud & Sambamurthy 1999, and Kirsch 1997) and their effects on IT project management success.

Other studies on project control issues have attempted to examine the need to deal with risk when managing an IT project. These studies have attempted to identify risk factors (Schmidt et al. 2001) and proposed models for dealing with risk (Barki et al. 2001). Another set of project control studies have also dealt with the management issues surrounding outsourced IT projects (e.g. Choudry & Sabherwal 2003; and Ahituv et al. 1984). Besides management and coordination issues, IT project management research has also looked into the importance of managerial support at both the project and organizational level. The following section looks at how managerial support can impact the success or failure of IT projects.

2.1.2 IT Project Management: Commitment Studies

IS literature argues the importance of managerial support (Chalmers 1985) in effective project management. While effective managerial support has been shown to be important for effective development efforts (Newman & Sabherwal 1996),

management support has also been shown to be detrimental to the organization. A number of studies on escalation of commitment have shown that unnecessary IT projects can be sustained if upper management support persists (e.g. Montealegre & Keil 2002, Keil et al. 2000, and Keil 1995). These IT projects continue to linger even though they may be considered unnecessary development efforts. These studies underscore the importance of management support in helping drive a project forward (either for the good or the detriment of the organization). Along with studies on planning and management support, IT project management literature has also looked to understand management process improvements. The following section deals with studies that have attempted to help facilitate process improvements in IT project management.

2.1.3 IT Project Management: Management Process Improvement Studies

A group of studies in the area of IT project management have examined ways to improve the management process. These studies deal with improvements that project managers can make to the management process and are not to be confused with software development research. Software development research focuses on development methodologies and techniques (i.e. a new object-oriented approach to development, introduction of parallel-programming methods, and adapting to organic systems design methodologies). In contrast, IT project management process improvements focus on issues of how managers can improve their management techniques (Kirby 1984), adjust their management styles to fit the complexity of the

IT project (Stanley 1988), and utilize performance measures as a means towards evaluating and refining management techniques (Aladwani 2002). The final categorization of IT project management studies, in the following section, deals specifically with IT project personnel issues.

2.1.4 IT Project Management: Project Personnel Studies

The prior studies examined in the previous sections of chapter 2 call attention, either directly or indirectly, to the importance of IT project personnel for achieving project success. With the IT personnel being the underlying factor in IT project management studies, it would make sense to attempt a look at the issues behind project personnel and their relations to IT project success.

A number of the IT project personnel studies draws from the area of team management and team conflict studies when looking to issues of personnel conflict within IT project teams (Roberts et al. 2005; Barki & Hartwick 2001) and issues of team leadership (Abdel-Hamid 1992; and Stokes 1990). Other studies have focused on personnel issues from a number of standpoints by coming up with models and formulas for calculating the appropriate IT project size (e.g. Abdel-Hamid 1989). Basili and Beane (1981) discuss modeling the Parr curve as an underlying approach towards estimating personnel on short to medium termed projects, while utilizing the Putnam model for lengthier long-term projects.

The importance of the IT project personnel assigned to an IT project is continually voiced throughout IT project management studies. It has even been

considered a primary factor for the successful completion of IT projects in some studies (e.g. Agarwal & Ferratt 2002; and Bolan 2001). Since IT project management literature continues to stress the importance of IT personnel, an understanding of the IT personnel staffing and sourcing literature will further help define the research question of interest. The following section examines the literature associated with IT personnel hiring.

TABLE 2.1 Review of IT Project Management Literature

Authors	Year	Summary	Key Factors[1]
Articles focused on Project Control Issues			
Keider, S.P.	1984	Approaches the study of project management success from a reverse perspective. Examines project failures and the reasons behind these failures as a means towards planning. Learning from mistakes and planning around them.	Control: Planning via Leaning from Failures
Ahituv, N.; Borovits, I.; & Pomeranz, I.	1984	Introduces methodology for managing a subcontracted IT project. Issues of how to manage and control IT projects given to external groups is studied.	Control: Managing External Projects
Khan, M.B.	1985	Talks about the SCM,software configuration management plan to help establish policies and procedures that help make IS development run more smoothly.	Control: Planning
Severson, E. & Kozar, K.A.	1985	Examines how project backlogs require strong project management controls with well-defined boundaries and a strong-project plan.	Control: Planning
Bienkowski, D.	1988	The issue of selecting the appropriate project management software for helping aid the develop-ment process.	Control: Planning
Brooks, D.	1988	The problem of scheduling the appropriate personnel at the right time to complete a group of IS projects.	Control: Planning
Ryan, H.W.	1990a	Article points out to project managers looking for new methods and processes to just concentrate on the standard management cycle and make more effort in planning and controlling their projects	Control: Planning
McComb, D. & Smith, J.Y.	1991	Examines why systems project failures occur. Planning problems and execution problems are examined in detail. An analytical framework is developed to help project managers better plan.	Control: Planning
Nidumolu, S.R.	1995	Analyzes the importance of coordination mechanisms on the success of IT projects.	Control: Coordination Mechanisms
Koushik, M.V. & Mookerjee, V.S.	1995	Looks at the importance of coordinating team members on IT projects to help achieve the project objectives.	Control: Coordination Mechanisms

[1]**Key factors list the key factors from a particular study that are believed to drive IT project success.**

TABLE 2.1 Review of IT Project Management Literature (continued)

Authors	Year	Summary	Key Factors[1]
Articles focused on Project Control Issues (continued)			
Kirsch, L.	1997	Formal & informal modes of control are examined as they pertain to IS development efforts.	Control: Modes
Weiser, M. & Morrison, J.	1998	Presents a strategy for capturing the project history behind an IT development effort. This history would be retained for easy retrieval by other development efforts.	Control: Managing Knowledge
Abdel-Hamid, T.; Sengupta, K.; & Swett, C.	1999	Examines how goal setting effects the mgt. of Software Projects. An experimental study is utilized to see how goal setting impacts resource allocation and project performance.	Control: Deadlines & Goals
Zmud, R. & Sambamurthy, V.	1999	Theory of multiple contingencies is applied to the issue of IT governance. IT contingency forces and their influence on the mode of governance are examined in relation to Project Management.	Control: Modes
Barki, H.; Rivard, S.; and Talbot, j.	2001	Model of software development risk management is presented.	Control: Managing Risk
Schmidt,R.; Lyytinen, K.; Keil, M.; and Cule, P.	2001	Looks at the risk factors associated with develop-ing successful IT projects. Surveys were utilized to find these factors.	Control: Managing Risk
Nidumolu, S.R. & Subramani, M.	2003	Looks at the trade-off between imposing strong hierarchical controls and allowing project autonomy to stimulate development.	Control: Modes
Nidumolu, S.R. & Subramani, M.	2003	Looks at the trade-off between imposing strong hierarchical controls and allowing project autonomy to stimulate development.	Control: Modes
Choudhury, V. & Sabherwal, R.	2003	Five cases are presented as examples of how ISD (information systems development) controls are similar in both insourced and outsouced projects.	Control: Managing External Projects
Chiang, I.R. & Mookerjee, V.S.	2004	Discusses the use of software faults as a method to determine the timing of integration activities for IT development efforts.	Control: Planning

[1]**Key factors list the key factors from a particular study that are believed to drive IT project success.**

TABLE 2.1 Review of IT Project Management Literature (continued)

Authors	Year	Summary	Key Factors[1]
Articles focused on Project Commitment Issues			
Chalmers, L.S.	1984	Studies the issues behind implementing a new security software package within an organization. Study points to need for strong management support to carry out new implementation.	Control: Management Support
Keil, M.	1995	Studies the reasons behind software project escalation. Based on literature in the area of escalation, a case study is presented for analysis and discussion.	Escalation: Communication Issues
Newman, N. & Sabherwal, R.	1996	Looks at how commitment to an ISD project can influence the success or failure of such projects. Looks at factors that influence the level of commitment to an IT project.	Project Commitment
Keil, M. & Flatto, J.	1999	Looks at escalation of commitment through the lens of options theory.	Escalation: Management
Keil, M. & Robey,D.	1999	Examines the issue of turning around troubled IT projects. Managerial effort is believed to be the key component for turning around troubled projects. Issues of de-escalating commitment on troubled projects also examined.	Escalation: Management & Leadership
Keil, M.; Mann, j.; & Rai, A.	2000	Examines issues concerning the escalation of IT projects. 4 theoretical models for explaining the escalation of commitment are presented and tested.	Escalation Communication Issues
Montealegre, R. & Keil, M.	2000	Case study on de-escalating IT projects. Study on the Denver International Airport baggage handling system. The development of this IT system is profiled in detail.	Escalation Communication Issues
Keil, M.; Tan, B.C.; & Wei, K.	2000	The escalation of commitment issue is examined from cross-cultural perspective. Singapore, Finland, & the Netherlands are used to study how power w/in cultures influences commitment.	Escalation: Cross-cultural Power issues
Smith, H.J.; Keil, M.; & Depledge, G.	2001	A model on the reluctance to report negative development efforts is presented. An experiment is run to test the model on 163 students. Focus is on "runaway" projects.	Escalation: Communication Issues

[1]**Key factors list the key factors from a particular study that are believed to drive IT project success.**

TABLE 2.1 Review of IT Project Management Literature (continued)

Authors	Year	Summary	Key Factors[1]
Articles focused on Management Improvement Issues			
Kirby, E.	1984	Discusses the inappropriate use of project management techniques by MIS professionals & how proposer usage can help forecast resources, costs, get more effective user involvement.	Improving Management Methodologies
Stanley, F.J.	1988	Discusses the need to improve management techniques to deal with the complex task of IS project management.	Improving Management Methodologies
Railing, L. & Housel, T.	1990	TRW's integrated voice and data network project is profiled in a case study. The various techniques to improve management and process of IT project management are described.	Improving Management Methodologies
Ware, R.	1991	Looks at what project management software can actually do and not do for a project manger. The costs of such software is also examined.	Improving Methods via Software Tools
Rodrigues, A.G. & Williams, T.M.	1997	Article discusses the lack of imporvement in management methodoligies for IT projects. Presents the System Dynamic (SD) model as a way to help improve management practices.	Improving Management Methodologies
Aladwani, A.M.	2002	Attempts to validate an integrated performance model dealing with IS projects. 6 categories for measuring IS project performance proposed. Survey administered to 84 IS project leaders.	Improving Performance Measurement
Articles focused on Project Personnel Issues			
Abdel-Hamid, T.K.	1989	Simulation model presented to test the interchangeability of months and the number of personnel. Case study also examines managing human resources in project life cycle.	Project Personnel: Staffing models
Stokes, S.L.	1990	Examines the importance of leading IT project teams effectively. Looks to collaborative approaches to manage personnel on teams.	Project Personnel: Leadership
Abdel-Hamid, T.K.	1992	Studies the effects of project management turn-over and the effect it has on the success of a project. Experiment run on 36 grad students.	Project Personnel: Leadership

[1]**Key factors list the key factors from a particular study that are believed to drive IT project success.**

TABLE 2.1 Review of IT Project Management Literature (continued)

Authors	Year	Summary	Key Factors[1]
Articles focused on Project Personnel Issues (continued)			
Basili & Beane	1981	Presents a staffing calculation model based on the Parr curve. Short, medium, and long-term projects are also taken into consideration.	Project Personnel: Staffing models
Yoon, Y.; Guimaraes, T.; & O'neil, Q.	1995	Study lookes to identify the factors that lead to the succesful development and deployment of expert systems. Focus on importance of inter-action between project personnel & end-users.	Project Personnel: End-User participation
Barki, H. & Hartwick, J.	2001	Deals with interpersonal conflicts during the development of information systems projects.	Project Personnel: Team Conflict
Bolan	2001	Discusses the importance of staffing on IT projects and how it is considered a key variable in the success of a project.	Project Personnel: Importance of Personnel
Agarwal & Ferratt	2002	Article about the management of IT personnel and the importance of IT personnel to organizations. Discussions about personnel on IT projects are also discussed.	Project Personnel: Importance of Personnel
Roberts, T.L.; Cheney, P.H.; Sweeney, P.D.; & Hightower, R.T.	2005	Examines how the complexity of a project can effect group interactions and project success. Complex = LAN & WAN development Less Complex = Website Development	Project Personnel: Team Interactions

[1]**Key factors list the key factors from a particular study that are believed to drive IT project success.**

2.2 IT Personnel Staffing

The continual evolution of technology creates a corresponding need in most organizations to continually upgrade or find the necessary and critical IT skills required for competitive success (Bartlett & Ghosal 2002). With the growing importance of information technology and subsequent need for appropriate IT personnel staffing, there has been a need to understand the role of the IT employee

within organizations. The importance of studying IT personnel as a separate occupational group has been voiced in a study by Orlikowski and Baroudi (1989).

From these initial calls for further studies on IT personnel staffing issues a number of studies on the subject have emerged. These studies have covered issues of ethical behavior among IT employees (Prior 2002), the influences of high-level IT executives over employees in organizations (Ennis 2001), and conflict issues between IT employees and other employees across organizational departments (Hornik, Chen, Klein & Jiang 2003). IT employee conflict studies have begun to define and differentiate the IT employee into a distinct sub-group or subculture (Barki & Hartwick 2001) within organizations. This differentiation has caused some researchers to state that IT employees and their fellow colleagues within organizations tend to have "different realms of meaning" (Agarwal & Ferrat 2000). Researchers have begun to point out that the main reasons for this conflict are communication problems or a lack of communication skills found in IT employees (Alvarez 2002 and Jacobs 1998). The differentiation of the IT employee has led to some studies that have examined the issues surrounding the hiring and retention of IT personnel. The following section examines an emerging stream of research that examines the strategic implications behind the hiring and retention of IT personnel.

2.2.1 Organizational Strategies for Hiring and Retaining IT Personnel

A look at IT staffing indicates it revolves around two key issues: *whom to recruit* and *how to ensure the IT staff has critical skills* (Schwarzkopf, et al. 2004, and Agarwal & Ferrat 2001). Organizations address the first issue of *whom to recruit* when they adopt an information technology human-resource (IT HR) strategy. A study by Agarwal and Ferratt (2001) presents a set of strategies that firms are currently employing in recruiting IT professionals. These strategies are: a long-term investment strategy, a short-term investment strategy, and a balanced investment strategy (Agarwal & Ferratt 2001) further segment this strategy into High Performance Professional and Balance Professional). Depending upon the IT HR strategy adopted by an organization (see figure 2.1), firms can then take an approach towards ensuring the availability of critical IT skills. The approaches available to an organization in regards to *ensuring the IT staff has appropriate critical skills* are either an acquisition approach or a developmental approach. Organizations will utilize some combination of these two approaches when attempting to ensure the

Figure 2.1 Information Technology HR Strategy

IT HR STRATEGY		
Short-term IT HR Strategy	**Balanced IT HR Strategy**	**Long-term IT HR Strategy**
Seeks only short-term relationships with IT professionals, assuming pressing needs are generic IT skills	Seeks relationships that yeild productive contributions for a number of years to reduce costs associated with turnover & related recruiting, while avoiding costs of LT development	Seeks LT relationships with IT professionals, assuming organization-specific knowledge and commitment is valuable for obtaining productive contributions

availability of the critical IT skills they deem important for current and future competitive success.

Under the long-term investment strategy, organizations view IT employees as worth developing and retaining due to their specific knowledge and competencies relative to the organization and IT (Schwarzkopf et al. 2004, and Agarwal & Ferratt 2002, 2001, and 1999). Firms employing this strategy focus on the retention and development of their IT employees. The sentiments of a CIO from a firm employing the long-term(LT) IT HR strategy indicate that they view *IT professionals as a precious resource and are greatly concerned about the risks of losing these valued assets* (Bartlett & Ghoshal 2002). With the long-term IT HR strategy, firms see the importance of IT employees, viewing them as valuable assets; due to both their business knowledge and their technical knowledge. The blending of these two knowledge bases (business and technical) creates a unique set of experiences that organizations, which employ the long-term IT HR strategy, find invaluable (Bartlett & Ghosal 2002).

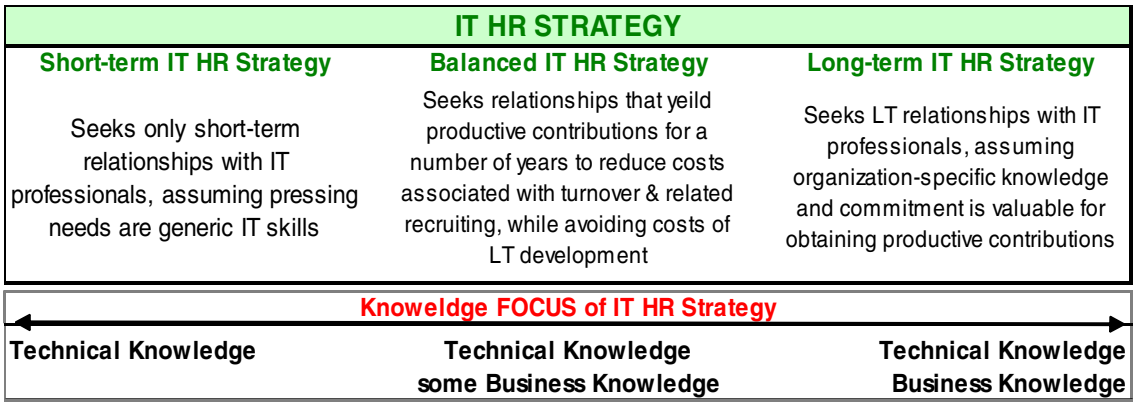
On the other end of the spectrum with the short-term IT HR strategy, firms view IT employees as generic resources. The value of the IT employee is based primarily upon what they can bring to the current project(s) at hand. Under the short-term IT HR strategy, organizations view the IT employee as not warranting the long-term expenses required for retention and upgrading (Agarwal & Ferratt 2001). Firms utilizing this approach view the IT employee as a generic resource that is easily obtained on the open labor market. Organizations employing this strategy may not

view IT as an essential or important part of the long-term business goals of the organization. IT is essentially a generic tool that can be brought into the organization whenever necessary. The synergies evolving from a blending of business and technical knowledge is either not considered or considered unimportant for organizations utilizing this type of strategy.

The third IT HR strategy falls between the two strategic extremes. Firms employing this strategy see the value of the IT employee for an extended length of time. This value is related primarily to the cost-saving benefits of avoiding recruiting and turnover costs (Agarwal & Ferratt 2001). While this strategy recognizes the possible need to retain IT employees for multiple projects, and thus avoid additional recruitment and hiring costs, it does not recognize a need for long-term retention and development, thus avoiding all costs associated with such a strategy.

Agarwal and Ferrat (2001) argue that the IT HR strategy that is employed by an organization presents the knowledge focus philosophy that a firm intends to follow (see figure 2.2). With a short-term strategy, organizations tend to place little emphasis on the business knowledge aspects of IT. In this instance, the organization believes that the business knowledge is either not relevant to the IT tasks at hand or can be easily incorporated into the IT tasks at hand. The focus is more on the technical knowledge that is required for the current IT project(s). It would appear that these firms see little value on the development of IT personnel who possess not only the requisite technical knowledge but also the business knowledge on how to apply their technical knowledge to projects relating to the firm.

Figure 2.2 IT HR Strategy & Knowledge Focus



It is argued that firms that take more of the long-term IT HR strategy believe that both technical and business knowledge are of equal importance (Arnold & Niederman 2001). In many instances, it is the experience and skills that emerge from the blending of these two sources of knowledge that firms employing the long-term IT HR strategy believe bring the most benefit to the organization. It is with this strategy that firms build the strategic resources described under the resource-based view of the firm.

Depending upon the strategic HR approach taken, firms approach the IT knowledge upgrade issue differently. Long-term approaches focus on the need for training to develop internal IT employees for the unpredictable nature of technology. Short-term approaches look to address needs when necessary and operate under a philosophy akin to JIT (just-in-time), while the balanced approach recognizes the

monetary benefits of retention, but sees the costs of training as outweighing the benefits.

2.3 Conclusions from Literature Review

A number of studies from the IT project management literature stream point to the importance of IT personnel sourcing and staffing. It has been shown, in some studies, to influence the successful completion of an IT project (Agarwal & Feratt 2002 and Abdel-Hamid 1992). A review of the IT project management literature has raised some important issues such as control and coordination (of IT personnel resources) and managerial support (of team personnel). Both are important issues that will need to be considered in light of the IT project personnel sourcing question.

From IT personnel staffing literature, the differentiation of the IT employee within organizations has led to a stream of research that raises the strategic implications behind IT personnel hiring and retention. Factors such as knowledge retention and training are key points to consider when deciding on the strategic approach to IT personnel staffing within organizations. The strategic importance of the IT personnel resource, raised by IT personnel literature, must also be extended to the IT personnel utilized on IT projects. The strategic implications of knowledge retention and training remain just as salient in the IT project context.

The primary conclusion, drawn from the review of IT project management literature presented in this chapter, is that the IT personnel question is a salient piece of the IT project success equation. In order to address the proposed question of IT

project personnel sourcing, the factors from both IT project management and IT personnel staffing literature must be integrated. The theoretical and research model developed in the following chapter will attempt to bring together these factors through an integration of internal labor market theory, knowledge-based theory, and transaction cost economics.

Chapter 3. The Project IT Personnel Sourcing Model

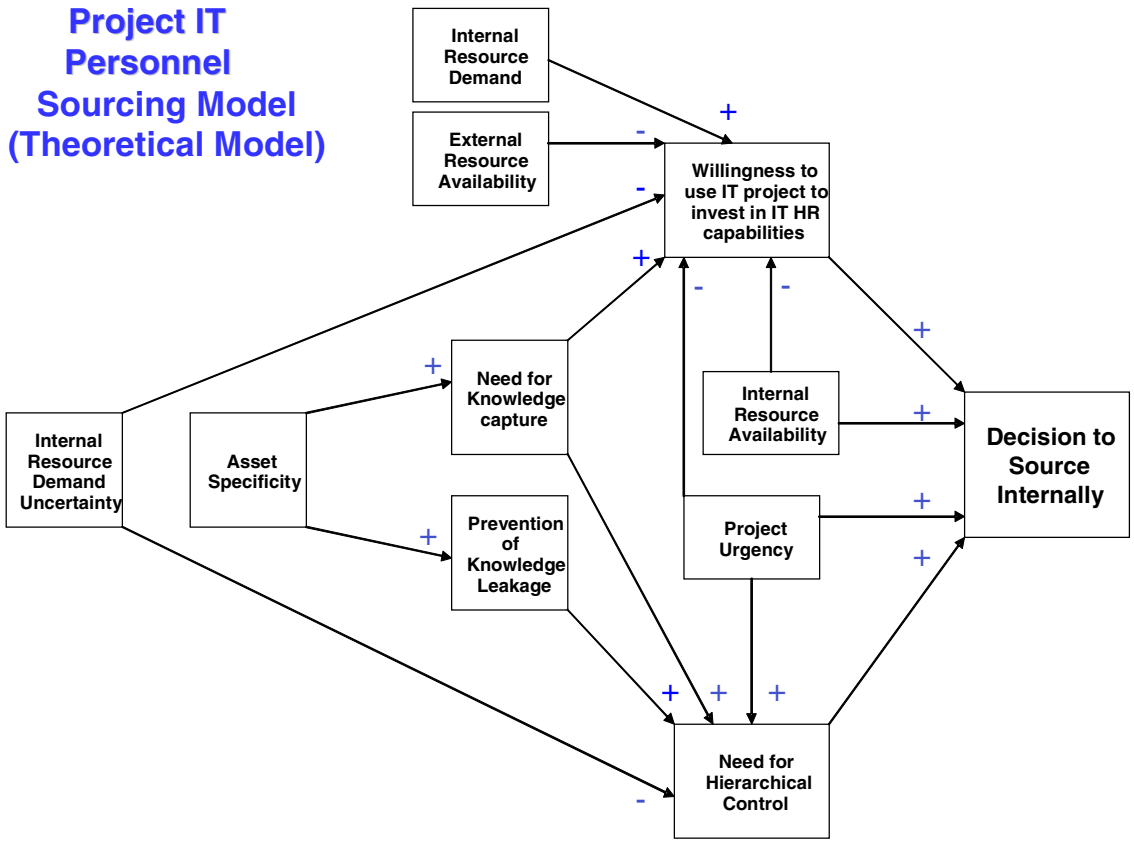
The theoretical model for *Project IT personnel sourcing* is developed in the following sections of chapter 3. The first section introduces the model with its various constructs. This is followed by a discussion on the surfacing of these constructs via three theoretical lenses: Internal Labor Market theory, Transaction Cost Economics, and Knowledge Based theory. These three theories provide the theoretical justifications for the sourcing decisions facing the project manager. This is followed by a section detailing the interviews that were conducted with a number of IT project management professionals. The interviews provide grounded justification for the constructs surfaced from the preceding three theories and also surfaces the final construct in the theoretical model. Then, the chapter's final sections will present the research model and provide a more detailed set of definitions and explanations regarding the constructs in the research model. The chapter concludes with a section that develops the hypotheses regarding the relationship surrounding these constructs for testing purposes.

3.1 The Theoretical Model

The theoretical model examines project IT personnel sourcing decisions'. The focus is on management-approved internal development efforts as opposed to external or commercial development. Within this context, the theoretical model attempts to ascertain the influence various key factors play on the sourcing decision a project manager faces with the various IT personnel required on the management approved

IT project (see Figure 3.1). The decision of interest in the theoretical model is the sourcing decision taken by a project manager to internally or externally source a particular IT personnel resource.

Figure 3.1. The Project IT Personnel Sourcing Model (Theoretical Model)



The *project IT personnel sourcing theoretical model* brings together a set of factors that are believed to have some bearing on the project manager's sourcing decision.

These factors can be segmented into resource factors and project factors (see Table 3.1). Resource factors or attributes are defined to be characteristics pertaining to a particular resource (e.g. value, imitability) (Madhok 2002). The resource factors found in the *project IT personnel sourcing theoretical model* are: asset specificity, the need for hierarchical control, internal resource demand, internal resource demand uncertainty, internal resource availability, and external resource availability. While resource factors pertain to characteristics of the resource under consideration, project factors or attributes *"address issues that are inherent to the IT project itself, such as timeframes and project deadlines"* (Rothenberg 2003). The project level attributes found in the proposed model are: willingness to use the IT project to invest in IT HR capabilities, prevention of knowledge leakage, need for knowledge capture, and project urgency. The combination of both resource and project level factors will directly or indirectly influence the IT personnel sourcing decisions that are made by the project manager.

3.1.1. The Resource Factors

The six resource factors found in the theoretical model are all characteristics, of the resource under consideration, which can have an influence on the project manager's sourcing decision. *Asset specificity* characterizes the uniqueness of an asset within an organization. A highly asset specific resource is unique to the organizational context within which it functions (Widener & Selto 1999; Williamson 1985). The *need for hierarchical control* refers to the desire to impose hierarchical

controls over the resource under consideration. A highly important or valuable resource would merit a greater degree of hierarchical control over the resource

Table 3.1. Factors Influencing the Project IT Personnel Sourcing Decision

Resource Factors	
1. Asset Specificity	The uniqueness of an asset within an organization.
2. Need for Hiearchical Control	The need to utilize institutional and formal controls over a particular IT personnel resource.
3. Internal Resource Demand	The demand within an organization for a particular IT personnel resource.
4. Internal Resource Uncertainty	The inability to accurately gauge the internal demand for a particular IT personnel resource.
5. Internal Resource Availability	The ability to locate and utilize a required resource within an organization.
6. External Resource Availability	The ability to locate and utilize a required resource from an external source (external to organization).

Project Factors	
1. Willingness invest in IT HR Capabilities	The willingness to utilize the IT project as a platform for developing needed IT skills and abilities.
2. Prevention of Knowledge Leakage	The need to protect knowledge experiences, generated by an IT project, from competitors.
3. Need for Knowledge Capture	The desire to maintain the knowledge experience generated by an IT project w/in the organization.
4. Project Urgency	The time limitations imposed upon an IT project.

Lindgren 2003; Lee & Yang 2000; and Thompson 1967). *Internal resource demand* deals with the internal need for the IT personnel resource for other projects or other purposes within the organization. *Internal resource demand uncertainty* refers to the uncertainty or degree of doubt associated with the need for a particular IT personnel resource within the organization. The internal and external resource availability constructs deal with the extent to which IT personnel resources are available for use

on an IT project. *Internal resource availability* refers to resources available for use within the organization while *external resource availability* refers to resources available for use outside the organization. All six of these constructs deal with some characteristic of the IT personnel resource.

3.1.2. The Project Factors

Project factors address issues that stem from the IT project itself. This includes the *willingness to use IT projects to invest in IT HR capabilities*. The *willingness* factor allows the IT project to be utilized as a means for developing new IT HR abilities. When an organization finds an IT HR capability to be of significance, they will tend to source that capability in a particular manner in order that employees acquire this knowledge. The knowledge capture and knowledge leakage factors deal with the retention and protection of important knowledge. The *knowledge capture* factor refers to the desirability of maintaining knowledge experience generated by the IT project within the organization. With the *need for knowledge capture*, the organization is looking to store or "capture" the knowledge generated from the IT project. The *prevention of knowledge leakage* factor refers to the need to protect the knowledge experience generated by the IT project from current and potential competitors. This is usually done prevent competitors from gaining access to this knowledge due to having it unintentionally diffuse or "leak" out of the organization. The final project level factor found in the model is the *project urgency* factor. Project urgency deals with the finite time-frame or deadline imposed upon the

IT project. Urgent projects tend to have a strategic importance for the organization and are generally time sensitive with short time-frames. The four project level factors all deal with some aspect of the overall IT project itself.

3.2 Surfacing of Theoretical Model Constructs

Internal labor market theory, knowledge based theory, and transaction cost economics present the theoretical underpinnings for the various factors found in the proposed sourcing model (see Table 3.2). The three theories focus on specific factors of the model in helping to frame the sourcing decision encountered by the project manager. Section 3.2.4 details the use of interviews with IT project professionals to help confirm the constructs surfaced by these theories. Along with helping to confirm the constructs, the interviews also surfaced a construct not drawn from the three complementary theories (see Table 3.2). The following three sections present and discuss the constructs surfaced via internal labor market theory, knowledge based theory, and transaction cost economics follows.

3.2.1. Internal Labor Market Theory

An important factor that must considered when making a sourcing decision on any IT project is the availability of these resources. The theoretical model incorporates the resource availability effects through two resource factors: the

available internal resources and *available external resources*. The core of Internal Labor Market (ILM) theory is the belief that the labor market is segmented into two distinct groups, an internal and an external labor market.

The initial pioneering work on Internal Labor Markets (ILM) was done by Clark Kerr (1954), who proposed the existence of an internal labor market. This proposition was in direct contrast to the existing economic views that held labor markets to be a single market of competitive workers fighting for all jobs all of the time (Camuffo 2002). Building from Kerr's proposition, Doeringer and Piore developed a set of characteristics explaining the unique aspects of governing the internal labor market (Doeringer & Piore 1971). Doeringer and Piore's work on distinguishing internal labor markets serves as the theoretical foundation of Internal Labor Market theory.

Internal labor theory market research concentrates on characterizing and describing the internal labor market and in turn distinguishing it from the external labor market. Internal labor markets are defined to be "an administrative unit within which the pricing and allocation of labor is governed by a set of administrative rules and procedures" (Doeringer & Piore 1971). A recent revision of this definition was proposed by Piore (2002), who adds that "internal labor markets are not simply bound by administrative rules and procedures, but also by social practices and customs." The segmented labor pool that lies at the heart of ILM gives us the theoretical basis for needing to consider both internal and external labor sources, which is an important aspect of the proposed model. The theoretical model incorporates this segmentation

by including the effects of having or not having internal and external resources available when making the internal sourcing decision. In the context of this study, the internal labor market is represented by the various IT personnel resources within a firm that are available for use by the firm for sourcing the project under consideration. The *external resource availability* factor in the theoretical model represents the resources outside of a firm's boundaries which can be used to acquire the IT personnel resource(s) required for a particular project. When making the sourcing decision, the project manager must consider the labor market from both an internal and external labor market perspective.

Table 3.2. Theoretical Origin of Project IT Personnel Sourcing Factors

Resource Factors	Source of Construct
1. Asset Specificity	Transaction Cost Economics
2. Need for Hiearchical Control	Transaction Cost Economics
3. Internal Resource Demand	Transaction Cost Economics
4. Internal Resource Uncertainty	Transaction Cost Economics
5. Internal Resource Availability	Internal Labor Market Theory
6. External Resource Availability	Internal Labor Market Theory

Project Factors	Source of Construct
1. Willingness invest in IT HR Capabilities	Knowledge Based View
2. Prevention of Knowledge Leakage	Knowledge Based View
3. Need for Knowledge Capture	Knowledge Based View
4. Project Urgency	Interviews

Since the internal labor market is generally located within a specific organization or institution, it is generally controlled by a set of well-defined procedures and company norms (Camuffo 2002, and Osterman 1982). The existence of institutional norms along with the institutions ability to reward (or penalize) internal labor through promotions (or lack of promotions) creates a governance mechanism that allows institutions stronger control over their own internal labor markets (Althauser & Kalleberg 1981, and Doeringer & Piore 1971).

The advancement and effects of information technology in the recent decades has made ILM researchers revise some of their perspectives regarding the internal

labor market. Internal labor markets theorists now recognize the possibility of different types of internal labor markets (Osterman 1982). Internal labor markets contain both blue collar and white collar laborers (Piore 2002, and Osterman 1982). Piore (2002) characterizes the new economy as an arena where work tends to be organized into projects that are unique, with modern day projects tending to require a mix of different technical skills. The new technologically dominant environment has created a subgroup of white collar workers that constitute a new labor market. Software engineers and designers can be taken as prototypical of this new labor market (Piore 2002).

The rise of this new technical labor market parallels the rise of contingent labor (contracting and outsourcing) that has occurred in recent years (Kunda, Barley, and Evans 2002). Many of these recent changes to the Internal Labor Market theory have been attributed to changes in technology, organization forms, and globalization (Kunda, Barley, & Evans 2002, and Piore 2002). The importance and evolutionary nature of technology makes firms carefully consider the type of knowledge or experience, and hence the workers that are valuable to a firm (Piore 2002, and Reich 1991).

Recent theoretical modifications by ILM theorists have also highlighted the importance of worker experience and knowledge. With the technical knowledge aspects of the new labor market (Piore 2002), firms must carefully consider the value of controlling and maintaining important knowledge for competitive purposes.

The recent ILM modification(s) is reflective of the current technological landscape and is highly representative of the context found in this proposed study. ILM recognizes the existence of two labor pools, which the project manager must take into account in making an IT project sourcing decision (internal versus external), but current ILM theory recognizes the need for controlling and maintaining technical knowledge in today's new economy (Piore 2002, and Reich 1991). Within the context of the proposed study, the IT project manager is cognizant of the two labor pools and how important knowledge can be more easily maintained with internal labor as opposed to external labor sources. Though ILM does not explicitly argue for one type of sourcing over another (internal versus external), it does point to the stronger degree of control organization's possess over internal labor markets, leading to greater control over knowledge resources (Piore 2002). A stronger theoretical case for controlling and maintaining the knowledge resource is found in the following section(s) discussion on knowledge based theories. The following section on *knowledge based theory* compliments ILM by arguing more strongly for the need to capture and maintain knowledge, while surfacing more factors for consideration in making the project IT personnel sourcing decision.

3.2.2. Knowledge Based Theory

Knowledge based theory (KBT) deals with the strategic importance organizations associate with proprietary or unique knowledge assets (e.g. Kogut & Zander 2003, 1996, & 1992, Foss 1996a & 1996b, and Spender & Grant 1996).

Another set of factors that must be considered when making the IT personnel sourcing decision deals with the development and retention of valuable IT knowledge generated from the IT project. Three factors in the proposed model address the knowledge development and retention issue: *willingness to use the IT project to invest in IT HR capabilities, need for knowledge capture,* and *prevention of knowledge leakage.* The issues of knowledge development and retention are the two key factors behind the knowledge based perspective.

It is the need to (1) build knowledge assets and the need to (2) protect these knowledge assets that knowledge theorists have built their explanations for the existence of the firm (e.g. Kogut & Zander 2003, 1996, & 1992; and Conner 1991). While the knowledge based perspective for the existence of the firm continues to be argued by scholars (e.g. Kogut & Zander 2003 & 1996, and Foss 1996a & 1996b), its underlying rationale regarding the importance of knowledge assets is accepted by both opponents (Foss 1996a & 1996b) and proponents (Kogut & Zander 2003 & 1996) of the knowledge based view. In order to sustain their performance, firms must continually develop, utilize and maintain their knowledge assets to prevent knowledge degeneration (Nonaka 2001). The importance of knowledge as a strategic asset resonates throughout the resource-based view. Current studies, by resource-based strategic researchers, seem to point to knowledge as the basic source of advantage in competition (e.g. Kogut & Zander 2003, Lindgren 2003, and Bollinger & Smith 2001). With the emerging central theme, from strategic management's resource based literature, that privately held knowledge is the basic source of

competitive advantage, the knowledge-based view is now theorized to be the essence of the resource-based perspective (Lindgren 2003, Pitt & Clark 1999, and Conner & Prahalad 1996).

The knowledge-based perspective views knowledge as the critical factor affecting an organization's ability to remain competitive in the new technologically driven marketplace (Lindgren 2003, Bollinger & Smith 2001, and Lee and Yang 2000). The evolutionary growth of technology during the past few decades has changed the conception of work from a focus on narrow and specific tasks carried out by individuals, to a focus on collective effort reflected through project teams driven by individuals with diverse skills (Lindgren 2003). This has led to the coining of the phrase "knowledge worker" in order to describe the increased importance of knowledge in the emerging postindustrial society (Drucker 1988 & 1993). The knowledge work performed by "knowledge workers" is *knowledge-intensive*, which usually requires a formal education, that is, abstract, technical, and theoretical (Starbuck 1992). With the emergence of project-driven knowledge intensive work, the creation, retention, utilization, and protection of these knowledge assets is of paramount concern for all organizations.

Organizational structures will tend to oscillate between bureaucratic and task force or project team oriented forms (Lindgren 2003, and Nonaka & Takeuchi 1995). This oscillation is reflective of the organization's need to not only create new knowledge but the need to combine, transform and exploit this new knowledge. A good example can be found in the U.S. military, which has a strong bureaucratic

nature during peacetime but is highly task force-oriented (project team oriented) in wartime (Nonaka & Takeuchi 1995). Depending upon the environmental situation, organizations will emphasize one form over another. During conditions of stability, a bureaucratic structure tends to work well as it emphasizes control and predictability of functions. The desired qualities of predictability and control during periods of stability will tend to inhibit qualities of innovation and self initiatives, which are important during periods of uncertainty and rapid change. In order to facilitate the knowledge creation, retention and use cycle that is so vital for business competition, firms must be able to transition effectively between bureaucratic structures and project-task oriented structures (Nonaka 2001, and Nonaka & Takeuchi). During periods of uncertainty and rapid change, project team structures can help facilitate the innovation and creation of new and strategic knowledge. Since project teams are temporary in nature, a bureaucratic structure must be used to help facilitate the retention and future exploitation of the newly created knowledge resource (Nonaka & Takeuchi 1995).

The project driven, knowledge worker organizations reflected in the knowledge-based perspective, mirrors the context within which this proposed study is situated. While this study focuses on the sourcing decision a project manager must make regarding a particular IT personnel resource, the knowledge intensiveness that characterizes IT projects merits and makes essential the consideration of knowledge issues (Lindgren 2003). Since the agility and flexibility characteristics of IT project teams is conducive to the creation of new knowledge (Nonaka & Takeuchi 1995),

project managers must consider whether the project presents opportunities to generate knowledge essential (strategic) for the future competitiveness of the firm, and thus source appropriately. The *willingness to use the IT project to invest in IT HR capabilities* factor reflects this need. Projects that may generate valuable or strategic knowledge will compel the project manager to develop this knowledge. Knowledge that is considered valuable to the firm also raises the issues of knowledge retention and protection (Nonaka & Takeuchi 1995, and Thompson 1967).

The issues surrounding knowledge retention and protection comprise the other half of the knowledge-based perspective. Since firms maintain their competitive advantage through the development and integration of knowledge assets, it follows that firms will need to retain and protect these assets (Kogut & Zander 2003 & 1996, and Thompson 1967). The maintenance and protection issues, espoused by the knowledge-based perspective, are reflected in the theoretical model through the *Need for Knowledge Capture* (retention) and the *Prevention of Knowledge Leakage* (protection) factors. With the *Need for Knowledge Capture*, the project manager considers the importance of retaining the knowledge generated from the IT project and will source the IT personnel resource accordingly. The *Prevention of Knowledge Leakage* reflects the knowledge protection issues that a project manager considers when making the sourcing decision. Along with the *Willingness to Use IT Project(s) to Invest in IT HR Capabilities,* the incorporation of these three factors in the proposed model reflects the importance of building, retaining, and protecting valuable

knowledge assets which are the theoretical basis for the knowledge-based perspective.

The knowledge based perspective gives the underlying reasons for the importance of knowledge. The current technologically driven organizations must create and integrate this knowledge via a myriad of project teams. Since an organization's competitive abilities is in many ways linked to their retention and integration of this crucial knowledge, the need to develop and hold on to this knowledge must weigh on the project manager's decisions on sourcing the IT personnel resource. The strategic nature of knowledge will cause sourcing decisions reflective of the strategic nature of the project. While the theoretical model considers the location of IT personnel resources (internal or external) and the strategic importance of knowledge, it must also incorporate the economic factors that are involved in a sourcing decision. These economic factors are found in the following sections discussion on transaction cost economics. Through the complementary integration of transaction cost economics with ILM and KBT, three additional factors in the theoretical project IT personnel sourcing model are surfaced.

3.2.3. Transaction Cost Economics

Transaction cost economics is an economically-rational perspective that recognizes the significance of transactions costs in any market transaction. TCE focuses on the decision making process that occurs when firms consider the issue of where the most beneficial means of obtaining goods and services resides; either

within a firm's boundaries or outside of a firm's boundaries. The TCE decision of interest, whether to obtain goods and services internally or externally, is analogous to the IT sourcing decision confronting the project manager in the theoretical model. In the theoretical project IT personnel sourcing model, the decision deals with whether firms should source a particular IT personnel resource internally or externally. The similarity between the TCE decision and the IT personnel sourcing decision (internal versus external) is also reflected in the factors that influence the decision processes of both situations.

The major consideration for the TCE decision is the cost that arises from transacting for the goods and services. These transaction costs *are the ex ante cost of drafting, negotiating, and safeguarding an agreement, and, more especially, the ex post costs of maladaptation and adjustment that arise when execution is misaligned as a result of gaps, errors, omissions, and unanticipated disturbances* (Williamson 1975). Essentially in the context of the IT personnel sourcing decision, transaction costs refer to the effort and costs incurred in locating, retaining, using and monitoring the specific IT resource(s) needed on a specific IT project. The four issues that cause transaction costs to arise are (1) asset-specificity: *the degree to which an asset needed to perform an activity can not be transferred to other activities, i.e. are unique to certain activities, including human expertise and knowledge of sources of competitive advantage*, (2) uncertainty: *the computational inability to ascertain the structure of the environment*, (3) opportunism: *self-interest seeking with guile, to include calculated efforts to mislead, deceive, obfuscate, and otherwise confuse*, and (4)

bounded rationality: *behavior that is intendedly rational but only limitedly so* (Williamson 1985; Coase 1937).

These four issues are found in the context of the IT personnel sourcing decision. The first issue deals with the costs associated with asset specificity. In the context of an IT project, asset specificity costs arise due to (1) information system and business process specificity issues (Badaracco 1991). Information system and business process specificity issues refer to the costs arising from ramping up the learning curve on IT personnel who are unfamiliar with a particular system or business process within which the project team must operate (Argote, McEvily, & Reagans 2003). Asset specificity costs will tend to rise as IT personnel resources assigned to a project are unfamiliar with the project environment (business processes) or systems. The project manager must consider the asset-specificity issue when making the sourcing decision regarding a particular IT personnel resource. This is represented in the proposed model by the *Asset Specificity* factor. A particular IT personnel resource that requires high asset specificity costs as opposed to a resource with low asset specificity costs will have different affects on the sourcing decision.

The second (uncertainty) and fourth (bounded rationality) issues both deal with aspects of uncertainty, which is reflected in the *Internal Resource Demand Uncertainty* factor. This factor deals with the issues of uncertainty involved in gauging the need for a particular IT personnel resource. The concept of *uncertainty* is defined as the degree of doubt associated with "the future state of the environment and what will be required to cope with that world" (Pfeffer 1982). This mirrors the

uncertainty issues of *being unable to ascertain the structure of the environment* from transaction cost economics and the bounded rationality issue that *implies that there are limitations on an individual's cognitive processing abilities* (Williamson 1985). In the context of project sourcing, project managers must make an optimal sourcing decision given the situation by considering how sourcing a particular IT resource can affect the possible future utilization of that resource given the uncertain future conditions that may exist within the organization. The uncertainty regarding the future demand of a particular IT personnel resource will play some role in the final sourcing decision made by the project manager.

The third issue of opportunism relates to a firm's need to monitor the personnel associated with IT projects. The potential to act opportunistically exists for the agents involved on an IT project (Moschandreas 1997). Opportunism will occur when both parties, the agent and the principle, have different goals (Tuttle, Harrell, & Harrison 1997). In the context of an IT project, the principle is interested in the successful completion of the project by meeting all the quality and requirements specifications at the lowest cost possible while the agent is interested in maximizing their fees. In order to alleviate this issue, an alignment of both the principle's and the agent's goals is needed (Jensen & Meckling 1976). This can possibly be achieved by stipulating incentive targets for the agents that are aligned to the goals of the principle. Firms will need to carefully monitor the situations that exist within these projects in order to oversee a project's progress and check on the continual alignment of goals in order to limit opportunistic behavior. Since quality issues, requirements

objectives and cost overruns on most IT projects are attributed to personnel; it is usually not the case that the technology is faulty or has gotten more expensive but it is the poor quality of work done by personnel, leading to missed objectives and an increase in personnel costs due to projects falling behind schedule (Moschandreas 1997); the need to monitor progress and control opportunism is important. The *Need for Hierarchical Control* factor in the proposed model represents the need to monitor or control the IT project due to opportunism. Project managers must consider the best means of controlling and monitoring an IT project in light of opportunism due to the importance of knowledge as stated by both *internal labor market* and *knowledge based* theories. Sourcing decisions will be influenced by control issues when looking to limit opportunism and thus prevent the leakage of valuable knowledge assets (Teece 1986);

The final factor of *internal resource demand* deals with the transaction cost issues of repetitive use and economies of scale. An anticipated high demand for a particular IT personnel resource brings up the issue of continual cost (the costs of continually utilizing an external resource). With an external sourcing decision, a strong demand may present high costs associated with continually contracting out for this particular IT personnel resource. The transaction costs associated with an external solution must be weighed against the internal sourcing decision where economies of scale, developed through the repetitive usage of such a resource, may present a more economical choice (Argote, McEvily, & Reagans 2003).

Along with the resource location considerations from *internal labor market theories,* and strategic knowledge implications from *knowledge based theories, transaction cost economics* raises important cost-related issues that must also be considered when making a sourcing decision on a particular IT project. In order to help confirm the importance of the eight constructs surfaced via the literature review of ILM, KBT, and TCE theories, a set of interviews was conducted with IT project management professionals. The following section details the interview process and the constructs that were verified via these interviews.

3.2.4. A Grounded Approach: Interviews with IT Project Professionals

A further validation of the factors surfaced in the prior sections on ILM, KBT, and TCE was done through a series of interviews. These interviews were conducted with five IT professionals from four separate organizations during February and April of 2004. The five IT professionals interviewed all work as project managers or directors in their respective organizations. The interviews were conducted either in person or via phone and lasted between 45 to 75 minutes in length (see Appendix A for a copy of the interview questions). The purpose of the interviews was to (1) validate and confirm the factors surfaced from the strategic management literature review and (2) surface any other potentially important constructs.

The interviews did help confirm (see Table 3.3a.) the importance of the eight factors surfaced from a review of MIS and strategic management literature focusing on *internal labor market theory, knowledge based theory,* and *transaction cost economics*. Along with helping to confirm the eight factors identified from *ILM,*

KBT, and *TCE*, the interviews also surfaced an additional factor (see Tables 3.3a. and 3.3b.). The additional factor surfaced in the interviews dealt with the time and temporal constraints imposed on IT projects:

> ***With the time constraints we needed people who knew our systems and we couldn't get outside developers up to speed.***
> (source: Subjects A&B Interviewed 2/26/04)

The temporal constraint factor has been integrated into the theoretical model through the *project urgency* factor. This factor deals with the *time constraints and time limitations imposed upon an IT project* (Gutierrez & Kouvelis 1991).

Different IT projects will have varying degrees of urgency associated with them. Projects that are of high urgency, with short time constraints, will merit certain sourcing considerations as opposed to projects with lower urgency levels and much broader time limitations. These time limitation issues can limit the possibilities or opportunities a project manager maybe able to utilize and will effect the final sourcing decision(s) that are made. As found via the interviews, short time limitations relative to the tasks required on an IT project can limit the time given for learning about a new system or business process and can also limit the ability to use an IT project as a means for developing new IT skills and abilities. With a pressing deadline due to a highly urgent IT project, project managers must deal with finishing the project first (Wysocki 2001). *Project urgency,* along with the eight previously discussed factors, will have some bearing on the sourcing decision(s) regarding IT personnel resources on IT projects.

Table 3.3a.
Interview Confirmation of the Factors Influencing the Project IT Personnel Sourcing Decision Table

Resource Factors	Interviews			
	Subject A/B**	Subject C	Subject D	Subject E
1. Asset Specificity	Confirmed			
2. Need for Hiearchical Control		Confirmed	Confirmed	Confirmed
3. Internal Resource Demand			Confirmed	Confirmed
4. Internal Resource Uncertainty			Confirmed	Confirmed
5. Internal Resource Availability	Confirmed	Confirmed	Confirmed	Confirmed
6. External Resource Availability	Confirmed	Confirmed	Confirmed	Confirmed

Project Factors	Interviews			
	Subject A/B**	Subject C	Subject D	Subject E
1. Willingness invest in IT HR Capabilities			Confirmed	Confirmed
2. Prevention of Knowledge Leakage	Confirmed		Confirmed	Confirmed
3. Need for Knowledge Capture			Confirmed	Confirmed
4. Project Urgency	Surfaced		Surfaced	

Note: ** Both subjects were from the same organization and were interviewed together. Thus the "Subject A/B" Designation.

"Confirmed" indicates the factor was confirmed by the interview subject(s) as an issued considered during the sourcing decision process.

"Surfaced" indicates the interview subject stating the influence of this factor during the sourcing decision.

Table 3.3b.
Interview Quotes Validating the Project IT Personnel Sourcing Decision Factors

Resource Factors	
1. Asset Specificity	*In one project we did for a company in California, due to the fact that the external people had more knowledge about the business processes and existing systems within this company in California, we used more external people [people from the contracting company] on the project team.* (Subject A/B)
2. Need for Hiearchical Control	*Another reason [for maintaining project control] is that if the external party doesn't work out you want to be able to say "goodbye" and still have project control in hand. Having control allows us to keep an eye on the scope, budget, etc.* (Subject D)
3. Internal Resource Demand	*Sometimes I'm able to send people off for training to acquire the skills [I know are needed] for an upcoming future project. On the PeopleSoft project it was real timely as people got training and came back and got to apply their [new] knowledge right away. In other instances we develop these skills on a current project in anticipation of future need.* (Subject D)
4. Internal Resource Uncertainty	*…we don't really look to develop technical expertise very explicitly. [being able to foresee technical needs is not always possible] and a lot of that can be outsourced.* (Subject E)
5. Internal Resource Availability	*…we have 22,000 people world-wide, so we can pull resources from [within our] organization if they are available and we need them.* (Subject C)
6. External Resource Availability	*If we encounter projects where we don't have the necessary resources on staff or [if they] are not available, then we will go to outside resources to back-fill that. Exploring the various external resource options available to us.* (Subject C)

Table 3.3b (continued).
Interview Quotes Validating the Project IT Personnel Sourcing Decision Factors

Resource Factors	
1. Willingness invest in IT HR Capabilities	*We actually outsource our own IT department. This allows us to put [certain personnel] on an internal project first to train them on new skills, before sending them out to an external client.* (Subject E)
2. Prevention of Knowledge Leakage	*…this is not so much an issue with regards to us, [but in my prior positions at other places] I can see issues of corporate secrecy being an issue on certain projects.* (Subject D)
3. Need for Knowledge Capture	*You don't want someone to come in and put up a system and walk away and then you can't support it, can't maintain it. You've got to be a part of it [to capture or retain that knowledge]…We used a group of sr.consultants [on one project] who acted primarily as mentors to our people, who learned from them and actually did a lot of the work. So, when they left, we had a completely competent staff.* (Subject D)
4. Project Urgency	*The project was all internally driven due to time constraints and the fact that we needed people to know our systems…We didn't have time to get outside developers up to speed on our systems...* (Subject A/B)

The following section presents the research model. While the factors in the theoretical model are important to the project manager's sourcing decision, some of these factors are deterministic in nature. The following section modifies the theoretical model due to these deterministic factors and presents the research model.

3.3. The Research Model

The theoretical model from section 3.1 presents an overall model of factors that were surfaced through interviews and an examination of transaction cost economics, knowledge based theory, and internal labor market theory perspectives. While this theoretical model presents a series of constructs that are believed to influence the IT personnel sourcing decision on IT projects, it contains constructs that are deterministic in nature. This determinism limits the testability of these constructs in the overall model. The deterministic constructs in the theoretical model are: *the internal resource availability construct, the external availability construct,* and *the internal resource demand uncertainty construct.*

The *internal resource availability* construct is a binary construct. Either the resource is available internally or the resource is not available internally. With this construct, when the resource is not available internally, the decision is limited to seeking an external sourcing solution. Thus, the construct is limited in how it can affect the dependent variable of *Decision to Source Internally.* Only when the resource is available internally is there a possibility for determining the effects of the other hypothesized factors. Without this construct being positive for internal

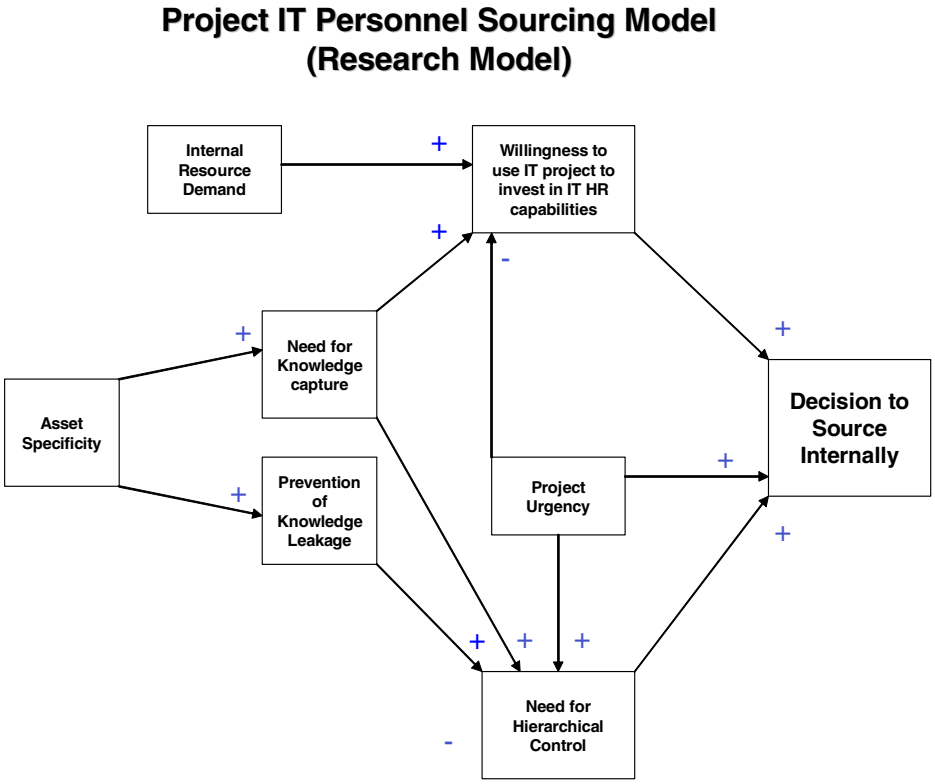
availability, the dependent variable of interest is limited to an external sourcing decision.

The *external resource availability* construct is also a binary construct that parallels the deterministic issues surrounding the internal resource availability factor. This external availability must also be positive for external resource availability (meaning the desired IT personnel resource is available externally) or the sourcing decision is limited to an internal sourcing solution, regardless the effects of the other factors. The limitations imposed by a negative external availability construct (IT personnel resources are not available in the external market), give a predetermined result of going internal for resources. This makes testing the theoretical model both unnecessary and uninteresting. Essentially, both the internal and external resource availability constructs must be positive (available in both locations) or the results are essentially deterministic. Only when both sourcing options are available, can one determine and investigate the effects of the other factors of interest to this proposed study. Any negative combinations (having one or more sourcing options be unavailable) involving the two sourcing factors is deterministic and presents an obvious sourcing decision that is of limited interest or value.

The *internal resource demand uncertainty* construct is another factor this is also deterministic in nature. With low to no uncertainty regarding the demand for a particular IT personnel resource in question, the actual demand (represented by the internal resource demand factor) supercedes any uncertainty effects. Without uncertainty about the internal demand, one will just look at what the internal demand

is and decide accordingly. Thus this factor is only of interest when there is internal demand uncertainty, otherwise its affects are virtually subsumed by the internal resource demand construct.

Figure 3.2.



Though the three previously identified factors of *internal resource availability*, *external resource availability*, and *internal resource demand uncertainty* have some level of significance in the IT personnel sourcing decision, their inclusion in the research model will generate a number of easily predetermined results. Since these three factors are deterministic in nature, there is little benefit to be derived from

their inclusion and they have been removed from the research model. The revised theoretical model gives the research model (see figure 3.2) that will be tested in this proposed study.

3.4. The Research Model: Construct Definitions and Hypotheses

The research model for IT personnel sourcing lays out the factors that can potentially affect the sourcing decision(s) a project manager can make regarding a particular IT personnel resource. The IT personnel resource examined in the model is defined to be "an information technology worker possessing skills and expertise needed by an organization for a specific IT project" (Byrd, Lewis, and Turner 2004).

3.4.1 Dependent Variable: Decision to Source Internally

The *Decision to Source Internally* construct represents the dependent variable in the model. This construct is defined as "the decision to source a particular IT personnel resource that is needed for a specific IT project with sources internal to the organization". This relates to one specific sourcing decision a project manager will make regarding a particular IT personnel resource. The decision is binary in nature and as a binary decision, the decision will be to either (1) source via resources internal to the organization or (2) source via resources external to the organization.

This sourcing decision is affected by a set of factors, which were surfaced in the prior sections of chapter three through interviews and an examination of literature from internal labor market theory, knowledge based theory, and transaction cost

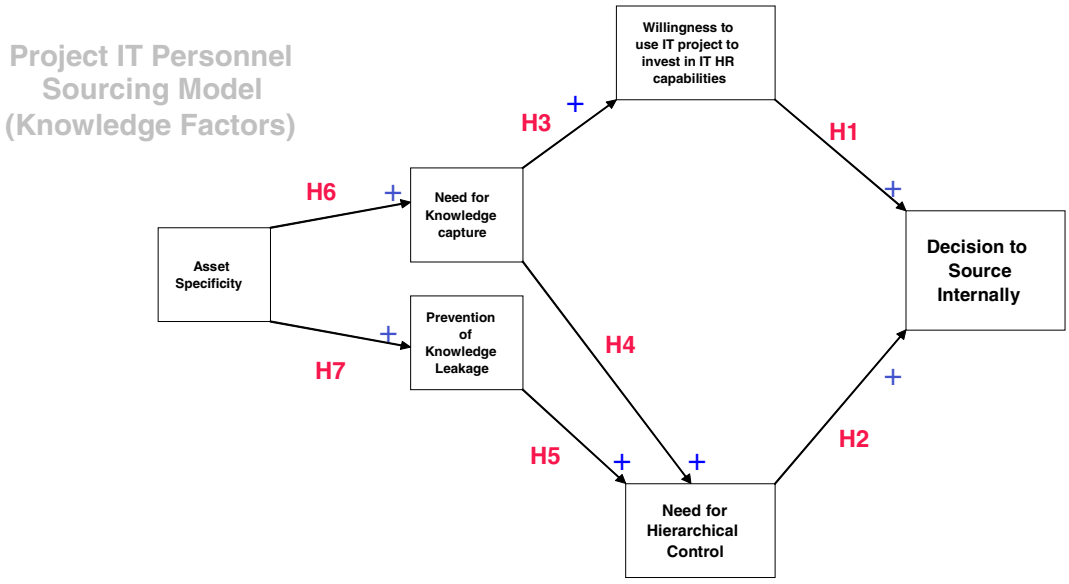
economics. The effects of these factors can be segmented into knowledge effects, resource demand effects, and time effects. Knowledge effects factors arise from issues concerning the creation, utilization, and dissimilation of knowledge and influence the sourcing decision through the *willingness to use IT projects, asset specificity, need for knowledge capture, prevention of knowledge leakage,* and *need for hierarchical control* constructs. The resource demand effect factor deals with the supply and demand issues regarding the IT personnel resource and influences the sourcing decision via the *internal resource demand* factor. The time effect factor is represented by the *project urgency* factor and arises from issues regarding project durations and project deadlines.

3.4.2 Knowledge Factors

The issue of knowledge that arises from the IT project sourcing decision deals with the development and control of knowledge assets. This is represented in the research model (see Figure 3.3) by the *willingness to use IT project to invest in IT HR capabilities, asset specificity, need for knowledge capture, prevention of knowledge leakage,* and *need for hierarchical control* constructs. As developed earlier, firms gain a competitive advantage through the development and control of strategic knowledge assets (Nonaka 2001). Both knowledge development and knowledge control influence how sourcing decisions are made on IT projects. A project manager needs to consider the development of new IT personnel skills (resources) and determine the necessary control required over this potentially strategic knowledge

resource. From the knowledge-based perspective, knowledge is seen as an important resource that arises from IT projects that need to be nurtured and protected (Nonaka & Takeuchi 1995; Nonaka 1994; Thompson 1967).

Figure 3.3.
Research Model for Project IT Personnel Sourcing: Knowledge Factors



A nurturing or developmental factor is the *willingness to use the IT project to invest in IT HR capabilities.* This factor is defined as "the degree of support for the development of internal IT personnel capabilities in order to take advantage of existing or potential opportunities" (Johnston and Carrico 1988). Internal labor market theory tells us that organizations are more apt to build knowledge assets for potential future use through their internal labor pools (Piore 2002; Doeringer & Piore

1971). In the context of sourcing IT personnel on an IT project, it would appear that sourcing internally may potentially help develop future knowledge assets for an organization. This leads to the following hypothesis which deals with the IT personnel development factor:

> **H1: The greater the organization's willingness to utilize an IT project to develop IT personnel resources, the greater the likelihood of sourcing internally.**

A control, or protection, factor regarding knowledge is represented in the IT sourcing model by the *need for hierarchical control*. The issues of opportunism, derived from transaction cost economics, can arise on an IT project as the new knowledge developed from a project can be utilized for the benefit of other competing firms. This is deemed more likely, from internal labor market theory, with external or contracted personnel working on a project (Piore 2002). Internal labor market theory also tells us that internal labor is generally more readily controlled due to institutional and social norms found within an organization (Doeringer & Piore 1971). The *need for hierarchical control* factor is defined as "the need for an organization to exert institutional and formal controls" (Hodgson 2004; and Kenne & Boukas 2003). The importance of the resource will dictate the level of control desired over a particular resource. Organizations do not seek to control all resources, on those that will give it a competitive advantage (Lindgren 2003; Pitt & Clark 1999; and Conner & Prahalad 1996).

Resources that will give a competitive advantage are referred to as core competency building resources or assets (Leonard-Barton 1995). The core

competency or core capability of an organization is defined to be "key areas of expertise that organizations develop over time, which are distinctive to that organization and critical to the organization's long term development" (Leonard-Barton 1995; Prahalad & Hamel 1990). Core competencies can be in any area (information technology, marketing, sales, etc.) but are most likely to develop in the critical, central areas of the organization (Prahalad & Hamel 1990, and Klein et al. 1998). IT projects that advance a firm's core competency will build upon or augment the core competencies of the organization. The potentially key resource(s) that a firm will want to control for strategic purposes are the IT HR resources utilized in these projects. With these potentially more important strategic resources, firms may deem stronger control a strategic necessity. Based on the strategic importance of the resource (Leonard-Barton 1995, Prahalad & Hamel 1990, and Thompson 1967), project managers may opt for internal sourcing as internal labor sources are more easily controlled (Piore 2002). This leads to the following hypothesis:

> **H2: The greater the need for hierarchical control over an IT personnel resource needed for an IT project, the greater the likelihood of sourcing this IT personnel resource internally.**

Along with developing and controlling important knowledge resources, the IT project sourcing decision must also consider the issues of capturing and protecting these key knowledge assets. The project level factors of *need for knowledge capture* and *prevention of knowledge leakage* reflect the need to capture and protect knowledge. The *need for knowledge capture* deals with the need to retain unique and innovative knowledge emerging from an IT project for strategic purposes. The need

to capture and retain this knowledge for competitive and future reasons exists when the knowledge is considered unique and innovative (Prahalad & Connor 1990).

The *need for knowledge capture* is defined as the need to capture and codify the knowledge that is generated by an IT project (Leonard-Barton 1995, and Thompson 1967). From knowledge-based theory, a firm maintains competitive advantage via the development and integration of both new and old knowledge assets which leads firms to want to develop and retain these assets (Kogut & Zander 2003 & 1996, and Thompson 1967). Since this knowledge is of importance to the organization, the organization will usually have a greater willingness to develop this knowledge and capability by utilizing the project to develop this IT HR resource. This leads to the following hypothesis:

> ***H3*: The greater the need for knowledge capture the greater the willingness by the organization to invest in developing IT HR capabilities.**

The unique nature of the knowledge asset also raises issues of asset specificity. With a highly unique or asset specific resource; a difficult to imitate resource that is required for an important task; firm's will want to not only develop this resource but they will also want to control this knowledge resource (Badaracco 1991, and Williamson 1985). Controlling this resource not only helps secure the utilization of this resource for the benefit of the organization but it also limits the threat potential from competitors. Competitors will not be able to get at this resource to exploit it for their own benefits, decreasing issues of opportunism. This leads us to the following hypothesis:

***H4*: The greater the need for knowledge capture the greater the need for hierarchical control.**

The factor of *prevention of knowledge leakage* deals with the need to protect knowledge experience generated by the IT project. Firms will want to ensure the control and usage of key knowledge assets by preventing competitors from obtaining this information (Nonaka & Takeuchi 1995). Strong hierarchical controls can help control the flow of information (Piore 1994, Nonaka 1994, and Williamson 1984). In order to help prevent knowledge leakage, the use of strong hierarchical controls is desired. This leads to the following hypothesis:

***H5*: The greater the need to prevent knowledge leakage, the greater the need for hierarchical control.**

The final knowledge factor deals with the issue of asset specificity. The *asset specificity* factor deals with the unique nature of the resource being considered in the sourcing decision (Williamson 1985). Drawing from transaction cost economics, asset specificity focuses on "the degree to which an asset or resource needed for an activity (resource needed for an IT project) is unique to the situation in which it is being employed". A resource with high asset specificity performs activities on an IT project that are difficult to imitate and may be unique to that particular asset such as human expertise and knowledge that is difficult to transfer (Widener & Selto 1999, and Williamson 1985). In the context of an IT project, the underlying issue in regards to asset specificity deals with the costs associated with using an asset specific resource versus utilizing a non-asset specific resource. With an asset specific

resource, the asset specificities issues relating to the IT project are understood by the IT HR resource. In contrast, the use of an IT HR resource that is non-asset-specific, will result in higher costs due to a period of familiarization as the IT personnel must "get-up-to-speed". With high asset specificity, the knowledge that emerges from an IT project potentially becomes extremely valuable to an organization due to the uniqueness of the knowledge created. This generates a need to capture the knowledge and prevent it from diffusing out of the organization (e.g. Kogut & Zander 2003, 1996, & 1992). The following two hypotheses deal with the knowledge capture and knowledge leakage aspects of asset specificity:

> ***H6*: The greater the level of asset specificity associated with an IT personnel resource, the greater the need for knowledge capture.**

> ***H7*: The greater the level of asset specificity associated with an IT personnel resource, the greater the need for the prevention of knowledge leakage.**

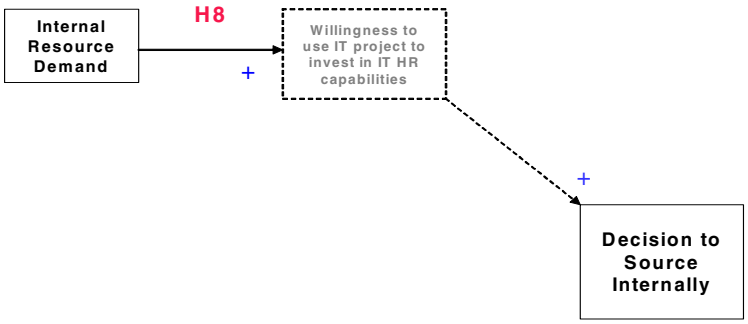
3.4.3 Resource Demand Factor

The resource demand factor in the proposed model focuses on the organizational demand for a particular IT personnel resources (see figure 3.4). The *internal resource demand* factor provides an overall indication of the need for a particular IT personnel resource. With strong internal demand (other projects or areas in the organization that need the IT HR resource in question) for a particular IT resource, internal labor market theory states two viable options. The first is to increase the internal labor market supply, or in the context of IT HR resources,

develop additional resources for use (Camuffo 2002; and Doeringer & Piore 1971). This leads us to the following hypothesis:

H8: The greater the internal demand for a particular IT personnel resource, the greater the willingness to use the IT project to invest in IT HR capabilities.

Figure 3.4. Research Model of Project IT Personnel Sourcing: Resource Demand Factor



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3.4.4 Time Factor

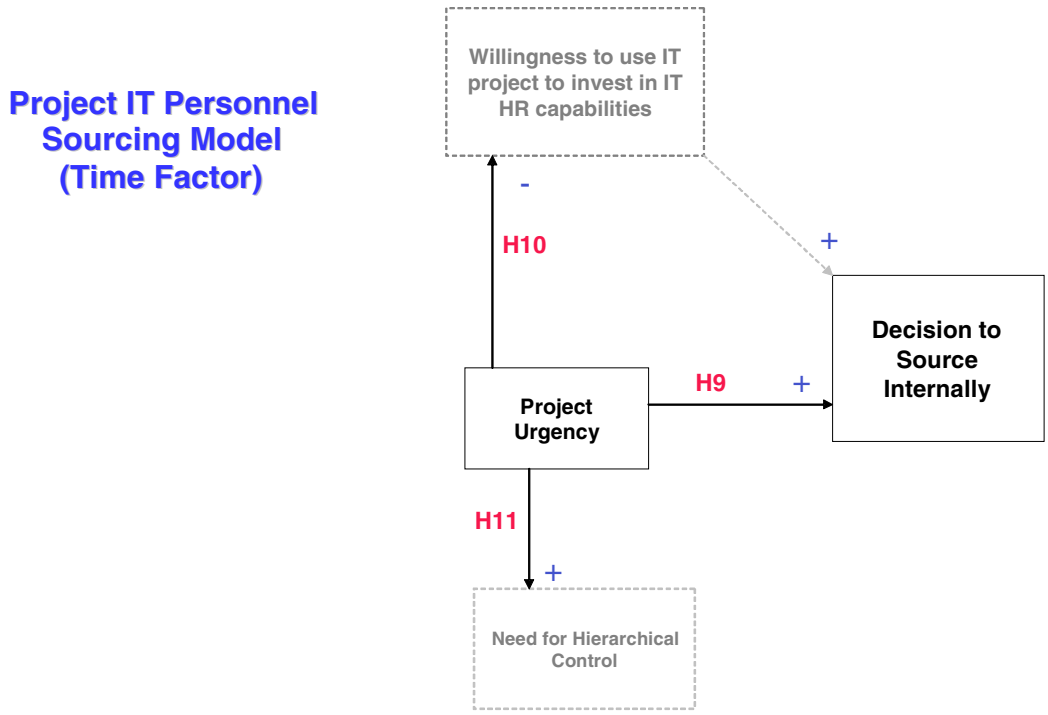
The project urgency factor in the proposed model (see figure 3.5) was surfaced through the series of interviews detailed in the prior sections of chapter three. This factor is defined to be the "level of importance assigned a particular IT project" (Barry, Tridas, & Slaughter 2002, Abdel-Hamid, Sengupta, & Swett 1999, and Abdel-Hamid 1990). The tendency regarding IT project urgency is *the greater the importance given an IT project the greater the urgency* (Abdel-Hamid 1990). The urgency or importance level of a project can be attributed to fleeting time-windows and project dependency issues. Some projects may need to be completed quickly due to issues of competition. There may only be a "fleeting window of opportunity" to take advantage of certain situations for competitive purposes. Another urgency issue deals with the possible interdependencies found among different IT projects. A particular IT project may be urgent because its completion is necessary for the initiation or potential completion of other key IT projects within the organization.

All IT projects are initiated with an allotted project duration (Barry, Tridas, & Slaughter 2002, and Abdel-Hamid, Sengupta, & Swett 1999). The project duration is *the*

time between a project's initiation and its desired completion (Barry et al 2002). Since urgent projects generally have limited time-frames (Abdel-Hamid 1999), the need to utilize internal resources where possible is generally desirable (Piore 2002). This can be attributed to the need for a rapid understanding of the current systems and

organization structures of the firm within which the IT project is being applied (Barry et al. 2002).

Figure 3.5. The Project IT Personnel Sourcing Model: Time Factor



With external resources, time is generally required for assimilation of information regarding the context of an IT project. Internal resources will more likely possess such knowledge and may need little or no time, compared to an external resource. This leads to the following hypothesis:

H9: The greater the project urgency, the greater the likelihood of sourcing internally.

The time limitations generally found with urgent projects will also not afford project managers the luxury of utilizing an urgent project for developmental purposes. When attempting to train or develop personnel, through on-site training, additional time considerations must be allotted for the training process. Additional time is generally required for potential mistakes and new knowledge integration attributed to the development process. This is especially applicable when training IT personnel due to the high knowledge-content associated with IT positions (Starbuck 1992). The need for additional time to deal with training issues is a luxury that is generally not possible when dealing with urgent (time-limited) projects. This limitation will tend to lessen any willingness regarding the training or development of IT personnel. Therefore, the project urgency factor will also have the following effect:

H10: The greater the project urgency on an IT project, the less willing an organization will be to utilize the IT project to develop IT personnel resources.

The importance of hierarchical control will also be affected by urgent projects. Since urgent projects tend to be time sensitive, there will be a strong need to minimize opportunism issues which may be very costly time-wise (Jensen & Meckling 1976). Transaction cost economics warns of the higher costs, both cost and time-wise, associated with opportunism issues (Williamson 1985). With unchecked opportunism, time frames spent on IT projects may grow due to agent's attempting to maximize their profits by extending project deadlines (Moschandreas 1997). In order

to minimize the effects of opportunism, and reduce the potential for time-loss, stronger hierarchical controls are desired (Moschandreas 1997). This leads to the following hypothesis:

> **H11: The greater the project urgency on an IT project, the greater the need for hierarchical control.**

The proposed hypotheses presented in this section are to be tested by the methodology found in the following chapter. Chapter four will outline and detail the testing methodology that is to be utilized for testing the proposed model and associated hypotheses.

Chapter 4. The Research Model and Research Methodology

Chapter 4 discusses the research methodology, the instrument utilized, the sample selection, the data collection process, and the statistical tools utilized in this research study. The following section addresses the methodology employed for testing the research model.

4.1 The Research Methodology

The research model was tested with the policy capture research technique, integrated with a survey questionnaire. Policy capture has been utilized in various studies dealing with strategic decision-making (Hitt & Tyler 1991), organizational behavior (Martocchio & Judge 1994), personnel decisions (Klass & Wheeler 1990), business logistics (Waller & Novack 1995), marketing issues (Batsell & Lodish, 1981), and financial issues (Slovic 1972). Though not commonly used, this technique for data collection is a valid and valuable adjunct to current survey methods (Webster & Trevino 1995).

Policy capture involves the use of vignettes or scenarios as a means to present internal and external conditions to the decision-makers. These scenarios are used to simulate real-life situations to derive decision-making responses. This technique has been shown to capture results that replicate real-world experiments (Batsell & Lodish. 1981). The policy capturing technique reveals salient variables (or the lack of) in the judgment and decision-making of individuals. It can also measure the consistency

with which the individual adheres to these relationships during the simulated decision-making process (Webster & Trevino 1995).

This study's research design utilizes policy capturing techniques as a means to simulate real-life decision-making processes regarding sourcing decisions on IT projects. The policy capturing technique utilized will present a series of scenarios followed by a set of related questions. These scenarios will deal with three of the factors in the research model. The effects of the remaining four factors are captured via a questionnaire. The following section addresses in detail the design of the research instrument.

4.2 The Research Instrument

The instrument utilized in this study is comprised of three parts. The first part utilizes the policy capturing technique to examine the following set of constructs: *Internal Resource Demand, Project Urgency,* and *Asset Specificity.* The second part contains questions to address the *Willingness to Use IT Project to invest in IT HR capabilities, Need for Hierarchical Control, Need for Knowledge Capture,* and *Prevention of Knowledge Leakage* factors on the sourcing decision (see Table 4.0). The third part is a measurement for the dependent variable of interest, the *Decision to Source Internally.*

The *Decision to Source Internally* was asked at the end of each scenario. The respondents, after being presented the IT project development issues for a specific vignette, must make a decision on whether the IT personnel resource they are considering should be sourced internally (Internal Sources) or not sourced internally

(External Sources). The answer to the sourcing question is presented in a 4-point Likert-type scale (1=definitely internal, 2=probably internal, 3=probably external, 4=definitely external).

Table 4.0
Methodological Approach to Constructs in Research Model

Research Model Construct	Method	Instrument Items
Decisiont to Source Internally	**Policy Capture**	
Willingness to Use IT Project to invest in IT HR Capabilities	**Questionnaire**	**26,27, 28, 29, & 30[1]**
Internal Resource Demand	**Policy Capture**	**Scenarios**
Project Urgency	**Policy Capture**	**Scenarios**
Need for Hiearchical Control	**Questionnaire**	**10, 11, 12, 13, 14,& 15[1]**
Asset Specificity	**Policy Capture**	**Scenarios**
Need for Knowledge Capture	**Questionnaire**	**16, 17, 18, 19, & 20[1]**
Prevention of Knowledge Leakage	**Questionnaire**	**21, 22, 23, 24, & 25[1]**

[1]Instrument items listed refer to Sample Survey Instrument in Appendix D.

Since policy-capture is a technique that has rarely been utilized in examining IT project sourcing decision-making, a series of scenarios were created specifically for IT project sourcing situations based on techniques found in previous policy-capture studies (Martocchio & Judge 1994; Hitt & Tyler 1991; Klass & Wheeler

1990; and Batsell & Lodish, 1981). In conjunction with designing the scenarios for this study, a questionnaire component has been designed to follow each scenario.

The instrument has not been utilized in prior studies. To help address this issue, a pre-test of the instrument was conducted to examine the instruments reliability and validity. The following section details the issues that arose from the pre-test. These issues have been incorporated into the instrument design discussion presented below.

4.2.1 Instrument Pre-Test

A pre-test of the initial instrument was conducted with graduate and undergraduate students from the University of Oklahoma and Washington State University. Students, from *systems analysis & design, field project*, and *project management* classes from the University of Oklahoma and *systems analysis & design,* and project management classes from Washington State University, were utilized as respondents for the pre-test. A set of two scenarios with thirty-one questions per scenario was administered to the students.

The two scenarios utilized included one scenario that reflected high asset specificity, high internal demand, and high project urgency and a second scenario that reflected low asset specificity, low internal demand, and low project urgency. After each scenario, students were asked to answer a set of 31 questions that examined the manipulations within the scenarios and the importance of *hierarchical control,*

knowledge capture, knowledge leakage, and the *willingness to utilize the IT project to invest in IT HR capabilities* in the scenario.

A total of 144 surveys were collected among the different classes in both locations, of which 134 surveys were valid. Factor analytic techniques were utilized in analyzing the pre-test surveys. In conjunction with administering the survey, a one-hour debriefing was conducted immediately following the completion of the survey by a graduate level project management class from the University of Oklahoma. This debriefing was utilized as a means to probe for more feedback regarding the instrument.

The analysis of the pre-test results has led to modifications in both the instrument and scenario design. Appendix E details the changes made to the original design. The following sub-sections covering scenario design and instrument design discuss the current design of the scenarios & instrument. These descriptions reflect changes made to the instrument due to the pre-test.

4.2.2 Policy Capture

As defined in chapter 3, the three factors to be utilized in the policy capturing-portion of the study are dichotomous variables. The manipulation of these 3 factors; *internal resource demand, project urgency,* and *asset specificity;* leads to a total of 8 (2x2x2) scenarios (see appendix C.). The "Internal Resource Demand" factor will exhibit either high internal resource demand for a particular IT personnel resource or low internal resource demand for a particular IT personnel resource. The scenarios

(see Appendix C.) present high demand by pointing out the need for the IT personnel resource on potential future IT projects while presenting low demand with the absence of need on other IT projects. The "Project Urgency" factor will either show a high project urgency or low project urgency regarding a particular IT project. Within the scenarios, high project urgency is presented as a "quick 3-month development effort" while a low project urgency is presented as a "12-month development effort". To further enhance the urgency manipulation, IT projects in the fictitious organization are stated as having and average "6-month development cycle". "Asset Specificity" is the third factor manipulated in the policy capturing portion, presenting either a high level of asset specificity or low level of asset specificity regarding a particular IT personnel resource.

The eight scenarios are segmented into two different IT development projects. The backup database development project was used to signify a non-asset specific type of IT project for the scenario's imaginary organization. To signify low asset specificity, the database scenarios will represent the database development effort as a project that requires little knowledge of the organization's business processes. The database project will not require project team-members to have extensive knowledge of the firm's existing systems for integration purposes. The database will essentially function as a back-up system for documentation related to the firm's various business transactions.

The second IT development effort described relates to a major revision of the organization's sales and support system. The upgraded system must be integrated

into the organization's existing systems so that it can (1) provide up-to-the-minute information regarding the organization's customers, (2) provide potential service-options of interest to the client, and (3) provide an interactive system detailing the various service options offered by the organization. This development effort was utilized as an asset-specific IT project as the revised sales and support system will need to be fully integrated with the organization's existing systems (order-line systems, financial systems, etc.). The IT personnel asset in question was expected to understand the organization's informational infrastructure for integration purposes as well as understanding the organization's business services and products.

In order to help minimize fatigue issues, the respondents were presented 2 non-repeating scenarios, along with the scenario's accompanying questionnaire. While this limits each respondent to only 2 scenarios, they will still be required to answer two-sets of 30 questions per vignette (60 questions in total). On average, pre-test results have shown that subjects are able to complete their two scenarios with accompanying questions within 15 minutes (average of 14.2 minutes). This segmentation technique has been successfully employed by other researchers utilizing policy capture such as Webster & Trevino (1995) and Cooksey (1996). Webster & Trevino (1995) argue for limiting or segmenting the number of scenarios to a single sitting without overly taxing the subjects. The instrument design will limit the number of scenarios, and thus the number of questions, presented to each subject in order to combat fatigue and boredom issues.

The presentation of the 2 non-repeated scenarios was random in fashion. In order to track potential fatigue issues, the order of the scenarios given to a subject was tracked (i.e. combination *A & B* is one order-type with "A" presented first, while combination *B & A* is another order-type with "B" presented first). While there are a total of twenty-eight two-scenario combinations possible, the need to track scenario order will result in a total of fifty-six possible 2-scenario combinations.

4.2.3 The Questionnaire

A questionnaire follows each scenario and is comprised of thirty questions. An un-randomized version of the instrument is presented on *Appendix D*. Questions are grouped by construct for purposes of facilitating the descriptions presented in section 4.2.3 and its related subsections. Question order was randomly sequenced, prior to actual administration to the test subjects. Each block of thirty questions refers specifically to the scenario preceding each block of questions.

The first set of items in the questionnaire (1 thru 9) present manipulation checks. They have been designed to determine if the manipulations found in the preceding scenario were effective. The manipulation checks deal with the three factors manipulated in the policy capture portion of the study: items 1 thru 3 relate to *Project Urgency,* items 4 thru 6 relate to *Internal Resource Demand*, and items 7 thru 9 relate to *Asset Specificity*. The twenty-one questions which follow the manipulation checks deal with the factors of *willingness to use IT project to invest in IT HR capabilities, need for hierarchical control, need for knowledge capture,* and the *prevention of knowledge leakage*. The four factors are all examined within the

context of a specific scenario. The responses to all twenty-one questions are captured on a 5-point Likert-scale (Babbie 1990). Respondents was asked to respond in a format that presents "strongly agree", "agree", "neutral", "disagree", and "strongly disagree" on a 5-point Likert-scale. The following sub-sections detail the design of the twenty-one items in the questionnaire.

4.2.3.1 Need for Hierarchical Control

The *need for hierarchical control* factor represents control factors an organization will formally institute in order to safeguard the success of the IT project. This factor is defined as "the need for an organization to exert institutionalized formal controls" (Hodgson 2004; and Kenne & Boukas 2003). These hierarchical controls are instituted as a means to deal with the potential opportunism (Schleifer & Vishny 1997; and Jensen & Meckling 1976) via enhancing employee loyalty to an organization (Hodgson 2004). With strong employee loyalty, employees will identify more closely with the organization they work for (Hodgson 2004). This will create greater alignment between the firm and the employee and reduce the potential for opportunism.

The attributes related to the *need for hierarchical control* in the research model are the need to control for opportunism and the need to create stronger employee loyalty bonds with the organization (Kirsch et al. 2002). As alluded to in Kirsch's (2002) study on formal control methods during IS development, organization's tend to monitor and closely track IT projects as a means towards controlling for opportunism. Blank (2000) presents empirical evidence suggesting

that a valid means to combat opportunism, aside from monitoring controls, is to enhance employee loyalty.

The *need for hierarchical control* scale items are defined by the need to control for opportunism via monitoring the project and tracking the actions of the project team members (items 10 thru 12) and by the need to create a strong loyalty bond between the employee and the organization (items 13 thru 15). The scale items dealing with the need to control for opportunism were modified from Kale, Singh and Perlmutter's (2000) scale measures for monitoring and protecting strategic assets during learning alliances. Employees will want to avoid acting opportunistically in order to help their career advancement (future IT projects, promotions, etc.) within the organization (Gulati and Singh 1998). Scale items 4 thru 6 focus on the need for the firm to enhance employee loyalty in the organization. These items were designed to reflect the need for loyalty from employees and the importance of loyalty in strengthening an organization's control over personnel. Together, the six scale items found in items 1 thru 6 comprise the *need for hierarchical control* over the IT project.

4.2.3.2 Need for Knowledge Capture & Prevention of Knowledge Leakage

The factors of *need for knowledge capture* and *prevention of knowledge leakage* reflect the need to capture and protect knowledge. As new knowledge can potentially arise from an IT project, organizations must retain this knowledge and safeguard against the possibility of competing organizations utilizing this knowledge for their own opportunistic benefits (Piore 2002). The *need for knowledge capture*

deals with the need to retain the knowledge emerging from an IT project for strategic purposes. The need to capture and retain this knowledge for competitive and future reasons exists when the knowledge is considered unique and innovative (Prahalad & Connor 1990).

The *need for knowledge capture* is defined as the need to capture and codify the knowledge that is generated by an IT project (Leonard-Barton 1995; and Thompson 1967). The knowledge is transferred to the organization so that it can retain this knowledge for use on future endeavors. While a number of knowledge transfer instruments exist, the context of these instruments; such as what knowledge needs to be transferred (Gold et al. 2001), what is required for successful knowledge transfer (Karlsen and Gottsschalk 2004; & Jennex and Adelakun 2003), critical knowledge required of IS professionals (Lee, Trauth, and Farwell 1995), the sharing of knowledge in IS groups (Nelson and Cooprider 1996); makes adapting these instruments for this study problematic.

Scale items were developed for the *need for knowledge capture* by drawing from knowledge transfer literature to help define the various aspects of knowledge capture. The *need for knowledge capture,* within the context of the research model, arises when there is a need to acquire the knowledge for the organization, a need to transfer this knowledge to the organization, and a need to codify the knowledge for future use (Karlsen and Gottschalk 2004; & Gold et al. 2001). These aspects regarding the need for knowledge capture were used to construct scale items for the knowledge capture construct (items 16 thru 20). Along with a need for capturing the

knowledge from IT projects, an organization may also need to prevent knowledge leakage on strategically important projects.

The factor of *prevention of knowledge leakage* deals with the need to protect the knowledge experience generated on the IT project by the IT personnel resource in question. Firms will want to ensure the control and usage of key knowledge assets to preserve their competitive advantage. This is done by preventing competitors from obtaining this information and by safeguarding this knowledge within the organization (Nonaka & Takeuchi 1995). IT projects of this nature tend to play an important role in the strategic plans of the organization.

Within the context of this study, organizations will want to prevent the knowledge leakage of these strategic projects by restricting the flow of project information outside of the organization (Nonaka & Takeuchi 1995). The restriction of information flow to prevent knowledge leakage is accomplished by restricting access to the IT project, restricting the interactions of team members on the project with individuals not associated with the project, and by instituting rules governing the transfer of knowledge within these projects (Gold et al. 2001). The items for the *prevention of knowledge leakage* scale were adapted from Gold, Malhotra, and Segars' (2001) scale (items 21 thru 25) on knowledge protection processes. These items reflect the restriction aspects associated with the *prevention of knowledge leakage* construct.

4.2.3.3 Willingness to Use the IT Project to Invest in IT HR Capabilities

The *willingness to use the IT project to invest in IT HR capabilities* factor is defined as "the degree of support for the development of internal IT personnel capabilities in order to take advantage of existing or potential opportunities" (Johnston and Carrico 1988). A review of relevant literature revealed the absence of viable research instruments that dealt with this construct. As a construct unique to this study, scale items for this factor had to be created for the survey. In developing the items for the research model, the focus centered upon the degree of commitment a project manager was willing to impart for enhancing the skills of the IT project team members.

Since no appropriate instruments were found, a number of studies on human resource development did discuss the various aspects associated with training employees. These aspects include management's support for providing training to employees and the dedication of resources and assets to the training process (Acton & Golden 2003). Management support reflects commitment of the managing body to the training process (Acton & Golden 2003), while the resources needed includes the commitment of time (Eighteen 1999), the commitment to an evaluation effort (Schonewille 2001) and the commitment of finances (Pate et al. 2000) to the training effort.

In the context of the IT project environment, the *willingness to use IT project to invest in IT HR capabilities* construct embodies all these commitments. The project manager (management support in this context) must be committed and also be

willing to commit the appropriate resources for training. These resources include the willingness to commit the IT project itself which includes the financial implications of such a commitment, the willingness to commit the extended time required for the training, and the willingness to set-up evaluation mechanisms to monitor the effectiveness of the training.

The scale items developed for the willingness construct are based on the aspects of willingness drawn from HR literature. The five items pertaining to this construct are listed as questions 26 thru 30 on Appendix D. These five items comprise the various aspects associated with the *willingness to utilize the IT project to invest in IT HR capabilities.*

4.3 Pilot Test

A pilot test of the scenarios was conducted for testing the eight scenarios (Appendix C.). For face validity purposes and a further check of the manipulations presented in the scenarios, a pilot-test was conducted with personnel from the OU Information Technology department. The pilot test subjects were given all eight scenarios and were asked questions (items 1 thru 9) addressing the manipulations utilized in each scenario. The sample size for the pilot-test of the scenarios was an *n* of 9.

Modifications were made to the instrument based on the pilot test results. The actual sample data for testing the model was drawn from the members of the Project Management Institute (PMI). The following section discusses the subject population

to be used for this study and how the instrument was administered to the intended subjects.

4.4 Research Design

As mentioned in section 4.2.2, the administration of the survey will involve presenting two different policy capture scenarios to each subject. After each scenario, the subject was asked for their sourcing decision. Following each scenario, a questionnaire of 30-items was presented to the subject. This questionnaire is comprised of manipulation check items and items dealing with the constructs of interest detailed in sections 4.2.3 thru 4.3.5. In total, subjects will answer 2 sets of thirty-questions which pertain to the 2 random scenarios they was given. Prior testing has indicated an average time of 14.2 minutes for respondents to complete the entire survey.

The two scenarios presented was drawn from a set of 8 different scenario combinations. While increasing the number of scenarios per respondent may increase power, potential fatigue and boredom issues could limit subject participation. Pre-tested subjects noted that going beyond the two-scenario format would possibly require too much time.

Since a set of two-scenarios is to be administered to all respondents and presentation order was tracked, fifty-six possible combinations of the 2-scenario sets

was generated. These fifty-six possible combinations was randomly assigned to the subjects during the administration of the survey.

4.4.1 Sample Size & Power

The research design makes an overall power calculation problematic. Instead a power calculation for the scenario design is presented. The research design will require a power calculation (power of Chi-Squared) based on the proposed policy-capture portion of the design. Utilizing a power level of .80, a generally accepted minimum level of power (Cohen 1977), a significance level of .05 and an effect size of .20, the sample size required to achieve a .80 level of power is approximately n=196 (Cohen 1988). This power calculation is based on an effect size that falls between what Cohen considers a small effect size (.10) and a medium effect size (.30). The following section describes the subject demographics and the potential sample size that can be achieved through data collection.

4.4.2 Research Subjects

The subjects for the survey were drawn from members of the Project Management Institute (PMI). Membership in PMI consists of professionals working in the area of project management in various capacities. For this research study, individuals working in the area of IT project management were targeted. A set of

background information was collected from the research participants to help determine their professional area(s) of expertise.

The current membership count for the Dallas chapter stands at approximately 1,200 members, while the Oklahoma City chapter consists of 210 members (provided by Dallas & OKC PMI chapters). On average, 250 members attend the monthly meetings in Dallas while approximately 35 members attend the OKC monthly PMI meetings. A detailed description of the proposed administration and data collection process is described in the following sections.

4.4.3 Administering the Survey

Members from both the Dallas and Oklahoma City chapters were asked to participate in the study during a set of monthly meetings (mid June of 2005). The presidents and board-members from both chapters have agreed to provide time during their upcoming monthly meetings as a means for introducing and generating participation interest.

After making a short presentation regarding the research study, the members of PMI were asked to either complete a paper survey, which was distributed during the presentation, or provide their e-mail address on a sign-up form to complete an on-line version of the survey. The paper version of the survey will also have a return envelope attached for individuals to return the survey. Participants who wish to participate via the on-line survey were e-mailed a link to the survey site.

Several additional steps were taken to help encourage more participation in the study. First, a follow-up presentation was made in the month following the initial call for survey subjects. This was done to remind and encourage participants to complete the survey if they had not already done so and to ask for more participants (members who did not attend the prior month's meeting). Secondly, to help generate more interest and awareness about the study in the OKC PMI chapter, a short announcement ran in the Red Earth monthly internet newsletter (OKC PMI chapter) during the survey period. Follow-up e-mails were also be sent to on-line participants during two-week intervals to gently remind volunteers to complete the survey.

Prior to the administration of the survey, the appropriate forms and documentation was submitted for IRB (University of Oklahoma) approval. The appropriate subject permission forms were included with all surveys distributed or administered on-line.

4.4.4 Data Collection

As noted in the previous section, a short-presentation about the research project was given during the monthly meetings of both the Dallas and OKC chapters of PMI. During this presentation, members of the two chapters were asked to volunteer their participation in this research study. PMI members was given the choice, if they decide to participate, of filling out a paper-based survey distributed at the meetings (which they could complete at the meeting or mail back with the

provided envelope) or leaving their e-mail address for participation via an on-line version of the survey.

PMI members who agreed to participate via the on-line survey were e-mailed a link to the actual survey. Participants of the on-line survey were presented a survey that was identical in content to the paper-based version. Web / SQL space utilized on the University of Oklahoma's *pcbfaculty* server to house the web-based survey. Database space was allocated for capturing data generated from the on-line survey.

4.5 Data Analysis

The research design was tested through structural equation modeling techniques. The research model from Chapter 3 was tested with the data collected from the professional members of the PMI. The AMOS statistical analysis package was employed to run the path modeling techniques required for assessing the viability of the research model. SEM researchers have utilized a two-step process when assessing path models with instrumentation data (i.e. Russell 2005 and Kline 1998). This two-stage analytical methodology was utilized for analyzing the data collected for this study. The first stage was an assessment of the viability of the research instrument, followed by a second stage assessment of the research model's viability. This analysis methodology is in line with prior SEM studies that are similar in nature (Russell 2005; Kline 1998; Marcoulides 1998; and James, Mulaik & Brett 1982).

The following chapter will detail the data collection process outlined in Chapter 4. Issues that occurred during the data collection process are discussed in

Chapter 5. Chapter 5 will also present the results of the data integrity analyses performed on the collected data. Stage-one, of the two-stage path analytic methodology proposed for studying the research model, is also presented in the following chapter.

Chapter 5. Analysis of Collected Data and Research Model Revisions

Chapter 5 discusses the collection of the research data, presents a set of preliminary analysis on the collected data and discusses the need to revise the proposed research model. The chapter begins with a description of the actual data collection process (outlined in chapter 4). Chapter 5 continues with a review and discussion of the collected data. The integrity of the data is examined through a series of analyses including confirmatory factor analysis of the scale items and a set of analyses performed on the manipulation checks incorporated into the scale. The analysis of the collected data will be followed by a discussion of their results and their implications on the proposed research model from chapter 3. Chapter 5 will conclude with the presentation of a revised research model, predicated on the results of the data integrity analyses. The revised research model will be tested via a path analysis, using the colleted data. The results of the path analysis are presented in chapter 6.

5.1 Data Collection: Subject Recruiting & Administration of the Survey

The data collection process was initiated in April of 2005 and lasted until early September of 2005. Subjects were recruited at two meetings of the Dallas PMI Chapter; May 19th, 2005 & June 14th, 2005; and one meeting of the PMI Red Earth Chapter (June 17th 2005). During these recruiting sessions, a 5-minute presentation about the research study was made which was followed by a 5-10 minute Q&A session. No details regarding the content of the survey was divulged during the

presentations. Attendees were only told that the study involved some aspect of IT project management and that their involvement would either be through an internet survey or a paper survey that would be distributed to them at the meeting site. These surveys contained 2 randomly selected scenarios from a set of eight potential scenarios (see Appendix B for details). A "sourcing decision" was asked at the end of every scenario, which was followed by a set of 30 questions (asked after each sourcing decision). Chapter members who agreed to participate left e-mail contact addresses or took a paper version of the survey.

Prior to recruiting for volunteers at these meetings, a short explanation of the research study was made available to all members of both PMI chapters through their respective online newsletters (in the March thru June 2005 Red Earth Chapter & PMI Dallas Chapter newsletters). The online version of the survey was housed and collected in the University of Oklahoma's Price College of Business Faculty server. Volunteers for the study were given a password to access the internet survey. The internet survey came online on May 17th, 2005, with actual data collection starting on May 20th of 2005. The paper and online versions of the survey (see Appendix A & B) were both identical in content.

Throughout the actual data collection process, between May 20th thru September 9th of 2005, e-mail reminders were sent bi-weekly to non-responding volunteers (those who had not completed the survey either online or on paper). The presidents of both PMI chapters also sent monthly e-mail reminders to their respective chapter members during the May thru September time period. Data

collected from the online survey was downloaded every 2-3 days from the OU Faculty server and stored in files that were password protected. At the conclusion of the September deadline, a total of 281 survey responses were collected. Table 5.1 presents the breakdown of the 281 surveys that were collected during the data collection effort.

It was discovered during an initial review of the online data, a database storage allocation issue, with the OU Faculty database housing the on-line survey, affected the storage of the online data collected after July 17th of 2005. Data collected on and after this date was removed from the final sample size, which resulted in the removal of 22 online survey responses. Upon the removal of the 22 surveys, a total of 259 surveys were collected through both an on-line (N=240) and an identical paper version of the survey (N=19).

Table 5.1 Research Data Breakdown

Collected Data	Segmentation	By Type		By Scenario							
		Surveys	Scenarios	1	2	3	4	5	6	7	8
TOTAL Surveys Collected	Group 1		282	44	20	52	29	25	55	37	20
	Group 2		280	39	52	18	42	48	19	23	39
	COMBINED TOTAL	281	562	83	72	70	71	73	74	60	59
After eliminating for Database Issues	Group 1		260	40	18	52	25	18	53	36	18
	Group 2		258	30	51	15	40	47	16	21	38
	COMBINED TOTAL	259	518	70	69	67	65	65	69	57	56
After eliminating for Inconsistency Issues	Group 1		256	40	18	52	24	17	53	35	17
	Group 2		222	23	50	7	35	42	10	18	37
	COMBINED TOTAL	239	478	63	68	59	59	59	63	53	54

Scenario 1 = High Urgency, High Asset Specificity, High Demand
Scenario 2 = High Urgency, High Asset Specificity, Low Demand
Scenario 3 = Low Urgency, High Asset Specificity, High Demand
Scenario 3 = Low Urgency, High Asset Specificity, Low Demand
Scenario 5 = Low Urgency, Low Asset Specificity, Low Demand
Scenario 6 = High Urgency, Low Asset Specificity, High Demand
Scenario 7 = Low Urgency, Low Asset Specificity, High Demand
Scenario 8 = High Urgency, Low Asset Specificity, Low Demand

The remaining 259 surveys were then examined by scenario (each survey contained 2 different scenarios for a total of 518 scenarios) for any response

inconsistencies. Response inconsistencies were defined as scenarios that contained missing item responses (32 scenarios) and scenarios that contained only single response categorization to all items (i.e. answering "1" for all items, answering "2" for all items, etc.). The removal of both types of inconsistencies resulted in the elimination of 40 additional scenarios (32 due to missing item responses & 8 due to single response categorization) from the sample. This reduced the usable scenario sample size down to 478 separate scenarios. Of the 478 scenarios, 256 are categorized as Group 1 data (the 1st scenario presented to a subject) and 222 are categorized as Group 2 data (the 2nd scenario presented to a subject). The 478 scenarios were then tested to determine the integrity and viability of the data for the proposed study. The following section discusses the results of the various data integrity analyses performed on the collected data.

5.2 Analysis of Collected Data

This section details the statistical analyses utilized in assessing the integrity of the collected data. The data collected from the 478 scenarios was examined through a series of t-tests in order to determine the effectiveness of the scenario manipulations. A series of t-tests were run for the entire sample size (n=478) and for the two groups (Group1 and Group 2) designated in the prior section. The t-tests were followed by a set of confirmatory factor analyses (CFA's) performed on the Group 1 data. The CFA was done in order to confirm the theoretical viability of the instrument (did the items measure the desired theoretical constructs). The structure that emerged from

the Group 1 CFA was then utilized on the Group 2 data for confirmation. The following section details the results of the manipulation checks performed on the research instrument.

5.2.1 Manipulation Checks

The three manipulations of *project urgency, asset specificity,* and *internal demand* were tested in the questionnaire via a set of three questions apiece. The questions that pertain to each manipulation along with analysis of these items are found in Table 5.2. Results from a mean calculation of the manipulation items give strong indication that the respondents did respond positively to the manipulations. The responses were measured on a 5-point Likert scale (1=Strongly Agree ***to*** 5=Strongly Disagree). Manipulation items were worded in a manner where respondents belonging to a "high" manipulation grouping were expected to "agree" with the items, while "low" manipulation grouping respondents were expected to "disagree" with the items on the 5-point Likert scale (i.e. Q7. *The firm would like the project to be completed as quickly as possible.* Q25. *The IT personnel needed for the project will have skills that will be useful on other future IT* projects.).

Scenarios manipulated the urgency factor by providing a baseline (average IT project duration in the theoretical firm was given to be 6-months) and indicating either a time-frame of 3 months (high urgency) or 12 months (low urgency). High project urgency subjects had a response mean of 2.49 versus a response mean of 3.92 for low project urgency respondents. Results are statistically significant and seem to

indicate subjects were able to appropriately recognize the urgency levels in the scenarios presented to them.

The asset specificity factor was manipulated through the type of IT project presented in a scenario. Two different IT projects were presented: a database project that was described as having low asset specificity and a marketing sales support system that was described as requiring significant knowledge (high asset specificity) of a firm's internal systems for development and installation. The results from comparing high asset specificity subjects versus low asset specificity subjects also indicates a stronger level of agreement from higher asset specificity respondents, $t(478) = 13.595$, $p < .001$. The mean for the high asset specificity subjects was 2.93, while the low asset specificity subject mean was 3.82. The results of the asset specificity manipulation also appear to be statistically significant.

The third manipulation factor of internal demand was manipulated in the scenarios via an indication of the potential for reusing the IT personnel resource on current or future projects within the firm. The internal demand was also found to be statistically significant, $t(478) = 6.513$, $p < .001$. High internal demand respondents had a mean response of 2.92 while low internal demand respondents had a mean of 3.34. While the mean differences in the two groups was found to be statistically significant, a closer examination of the three internal demand items, shows that question 6 (*The abilities of the IT personnel on the project are highly likely to be required on future IT projects.*) did not seem to indicate any difference among the high and low groupings. The item reported a mean of 3.67 for high respondents

versus 3.62 for low respondents. A comparison of item 6 to the other two internal demand items (Q.25 & Q.30) seems to indicate that respondents may have perceived a difference in regards to the IT personnel described. While questions 25 and 30 refer to the *internal demand for the IT personnel* ***"needed"*** *or* ***"required"*** *on the IT project*, question 6 refers only to *the internal demand for the IT personnel on the IT project*. This reference to IT personnel in general may have led to a more general perception by the respondents; i.e. all IT personnel that were assigned to the IT project. Aside from item 6, the other two items; Q.25: $t(478) = 6.385$, $p < .0001$ and Q.30: $t(478) = 5.716$, $p < .0001$; were both statistical significant.

A reconfirmation of these results was done by testing the manipulation items for the Group1 (1^{st} response scenarios) and Group2 Data separately. Table 5.3 presents the results of the segmented data. The t-tests on both the Group1 and Group 2 data confirm that the *project urgency, asset specificity,* and *internal demand* manipulations appear to have been effectively manipulated in the scenarios. Aside from item 6 (Group 1: $t(256)=0.267$, $p<0.789$; Group 2: $t(222)=0.105$, $p<0.916$), which reflects the issues discussed from the combined group analysis, all other items in both groups were at least significant at the $p<0.05$ level or better.

Aside from item 6 (dealing with internal demand), the other manipulation items give strong indication that the test subjects appear to be responding to the scenario manipulations in a manner that is consistent with the test designs expectations. Subjects in the high end groupings for the three manipulations appear to have responded with stronger agreement to the manipulation items as opposed to

Table 5.2 Combined Manipulation Items

Factor Item	Group	N	Mean	t	df	Sig.
Project Urgency Q7.	High	248	2.46			
	Low	230	4.19			
t-Test with Equal variances assumed				16.263	476	0.0001
Project Urgency Q19.	High	248	2.58			
	Low	230	4.2			
t-Test with Equal variances assumed				15.656	476	0.0001
Project Urgency Q23.	High	248	2.44			
	Low	230	3.38			
t-Test with Equal variances assumed				9.666	476	0.0001
Project Urgency Items	High	248	2.49			
	Low	230	3.92			
t-Test with Equal variances assumed				23.526	476	0.0001
Asset Specificity Q2.	High	248	3.02			
	Low	230	3.89			
t-Test with Equal variances assumed				7.999	476	0.0001
Asset Specificity Q11.	High	248	2.88			
	Low	230	3.8			
t-Test with Equal variances assumed				7.992	476	0.0001
Asset Specificity Q20.	High	248	2.87			
	Low	230	3.77			
t-Test with Equal variances assumed				7.557	476	0.0001
All Asset Sp. Items	High	248	2.93			
	Low	230	3.82			
t-Test with Equal variances assumed				13.595	476	0.0001
Internal Demand Q6.	High	238	3.67			
	Low	240	3.62			
t-Test with Equal variances assumed				0.417	476	0.677
Internal Demand Q25.	High	238	2.78			
	Low	240	3.47			
t-Test with Equal variances assumed				6.385	476	0.0001
Internal Demand Q30.	High	238	2.29			
	Low	240	2.92			
t-Test with Equal variances assumed				5.716	476	0.0001
Internal Dem. Items	High	238	2.92			
	Low	240	3.34			
t-Test with Equal variances assumed				6.513	476	0.0001

subjects falling in the low end groupings. With subject responses to the scenario manipulations appearing to be consistent with expectations, the following section addresses the effectiveness of the instrument in capturing the latent constructs proposed in the research model. A series of confirmatory factor analyses was performed on both the group 1 and group 2 data. The following section details the results and implications of the CFA analyses.

Table 5.3 Manipulation Analysis by Group

	Group 1						Group 2					
Factor Item	**Group**	**N**	**Mean**	**t**	**df**	**Sig.**	**Group**	**N**	**Mean**	**t**	**df**	**Sig.**
Project Urgency Q7.	High	128	2.67				High	120	2.24			
	Low	128	4.3				Low	102	4.06			
t-Test with Equal variances assumed				10.966	254	0.0001				12.143	220	0.0001
Project Urgency Q19.	High	128	2.81				High	120	2.33			
	Low	128	4.27				Low	102	4.13			
t-Test with Equal variances assumed				9.982	254	0.0001				12.415	220	0.0001
Project Urgency Q23.	High	128	2.54				High	120	2.33			
	Low	128	3.3				Low	102	3.46			
t-Test with Equal variances assumed				5.748	254	0.0001				7.885	220	0.0001
Asset Specificity Q2.	High	134	2.72				High	115	3.36			
	Low	122	4.02				Low	107	3.75			
t-Test with Equal variances assumed				8.833	254	0.0001				2.25	220	0.025
Asset Specificity Q11.	High	134	2.81				High	115	2.94			
	Low	122	3.73				Low	107	3.9			
t-Test with Equal variances assumed				5.773	254	0.0001				5.668	220	0.0001
Asset Specificity Q20.	High	134	2.97				High	115	2.74			
	Low	122	3.84				Low	107	3.68			
t-Test with Equal variances assumed				5.836	254	0.0001				5.637	220	0.0001
Internal Demand Q6.	High	180	3.72				High	58	3.53			
	Low	76	3.76				Low	164	3.55			
t-Test with Equal variances assumed				0.267	254	0.789				0.105	220	0.916
Internal Demand Q25.	High	180	2.69				High	58	2.78			
	Low	76	3.38				Low	164	3.47			
t-Test with Equal variances assumed				4.399	254	0.0001				2.359	220	0.019
Internal Demand Q30.	High	180	2.26				High	58	2.29			
	Low	76	3.04				Low	164	2.92			
t-Test with Equal variances assumed				5.004	254	0.0001				2.28	220	0.024

5.2.2. Confirmatory Factor Analysis of Instrument Items

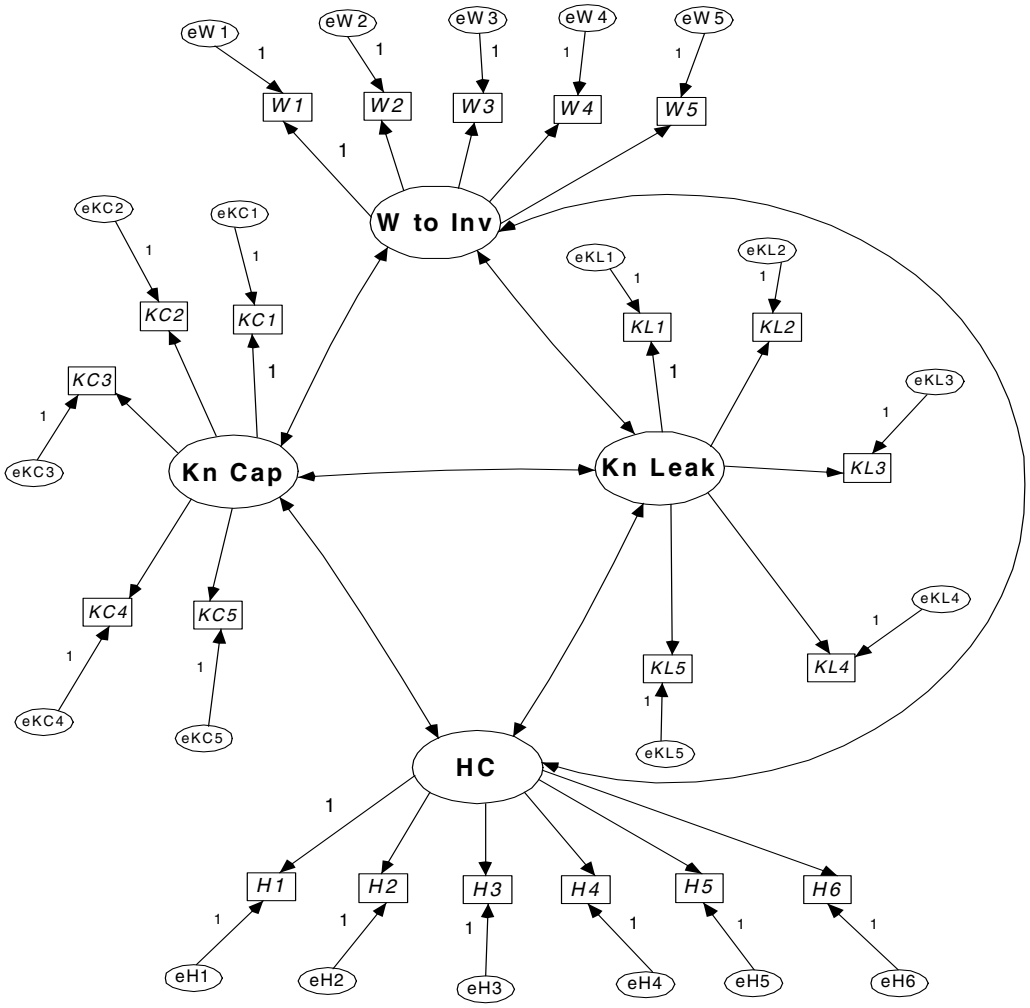
A detailed examination of the items utilized to capture the effects of *hierarchical control, the willingness to utilize the IT project to train IT personnel*, *knowledge leakage,* and *knowledge capture* in the various sourcing scenarios is presented. Due to the within-subjects design of this study with each respondent asked to analyze two consecutive scenarios, the 478 scenarios were segmented into two groupings based on when the scenario was administered. Group 1 contains data from scenarios that were administered as the *first scenario* to a respondent, while Group 2 data pertains only to the *second scenario* that was administered to a respondent. The results of the Group 1 confirmatory factor analysis are discussed in the following section.

5.2.2.1. Confirmatory Factor Analysis of Group 1 Data

A two-step modeling methodology advocated by various researchers (Byrne 2005, Kline 1998, and Russell et al. 1998) was utilized in performing a confirmatory factor analysis (CFA) of the items in the research instrument. The method calls for the testing of a pure measurement model which underlies the full structural model that is proposed from theoretical arguments (Kline 1998). If the fit of the measurement model is found acceptable, one can then proceed to the second step of testing the structural model. The pure measurement model; essentially the CFA model; was created from the proposed research model. The four latent constructs being tested (*Willingness to Invest, Knowledge Capture, Knowledge Leakage, and*

Hierarchical Control) contain no direct effects among each other with all possible pairs of latent variables allowed to co-vary (Kline 1998). Figure 5.1 (MOD1) represents the initial pure measurement model that was tested via AMOS.

Figure 5.1. MOD1 the Pure Measurement Model of Willingness to Invest, Knowledge Capture, Knowledge Leakage, and Hierarchical Control



The results of the CFA are presented in Table 5.4. The table shows the CFA results from four different models (MOD1, MOD2, MOD3, and MOD4) that were

tested to determine item reliability and model fit. Standardized regression weights for all the items of interest are reported in the table, grouped by the appropriate latent construct. The standardized regression scores from AMOS are generally interpreted as a factor loading score for the item on its' respective latent construct (Arbuckle 2005; and Byrne 2005).

Table 5.4. Item Standardized Regression Weights for Group1 Data

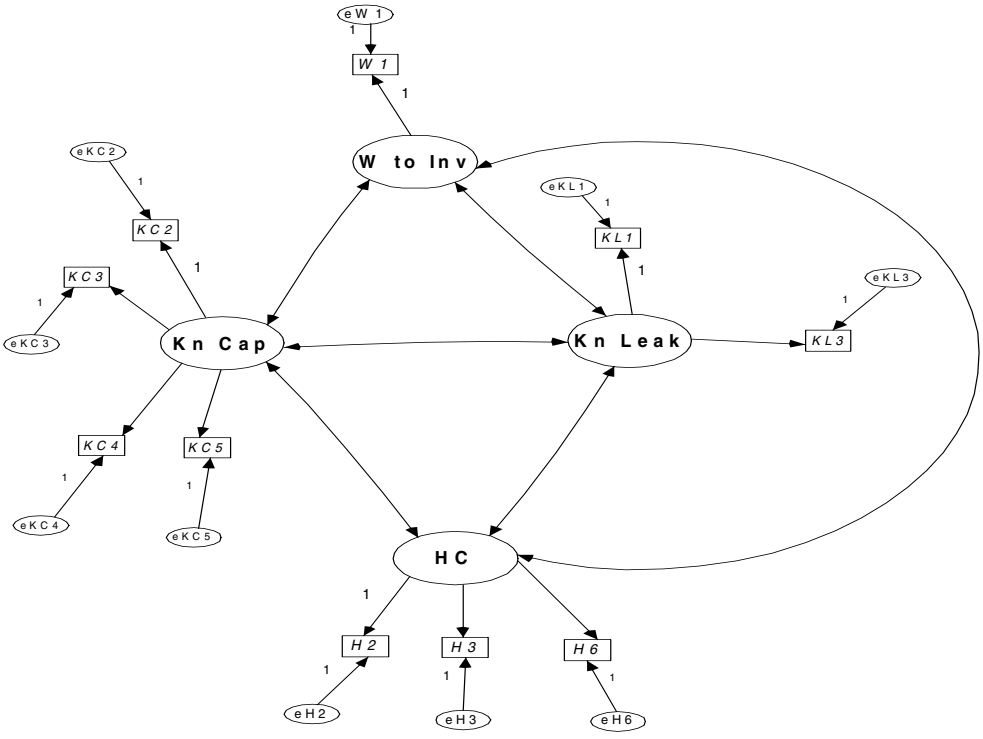
		MOD1	MOD2	MOD3	MOD4
Hierachical Control	H1	0.28			
	H2	0.60	0.62	0.52	0.57
	H3	0.64	0.59	0.54	0.57
	H4	0.39			
	H5	0.42			
	H6	0.58	0.50	0.50	0.52
Willingness to Invest	W1	0.76	0.62		
	W2	0.35			
	W3	0.44			
	W4	0.37			
	W5	0.37			
Knowledge Capture	KC1	0.18			
	KC2	0.82	0.85	0.81	0.81
	KC3	0.68	0.64	0.58	0.61
	KC4	0.76	0.64	0.84	0.83
	KC5	0.68	0.63	0.70	0.69
Knowledge Leakage	KL1	0.56	0.63	0.60	
	KL2	0.35			
	KL3	0.67	0.59	0.66	
	KL4	0.47			
	KL5	0.38			

While there is no universally accepted standardized regression weight, several recent studies that have run CFA's to evaluate instrument reliability and validity, have generally utilized the 0.50 level as a minimally acceptable score (i.e. Price, et al.

2002; Traub 2001; Doll, Xia, & Torkzadeh 1994; Russell et al. 1998 2002; and Brough, O'Driscoll, & Kalliath 2005). The 0.50 level was adopted and utilized on the results of the CFA on MOD1, eliminating items H1, H4, H5, W2, W3, W4, W5, KC1, KL2, KL4, & KL5 from the pure measurement model. These items were removed to create MOD2 (see Figure 5.2), which was then tested for item loading scores. It should be noted that several sub-models were run prior to MOD2. These sub-models tested the removal of the previously listed items in single and multiple combinations. No significant effects were found on the overall model with all items marked for removal continuing to load below 0.50 in all sub-models. The results of MOD2 present a set of items which loaded between .50 and .853.

Figure 5.2. MOD2

(Removal of Items: H1, H4, H5, W2, W3, W4, W5, KC1, KL2, KL4, & KL5)



Along with examining the loading scores, the fit of the model must also be determined with each model tested. Since no one statistic is universally accepted as an index of model adequacy, several indices are examined in concert in order to present a more rounded view of a model's fit. The indices utilized (see Table 5.5) are the Relative Chi-Square (CMIN/DF), the Goodness-of-Fit (GFI), the Adjusted-Goodness-of-Fit (AGFI), and the Root Mean Square Residuals (RMR).

Table 5.5. Summary of Model Fit Statistics for Group 1 Data

Model	CMIN/DF	GFI	AGFI	RMR
MOD1	3.34	0.70	0.62	0.13
MOD2	4.89	0.85	0.73	0.10
MOD3	4.71	0.87	0.76	0.10
MOD4	4.25	0.92	0.82	0.08

The model's relative chi-square is utilized as a means of making the chi-square statistic less dependent upon sample size (Arbuckle 2005). In AMOS the relative chi-square is represented as CMIN/DF (or the chi-square index divided by the degrees of freedom). Some researchers have suggested that this fit index should be 3 or less (Kline 1998) while others have allowed for values as high as 5 for considering adequate fit on a model (Carmines & McIver 1981). The results of the CMIN/DF statistic appears to be moving in an upward fashion (from 3.3 on MOD1 to 4.9 on MOD2), indicating a poorer fit when going from MOD1 to MOD2. The CMIN/DF index on both MOD1 and MOD2 fall within the 5.0 threshold established by Carmines and McIver (1981) but lack the stronger fit threshold of <3 advocated by Kline (1998). It should be noted that this statistic is sensitive to departures from

multivariate normality (Bollen 1989), and must be interpreted with some caution (Joreskog & Sorbom 1999).

The goodness-of-fit index (GFI) is the percent of observed covariance, observed by the co-variances implied in the model. A variation of this is the adjusted-goodness-of-fit index (AGFI), which adjusts GFI for degrees of freedom. Researchers have interpreted GFI and AFGI scores in the .80 to .89 ranges as reasonable fit, with scores above .90 as good fit (Doll et al. 1994; Kline 1998; and Joreskog & Sorbom 1999). Results of the GFI index indicate an improving fit score as the model is refined from MOD1 (GFI=.7) to MOD2 (GFI=.85). AGFI also appears to improve from MOD1 (AGFI=.62) to MOD2 (AGFI=.73). Results of both the GFI and AGFI indicate model fit improvement with MOD2.

The final fit index is designated as RMR in AMOS (root mean square residuals). Generally, smaller values of RMR are associated with better fitting models with scores below .05 considered as evidence of good fit (Byrne 1989; and Joreskog & Sorbum 1982). While the RMR scores from MOD1 to MOD2 are not at the .05 threshold, they indicate an improving fit from MOD1 (RMR=.13) to MOD3 (RMR=.10).

The results of MOD2, present a latent variable (*willingness to invest)* that is only captured by a single measurement item. One-item factors are generally not acceptable as they are poorly defined (Tabachnik & Fidell, 1989). Due to this issue, the *willingness to invest* factor was eliminated and a revised model (MOD3) was tested (see Figure 5.3). From table 5.4, all loadings of the remaining items continue

to remain at or above the 0.50 threshold. The results of fit index statistics also indicate improved model fit (see Table 5.5). However, MOD3 also contains a questionable latent construct (*knowledge leakage*) as this construct is only defined by two instrument items. A minimum of three items is generally acceptable for defining a latent construct (Tabachnik & Fidell, 1989; and Byrne 2005). Due to this issue, the *knowledge leakage* construct was removed to create MOD4 (see figure 5.4), which was subsequently tested in AMOS. The results of MOD4 present a model with stronger overall GFI, AGFI, and RMR fit index scores relative to MOD1 thru MOD3 (see Tables 5.4 & 5.5). While the CMIN/DF for MOD4 lags the fit index reported on MOD1, it is an improvement over MOD's 2 and 3 and is well within the acceptable 5.0 threshold advocated by Carmines and McIver (1981).

Figure 5.3. MOD3 (Removal of *Willingnes to Invest*)

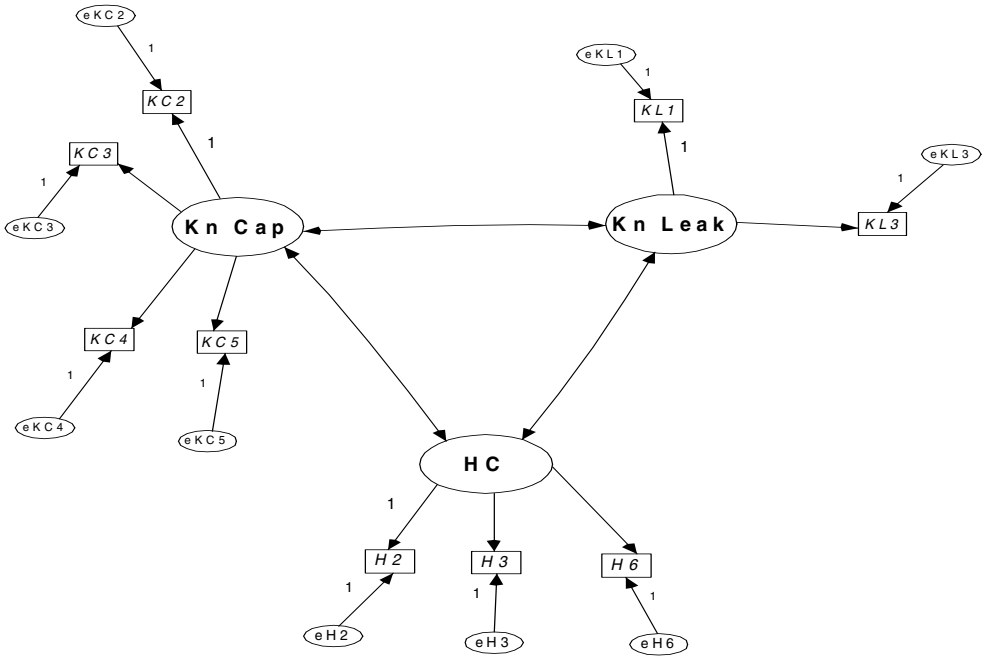
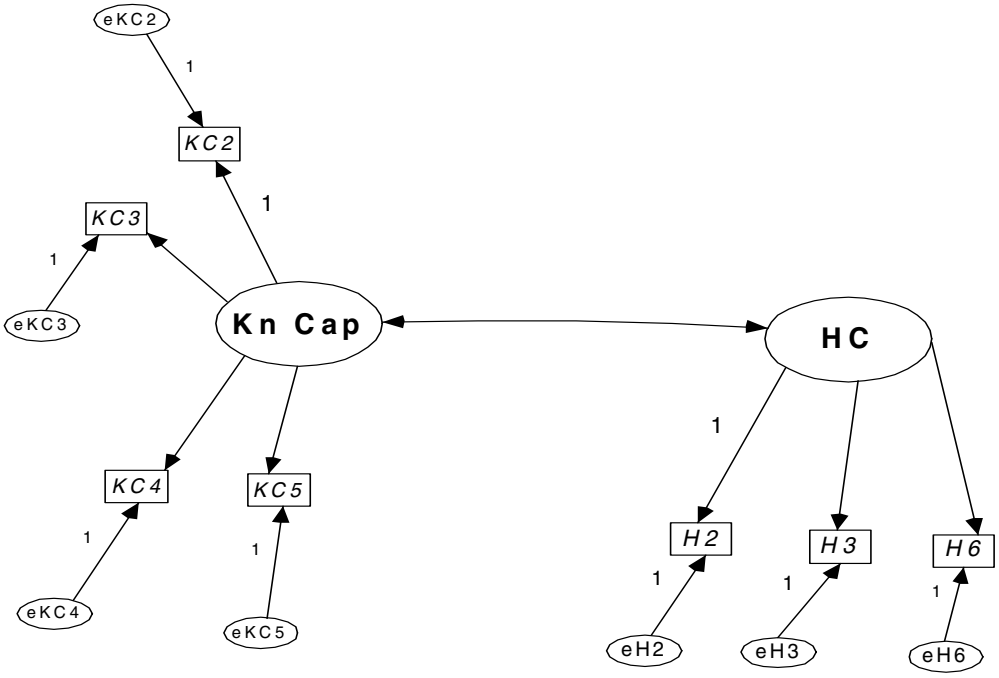


Figure 5.4. MOD4 (Removal of *Knowledge Leakage*)



5.2.2.2. CFA & Review of Knowledge Capture and Knowledge Leakage Items

An issue that arises, from the CFA on Group 1 data, deals with the knowledge capture and knowledge leakage constructs. Since both constructs deal with the issue of *knowledge,* there is the potential issue of respondents perceiving both knowledge constructs in a similar fashion. From chapter three, "knowledge leakage" has been defined as the need to retain knowledge and experiences generated from an IT project, while "knowledge capture" is defined as the transfer and codification of knowledge coming from the IT project. A review of the knowledge items in the questionnaire can help determine the potential inter-relationship among these items.

A review of the "knowledge capture" items (see Table 5.6A.) reveals that KC1 may have loaded weakly since it deals with issues of communicating new IT project knowledge, relative to items KC2 thru KC5 which reflect issues of retaining and capturing the new knowledge. This reasoning, placed in the context of the CFA scores on MOD1 (see Table 5.4), potentially explains the lower loading of KC1 (0.179) and stronger loadings seen on KC2 thru KC5 (ranging from 0.676 to 0.818). The stronger loading items appear to reflect aspects of "knowledge capture", as discussed from Chapter Three, by focusing on issues of knowledge retention.

A similar review of "knowledge leakage" items (see Table 5.6B.) also provides some reasoning for the loading scores observed in MOD1. Items KL1 and KL3 both appear to deal with issues of restricting the flow of knowledge to external entities (individuals or organizations). Item KL4 also reflects the notion of restricting outside access to knowledge, but seems to point to only certain types of IT projects (*Due to the nature of the project…).* Aside from KL1 (load= 0.561) and KL3 (.669), KL4 was the third highest loading item (.467) on the "knowledge leakage" construct. This appears to indicate some relationship among these three items with the major difference being KL1 and KL3 indicating knowledge restriction on IT projects, while KL4 presents knowledge restrictions on specific types of IT projects. Item KL5, like KL4, also appears to indicate restricting knowledge flow for certain types of IT projects (*The sensitivity of the project…).* Respondents may have viewed certain IT projects as sensitive and others as non-sensitive. The last item, KL2, appears to focus on issues of adopting policies and procedures for the purpose of

protecting knowledge. As the only item that states the need for rules and policies, it does not appear to relate strongly with the other "knowledge leakage" items and had the lowest loading score (.354). Only items KL1 and KL3 load above the 0.50 threshold and appear to load together on the "knowledge leakage" construct.

An analysis of the six strongly loading items (KC2, KC3, KC4, KC5, KL1, & KL3) gives no clear indication that they all relate to single clearly defined "knowledge-type" latent construct. The high loading knowledge capture items clearly relate to issues of retaining knowledge, while the two knowledge leakage items deal with protecting knowledge by restricting information flow.

Table 5.6A. Knowledge Capture Items

KNOWLEDGE CAPTURE		Load
KC1	It is crucial that the experiences gained by project members, from working on the project, be communicated to other personnel within the firm.	0.179
KC2	It is essential that the knowledge gained by project members, from working on the project, be captured so it may be applied to future development efforts within the firm.	0.818
KC3	The experiences and understanding gained by project members, from working on the project, needs to be retained for competitive purposes.	0.676
KC4	It is important that the firm capture the knowledge gained by project members while completing the project.	0.763
KC5	It is important that the knowledge gained by project members, from working on the project, to be transferred or captured in a form such that it can be retained within the the firm.	0.683

Table 5.6B. Knowledge Leakage Items

KNOWLEDGE LEAKAGE		Load
KL1	The firm must restrict the flow of information about the project to individuals not employed by the firm.	0.561
KL2	The firm must adopt stringent policies and procedures for protecting the knowledge gained by project members from the project.	0.354
KL3	The firm needs to protect the knowledge, gained through working on the project, from being acquired by other organizations'.	0.669
KL4	Due to the nature of the project, the firm must restrict access, of individuals not employed by the firm, to the knowledge gained by project members.	0.467
KL5	The sensitivity of the project compels the firm to prevent the knowledge gained by project members from flowing outside the firm.	0.381

While there did not appear to be a clear linkage among the ten knowledge items, a revised model was tested in order to verify this assumption. A confirmatory factor analysis was run on a modified version of MOD1 (see Figure 5.5). The results of the CFA are presented in Table 5.7. Maintaining the 0.50 loading threshold, the "willingness to invest" construct continues to have only one item; W1; loading at .747. Hierarchical control mirrors its MOD1 results, as well, and has items H2, H3, and H6 loading above 0.50. The merged "knowledge" construct (labeled *Kn Cap*) results in items KC2 thru KC5, KL1, KL3, and KL4 all loading above 0.50. MOD2A was then created by dropping the low loading items and rerun in AMOS. As with prior methods, the dropped items were tested singly and in-combination in order to determine any additional effects on the model. Two items of note did occur with these sub-models. In some cases, W1 did not load above 0.50 on "willingness to invest" and items KL1 and KL4 also did not load above 0.50 in several sub-models.

From the results of MOD2A, these items (W1, KL1, and KL4) were found to load problematically and were eliminated to create MOD3A (see Figure 5.6). MOD3A presented a model with all items loading above the 0.50 threshold.

Figure 5.5. Modified MOD1
(Knowledge Merged Model)

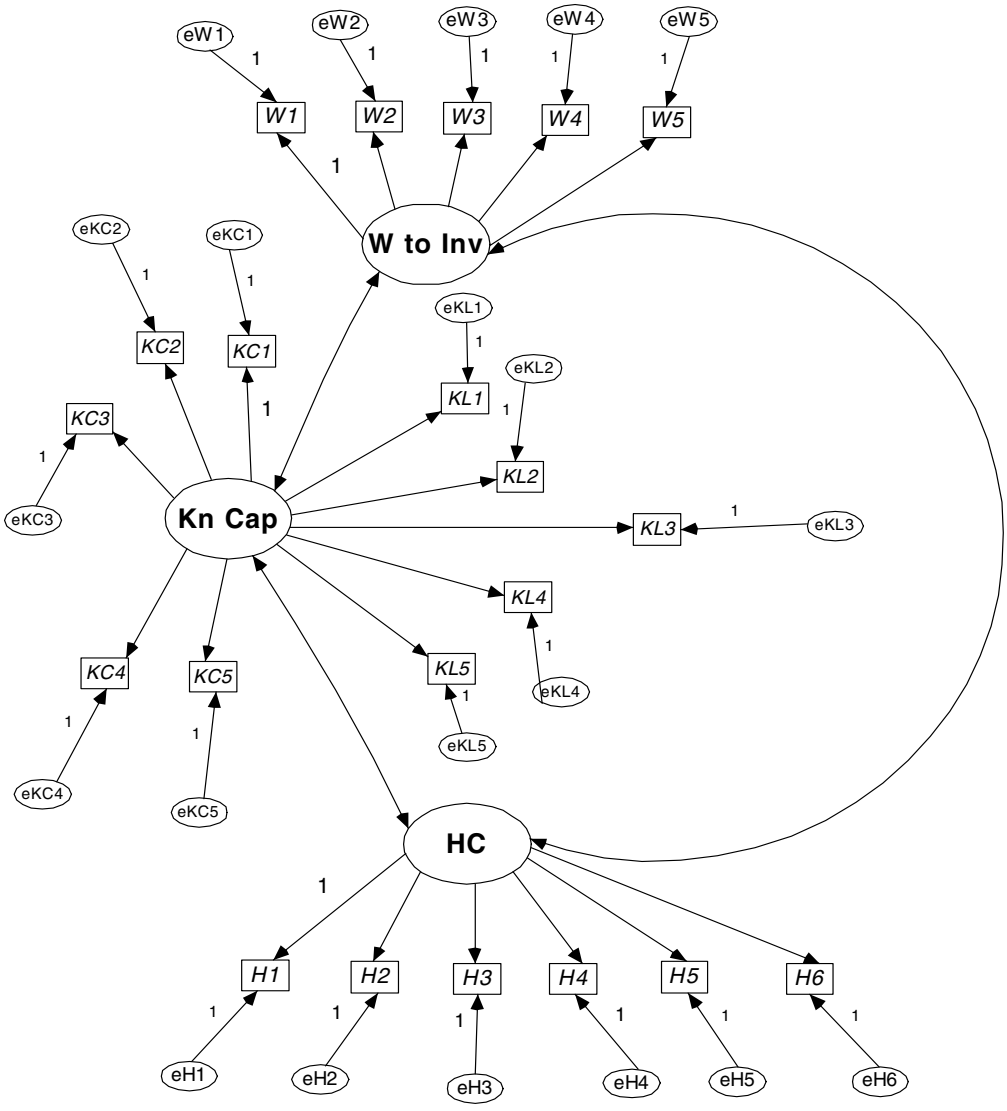


Figure 5.6. MOD3A

(Merged Knowledge Construct)

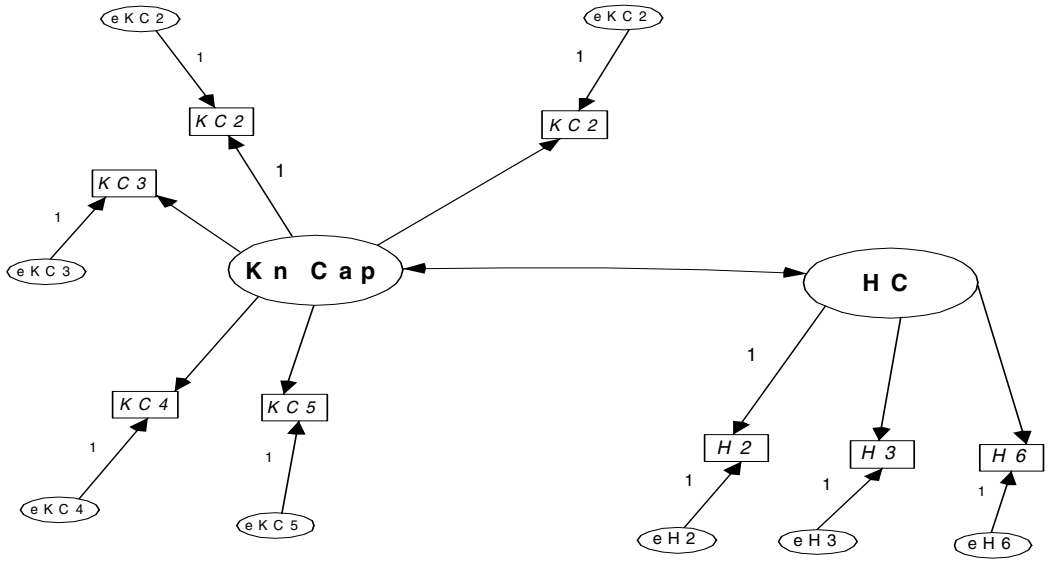


TABLE 5.7.
Item Standardized Regression Weights
for Knowledge Merged Model on Group 1 Data

		MOD1A	MOD2A	MOD3A
Hierachical Control	H1	0.29		
	H2	0.60	0.59	0.59
	H3	0.64	0.57	0.56
	H4	0.41		
	H5	0.43		
	H6	0.59	0.51	0.60
Willingness to Invest	W1	0.75	0.28	
	W2	0.35		
	W3	0.43		
	W4	0.39		
	W5	0.38		
Knowledge (Merged)	KC1	0.18		
	KC2	0.81	0.87	0.80
	KC3	0.68	0.64	0.60
	KC4	0.77	0.67	0.83
	KC5	0.69	0.79	0.71
	KL1	0.55	0.47	
	KL2	0.37		
	KL3	0.74	0.75	0.76
	KL4	0.50	0.45	
	KL5	0.40		

Table 5.8 Summary of Model Fit Statistics for Knowledge Merged Models

Model	CMIN/DF	GFI	AGFI	RMR
MOD1A	3.34	0.70	0.62	0.13
MOD2A	4.85	0.72	0.65	0.14
MOD3A	6.03	0.68	0.60	0.18

While item KL3 loads on the merged "knowledge" construct, MOD3A's fit index scores are all lower than the fit index scores from MOD4 (see Table 5.5). From a statistical fit standpoint, MOD4 appears to be a more appropriate measurement model as opposed to MOD3A and reaffirms the belief that knowledge item KL3 is not related conceptually to knowledge items KC2 thru KC5 (see Tables 5.6A & 5.6B). The CFA results on the merged "knowledge" construct models indicate MOD4 as the more appropriate model for testing the structural fit of the data. The following section assesses the reliability of the scale items found in MOD4.

5.2.2.3. Reliability & Consistency Assessment of MOD4 Items

A test of the reliability and internal consistency among the items for the two constructs on MOD4 was performed. The Cronbach's Alpha score for the four items on "knowledge capture" was .827. The results indicate good reliability and internal consistency among the four items grouped for the "knowledge capture" construct (see Table 5.9). The "hierarhcial control" items had a Cronbach's Alpha of .605. The results on "hierarchical control" are not as high as those for "knowledge capture" and

may potentially indicate some reliability and internal consistency issues among these three items (H2, H3 & H6).

Table 5.9. Knowledge Capture Reliability Scores

CRONBACH: .827

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
KC2	15.13	13.02	0.66	0.79
KC3	14.94	14.19	0.64	0.80
KC4	14.86	15.59	0.58	0.81
KC5	15.56	14.32	0.59	0.81

Table 5.10. Hierarchical Control Reliability Scores

CRONBACH: .605

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
H2	6.19	4.56	0.66	0.60
H3	6.23	4.30	0.67	0.59
H6	5.89	4.94	0.62	0.57

5.2.2.4. Confirmatory Factor Analysis of Group 2 Data

The two-step CFA methodology utilized on the *Group 1* dataset (responses to the first scenario presented) was then replicated on the *Group 2* dataset (responses to the second scenario presented). Based on the same limitations from the CFA analysis on *Group 1* data (0.50 load threshold for retention of a scale item), the analysis of

Group 2 data did not yield similar results. *Group 2* only allowed for two main models (MOD1 & MOD2C) to be run before no more items were required to be eliminated. The final model (MOD2C) yielded very poor fit statistics, indicating an overall problem with the relationships among the latent constructs (see Table 5.11 and 5.12).

Table 5.11. Item Standardized Regression Weights for Group 1 & Group 2 Data

		MOD1		MOD2	MOD2B
		Grp 1	Grp 2	Grp 1	*Grp 2*
Hierachical Control	H1	0.279	0.178		
	H2	0.601	0.535	0.620	0.521
	H3	0.639	0.671	0.594	0.653
	H4	0.391	0.563		0.553
	H5	0.415	0.548		0.522
	H6	0.583	0.504	0.500	0.500
Willingness to Invest	W1	0.764	0.612	0.624	0.595
	W2	0.345	0.270		
	W3	0.436	0.582		0.584
	W4	0.365	0.522		0.531
	W5	0.369	0.541		0.515
Knowledge Capture	KC1	0.179	0.129		
	KC2	0.818	0.725	0.853	0.721
	KC3	0.676	0.785	0.643	0.788
	KC4	0.763	0.619	0.638	0.616
	KC5	0.683	0.684	0.634	0.684
Knowledge Leakage	KL1	0.561	0.551	0.633	0.561
	KL2	0.354	0.532		0.523
	KL3	0.669	0.506	0.594	0.526
	KL4	0.467	0.551		0.575
	KL5	0.381	0.553		0.519

The second set of data (Group 2) was run with the initial model (MOD1) from figure 1 and yielded more item loadings above the 0.50 level than the Group 1 data.

A comparison of the loadings between Group 1 and Group 2 on MOD1 is displayed in Table 5.11. Only three items, H1, W2, and KC1, showed very poor loadings

While the second data set showed more item loadings above the 0.50 level, the model fit statistics from the MOD1 run on the Group 2 data yielded much poorer fit statistics than did the first data set (see Table 5.12). The CMIN/DF statistic was 5.33 for the Group 2 data, above the 5.0 level allowed some researchers (Carmines & McIver 1981). The CFI (.68), AGFI (.60) and RMR (.15) statistics also indicate a poor fitting model. Based on a comparison of MOD1, all four fit statistics from *Group 2* data fell below their respective counterparts from Group 1.

Table 5.12. Fit Statistics for Group 1 & Group 2 Data

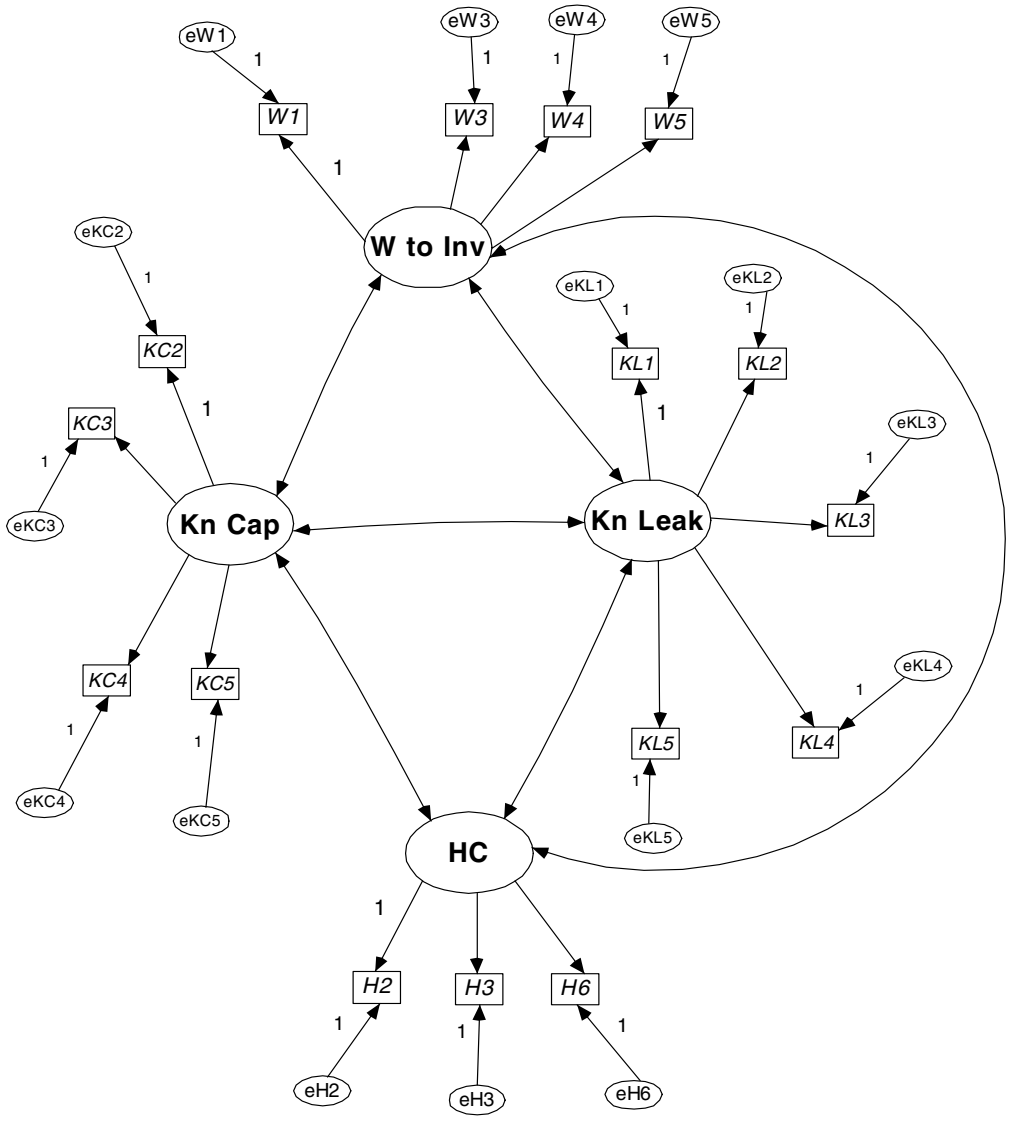
Model	Group	CMIN/DF	GFI	AGFI	RMR
MOD1	1	3.34	0.70	0.62	0.13
	2	5.33	0.68	0.60	0.15
MOD2	1	4.89	0.85	0.73	0.10
MOD2C	2	6.49	0.84	0.70	0.11

Based on the results from Group 2 data, a second model based on Group 2 results, called MOD2C, was created by eliminating the three poor loading items (H1, W2, and KC1) from MOD1 (see figure 5.7). As in prior item removals, sub-models that tested the removal of the items (H1, W2, and KC1) in single and multiple combinations were run in order to test their potential effects on the overall model. These sub-models did not yield any item loadings below the 0.50 threshold except for the three items in question (H1, W2, and KC1).

The results of MOD2C indicated a model that had all item loadings above the 0.50 level (see Table 5.11). The fit statistics for MOD2C are mixed with only one fit statistic (GFI=.84) indicating adequate fit while the AGFI (.70), RMR (.11), and CMIN/DF (6.49) indices indicating poor fit. While the two models (MOD2 vs. MOD2B) are not comparable between the two data sets, it should be noted that the first data set showed stronger fit indices on its MOD2 results as compared to the second data set on its MOD2C results. At this point, no more items for the second data set could be eliminated, based on the 0.50 loading criteria. While all remaining items in MOD2C are loading above 0.50, it fails three (CMIN/DF, AGFI, RMR) of the four fit statistic tests that were run, indicating problematic issues with the measurement model.

MOD4 (see Figure 5.3), derived from the Group 1 data set, clearly presents the strongest fitting measurement model on all four fit indices. Based on the results of the various statistical tests performed on both the Group1 and Group 2 data sets, it seems reasonable to accept MOD4 as the basis for any required revision of the research model. The final section in this chapter discusses the required revisions needed due to the results of the measurement model. A revised research model, derived from the results of the CFA, is presented in the following section.

Figure 5.7. MOD2C (removal of H1, W2, & KC1) Group 2 Data



5.3. Revising the Research Model

Based on the conclusion that MOD4 was the strongest fitting model that presented appropriate loadings for the remaining items, the elimination of the *Willingness to Invest in IT HR Capabilities* and *Prevention of Knowledge Leakage* constructs from the measurement model necessitates their removal from the research

model. While the elimination of these two constructs will result in the inability to test the proposed hypotheses related to both eliminated constructs, the remaining *Need for Knowledge Capture* construct presents the need to incorporate some new relationships among the remaining variables. These new relationships present an additional set of hypotheses for testing purposes.

The definition provided in Chapter 3 on the *need for knowledge capture*; ***the desire to maintain the knowledge experience generated by an IT project within the organization***; gives indication that demand is a component that potentially drives this need to retain knowledge. It is through internal demand for a knowledge resource that a firm will want to retain or capture this resource (e.g. Kogut & Zander 2003; Lindgren 2003; Bollinger & Smith 2001). This leads to the potential influence of the *internal demand* construct on the *need for knowledge capture* (see Figure 8). As internal demand for a knowledge resource increases, the need to capture or retain this knowledge will also increase. Hypothesis 12 reflects the issue of internal demand in knowledge capture:

> ***H12*: The greater the internal demand for a knowledge resource the greater the need for knowledge capture.**

The project urgency factor can also have an effect on the need for hierarchical control. As projects become more urgent, time constraints will limit an organization's interest and ability to capture project knowledge. From the interviews conducted with project managers and project directors, high project urgency will mitigate the need to capture knowledge. "… due to time constraints and the fact that

we needed people to know our systems…there was no time to train or pass along knowledge on such projects…" (Subjects A & B from PM interviews). This leads to the following hypothesis:

> ***H13*: The greater the project urgency, the lower the need for knowledge capture.**

The need to capture knowledge can also directly influence the sourcing decision made by a project manager. From internal labor market theory, organization's have a stronger ability to control internal personnel (Piore & Doeringer 1971). Since internal personnel are more strongly linked to the organization due to their employment status, their knowledge and abilities can be better controlled and retained for internal use (Piore 1981). Based on internal labor market theories, organization's that have a strong *need to capture knowledge*, can better facilitate this process with internal personnel. The following hypothesis addresses the issues of knowledge capture and internal sourcing.

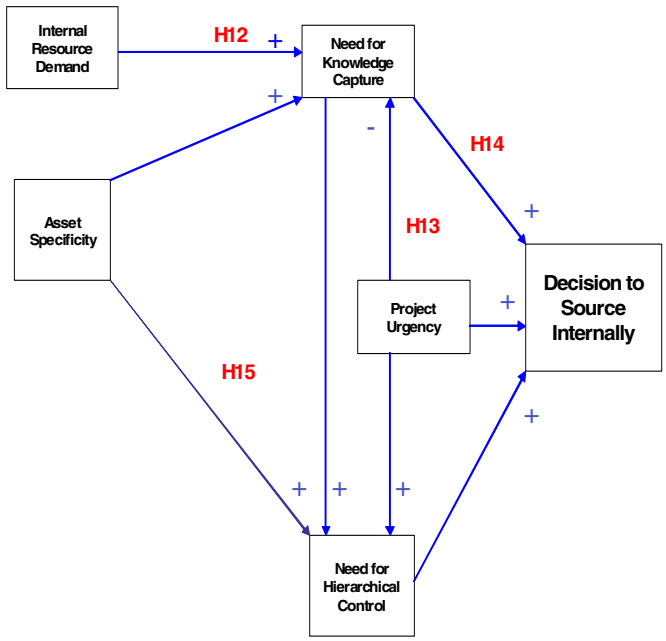
> ***H14*: The greater the need for knowledge capture, the greater the likelihood of sourcing internally**

The final hypotheses that is derived from the revised model also deals with issues of control over internal personnel. From knowledge based theory, highly asset specific knowledge resources are important strategic assets that organizations will want to keep internal (e.g. Kogut & Zander 2003 & 1996; and Conner 1991). In order to better control asset specific resources, stronger levels of hierarchical control can be imposed by the organization. This leads to the following hypothesis:

***H15*: The greater the level of asset specificity associated with an IT personnel resource, the greater the need for hierarchical control.**

The revised research model (IT Personnel Sourcing Model v2.0) presented in figure 5.8 takes into account the issues discovered through the confirmatory factor analysis of the measurement model. With this revised model, four additional hypotheses are proposed along with the revised research model. The revised model will be tested via Path Analysis as a means for confirming or rejecting the models hypotheses. The results of the Path Analysis on the revised model are presented in the following chapter.

Figure 5.8. The IT Personnel Sourcing Model v2.0



Chapter 6. Results: Testing of Research Model(s)

The revised research model presented at the conclusion of chapter 5 was tested with Group 1 data utilizing path analytic techniques. Prior research studies that have utilized path analytic techniques for analyzing theoretically based research models with data collected via instruments (Kline 1998, Marcoulides 1998, Russell et al. 1998, and James, Mulaik & Brett 1982) emphasize a two-stage methodology; (1) confirm the measurement model and, (2) test the structural model. The primary purpose of this two-step process is to validate the reliability of the instrument and the data collected with a measurement model, prior to proceeding with an analysis of the proposed structural research model (Kline 1998). Based on the set of poor fit indices found when testing the Group2 data with the measurement model (see section 5.2.2.4 of chapter 5), proceeding with a structural analysis of the Group 2 data set is unwarranted. Given the "poor" fit results from Group 2 data and the "acceptable" CFA fit results of the Group 1 data, the analysis in this chapter focuses solely on the Group1 data.

Testing of the Group 1 data was done through path analytic techniques using the AMOS 6.0 statistical package. Chapter 6 begins with a path analysis of the revised research model (v.2.0) utilizing the Group1 data set. This is followed by a discussion of the results from the path analysis. The results of the initial path analysis lead to a re-examination of the proposed research model. The re-examination of the research model is augmented with a series of ad hoc analyses on the Group 1 data. The results of the additional analyses provide the basis for additional modifications to

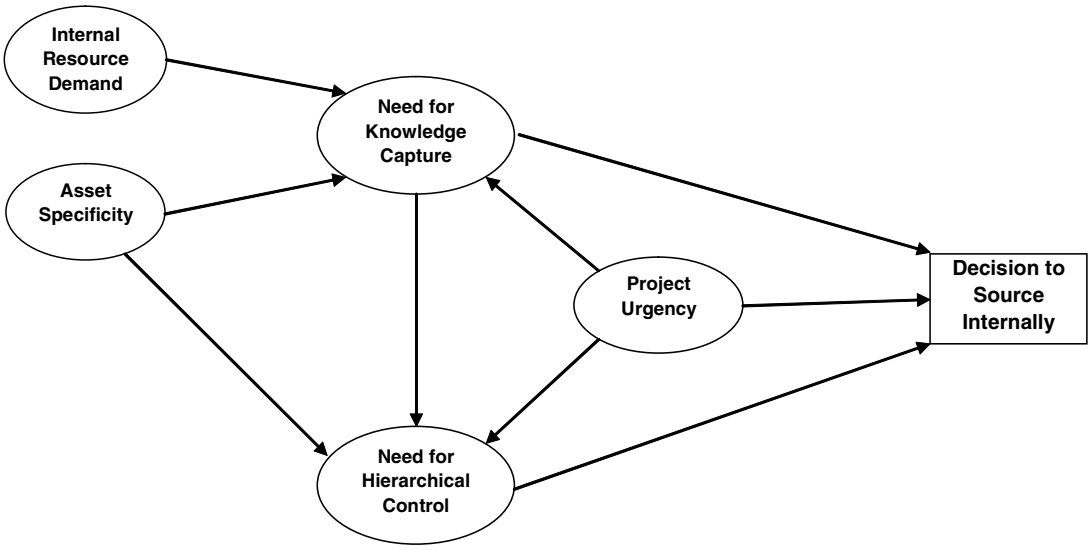
the proposed structural research model. The reasoning for the modifications is presented during the discussion of the initial path results. The modified structural research model is then used to assess the hypotheses proposed in chapters 3 and 5. Chapter 6 concludes with the results of the hypotheses testing. The implications of these results are discussed in the subsequent final chapter of this study.

6.1 Results of Path Analysis

Based on the results of the confirmatory factor analysis run on Group 1 data, MOD4 (see Figure 5.4 in Chapter 5) was found to have the strongest set of fit indices, which fell within accepted fit index thresholds (Kline 1998; Byrne 1989; Joreskog & Sorbom 1999 & 1982; and Carmines & McIver 1981). The revised research model (version 2.0), presented at the conclusion of the previous chapter, was adapted as the structural model (see Figure 6.1) for testing the Group1 data set. Assessment of the structural model was performed with the AMOS 6.0 statistical package.

When utilizing path analysis to confirm a proposed structural model, two issues need to be considered in sequence. First, does the model exhibit good fit, via the fit statistics and secondly, are the path coefficients significant (Kline 1998; Marcoulides 1998; and Joreskog & Sorbom 1999). The revised model was tested with the Group 1 data and presented an overall set of fit statistics displayed in table 6.1. Recalling the "acceptable" fit thresholds established by researchers in prior studies, a CMIN/DF below 5.0 (Carmines & McIver 1981), GFI and AGFI scores above 0.80 (Doll et al. 1994; Kline 1998; and Joreskog & Sorbom 1999), and RMR

Figure 6.1
IT Personnel Sourcing Model v.2.0



values below 0.080 (Doll et al. 1994; and Byrne 1989), table 6.1 results appear to indicate a model that has "acceptable fit". Aside from the AFGI score of 0.78 falling slightly below the 0.80 threshold, the overall set of fit indices gives indication of acceptable fit levels.

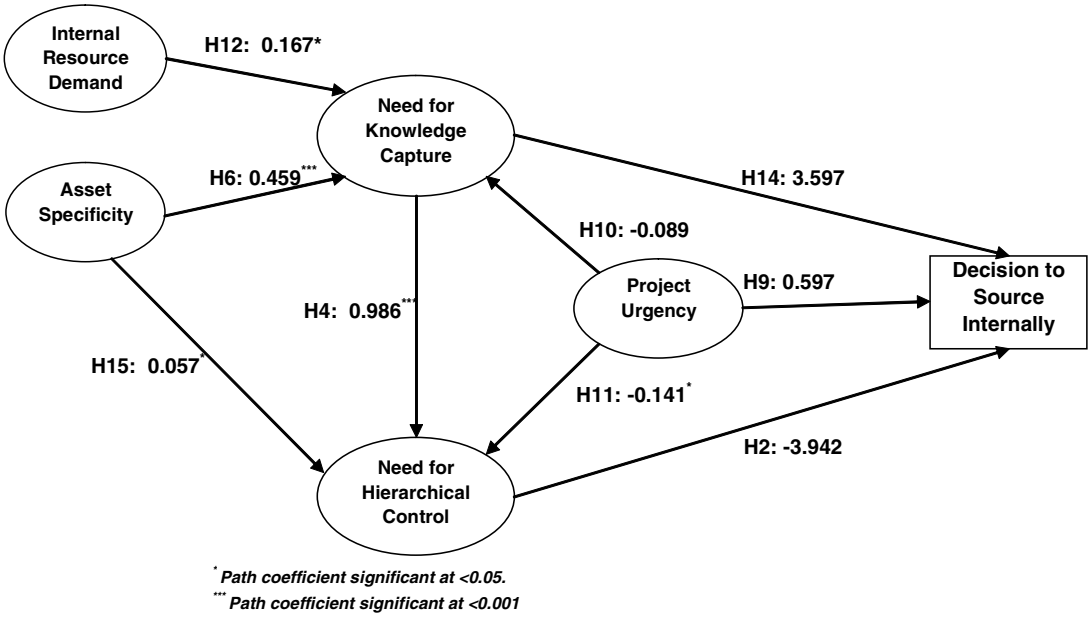
Table 6.1
Fit Statistics for Group 1 Data (Model v2.0)

Model	CMIN/DF	GFI	AGFI	RMR
Research Model	4.900	0.864	0.776	0.079

The fit index results, of the Group 1 data, indicates support for "acceptable" fit with Group 1 data on the revised structural research model (Figure 6.1). With the model presenting acceptable fit scores on the Group 1 data, examination of the path

coefficients is warranted. The results of the path analysis are presented in figure 6.2, which displays the path coefficients and provides indications of their significance. The results of this path model show direct paths from the *need for knowledge capture* and the *need for hierarchical control* are non-significant along with two non-significant paths emerging from the project urgency construct (*project urgency => need for knowledge capture* and *project urgency => decision to source internally*).

Figure 6.2
Path Model Results for Group 1 Data



The results of the path model on Group 1 data give some indication that the *project urgency* construct may be problematic. A re-examination of the resource availability variables, that were presented in the theoretical model (see Chapter 3) but eliminated from the research models due to the deterministic nature of these

variables, can offer some insight and potentially explain the results found in figure 6.2. After the administration of the survey at the Dallas PMI meetings, two respondents indicated clarity issues in regards to the internal availability of the required IT personnel. Essentially, these two respondents stated they were unclear as to the availability of the IT personnel resource and made some assumptions when completing the survey. They indicated knowing if "*there was a usable resource available internally***"** would have helped them in determining the appropriate sourcing option. The set-up in the scenarios state: *"when considering the internal IT staff option, assume the firm's IT staff possesses the appropriate technical expertise required for the projects presented to you"*. One respondent stated "they assumed the IT personnel resource was available internally", while the other assumed "internal availability might be an issue and made decisions under this assumption".

The resource availability issue potentially impacts how the *project urgency* variable may have been perceived in the scenarios. Logically, if a resource is available internally for an urgent project it will be used and if not, an appropriate resource is acquired externally as quickly as possible. From the sentiments provided by the two respondents at the Dallas chapter meeting, it appears subjects could potentially assume one of two possibilities: (1) the firm possesses the required IT personnel resource or (2) the firm may not possess or have available the required IT personnel resource. The effects of this issue may explain the "wash effect" (non-significant path results) found with the *project urgency* variable.

6.1.1 Additional Analysis: Linear Regression Model

In order to help test the assertion that *project urgency* may be a problematic variable, a linear regression model containing only the manipulation variables of *project urgency, internal demand,* and *asset specificity* was run in order to help determine their effects on the dependent variable (*decision to source internally*). The regression model was created by utilizing the manipulation check items, from the research instrument, as surrogate measures for *project urgency, internal demand,* and *asset specificity* constructs. The manipulation items were aggregated (scores added together) by type (all item scores on project urgency combined, etc.) to create a scaled score. The results of the regression analysis are presented in tables 6.2.

Based on the R^2, the three manipulation items appear to account for 0.11 of the variation on the decision to source internally. The t-values of the three manipulation items indicate that project urgency ($t = -2.089$; $p<.05$), while statistically significant, is in the opposite direction of the sourcing decision. This result ($B = -0.135$) does not make theoretical sense and gives further indication that the inclusion of the *project urgency* variable in the overall model maybe problematic. The results of the other manipulation variables indicate that *asset specificity* ($t = 5.327$; $p<.01$) has a significant affect in the appropriate direction while *internal demand* ($t = -1.025$; $p=.307$) is not significant. These results suggest that issues of asset specificity potentially have some impact on how a sourcing decision is made on an IT project, but internal demand appears to have little direct impact on the IT project sourcing decision. The following section presents the results of a series of

path models that were tested in order to further investigate the results of the v2.0 path model.

Table(s) 6.2
Regression Model Summary for Manipulated Items

Regression Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.332(a)	0.11	0.1	0.859

a Predictors: (Constant), DM Scale, URG Scale, ASP Scale

ANOVA(b)				
Model		Mean Square	F	Sig.
1	Regression	7.682	10.41	.000(a)
	Residual	0.738		
	Total			

a Predictors: (Constant), DM Scale, URG Scale, ASP Scale
b Dependent Variable: S1

Coefficients(a)					
	Unstandardized Coefficients		Standardized Coefficients		
Model	B	Std. Error	Beta	t	Sig.
1 (Constant)	1.563	0.242		6.467	0.000
Dem Scale	(0.035)	0.034	(0.073)	(1.025)	0.307
Asp Scale	0.112	0.021	0.363	5.327	0.000
Urg Scale	(0.038)	0.018	(0.135)	(2.089)	0.038

a Dependent Variable: S1

Dem Scale = aggregated internal demand score
Asp Scale = aggregated asset specificity score
Urg Scale = aggregated project urgency score

6.1.2 Additional Analysis: Path Models

A set of two path sub-models was created; by taking the v.2.0 model and segmenting it along the *need for knowledge capture* and the *need for hierarchical control* variables (see Figures 6.3 & 6.6). In both sub-models, direct paths were added from *asset specificity* and *internal demand* in order to re-verify the findings

from the regression model. *Project* urgency is also initially retained in both sub-models to see its overall effects on the sub-models. With the Knowledge Capture Model v1.0 (Figure 6.3), the results of the fit indices (see Table 6.3) indicated a poor fitting model that did not allow for appropriate interpretations of the path coefficients. Both the CMIN/DF and RMR statistics indicate "poor" fit, while AGFI indicates "marginally acceptable" fit with GFI being the only index indicating "acceptable" fit. Based on these fit index results, a second version of the Knowledge Capture path sub-model was created (without *project urgency*) and tested (see Figure 6.4)

Figure 6.3.
Knowledge Capture Model v1.0

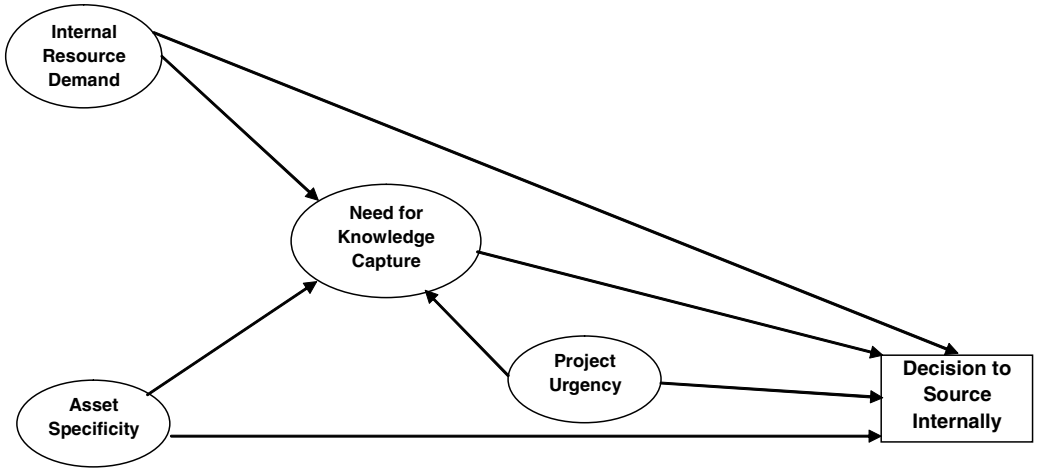


Table 6.3
Fit Statistics for Knowledge Capture v1.0 Model

Model	CMIN/DF	GFI	AGFI	RMR
Research Model	4.900	0.864	0.776	0.079

Figure 6.4.
Path Analysis for Knowledge Capture v 2.0

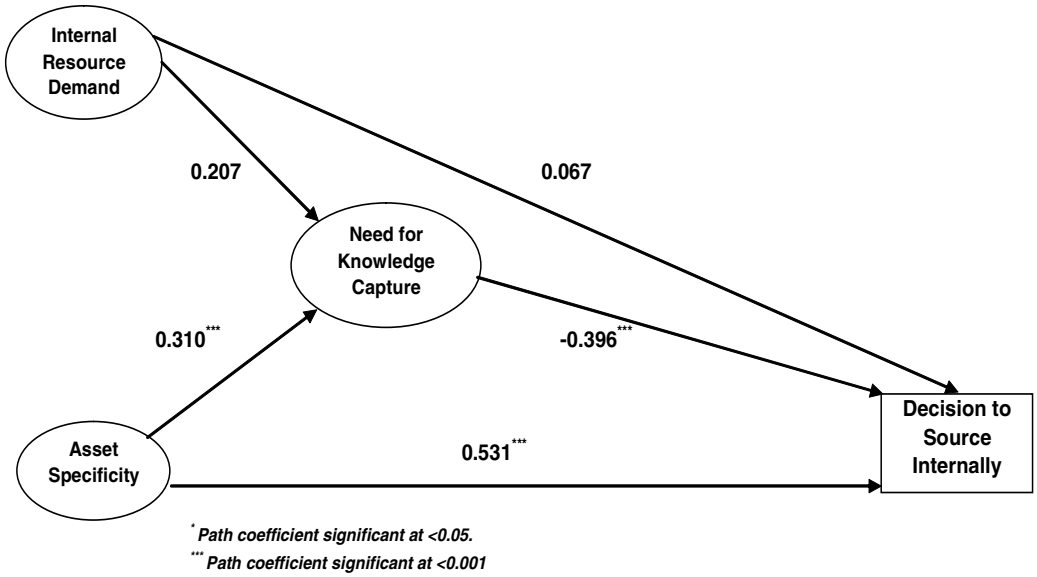


Table 6.4
Fit Statistics for Knowledge Capture v2.0 Model

Model	CMIN/DF	GFI	AGFI	RMR
Research Model	3.444	0.933	0.874	0.095

The results of the second Knowledge Capture sub-model presents a model with acceptable fit index scores (see Table 6.4). The CMIN/DF, GFI, and AGFI index scores indicate a model with "good" fit, while RMR gives indication of a "marginally acceptable" fit. With an appropriately fitting model, the path coefficients are seen to have significant results on all paths except for the two paths leading from *internal demand.* The result of the *internal demand* path leading (0.067 non-

significant) to the sourcing decision appears to verify the insignificant result seen in the regression model. These results also verify that *asset specificity* does appear to have a direct and indirect affect on the sourcing decision.

A similar set of path models was tested for the *need for hierarchical control* construct. Figure 6.5 presents the Hierarchical Control path model that was tested with the inclusion of the *project urgency* variable. The fit index scores (see Table 6.5) for the Hierarchical Control v1.0 model is mixed. CMIN/DF gives indication of "poor" fit, while GFI and AGFI indicate model fit with RMR presenting "marginally acceptable" fit. While these fit index results present some possible leeway for interpreting the path coefficient results, both paths (to *hierarchical control* and the *decision to source internally*) from the *project urgency* variable were found to be insignificant. This resulted in the testing of a second Hierarchical Control sub-model (see Figure 6.6).

Figure 6.5.
Hierarchical Control Model v1.0

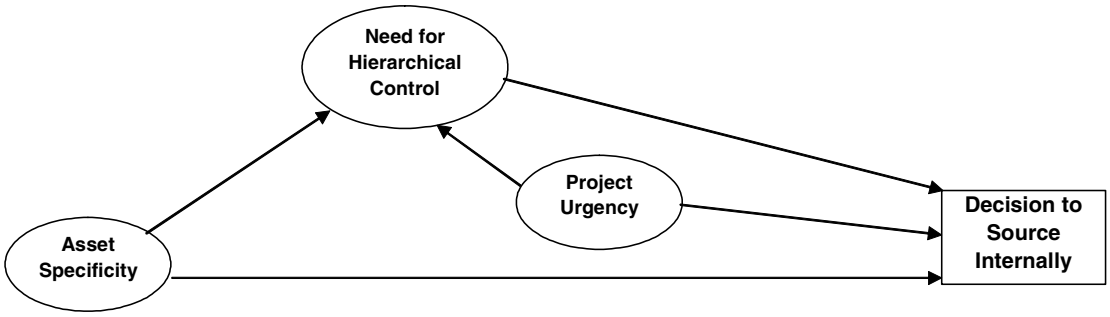


Table 6.5
Fit Statistics for Hierarchical Control v1.0 Model

Model	CMIN/DF	GFI	AGFI	RMR
Research Model	5.717	0.925	0.841	0.099

Figure 6.6.
Results of Hierarchical Control Model v2.0

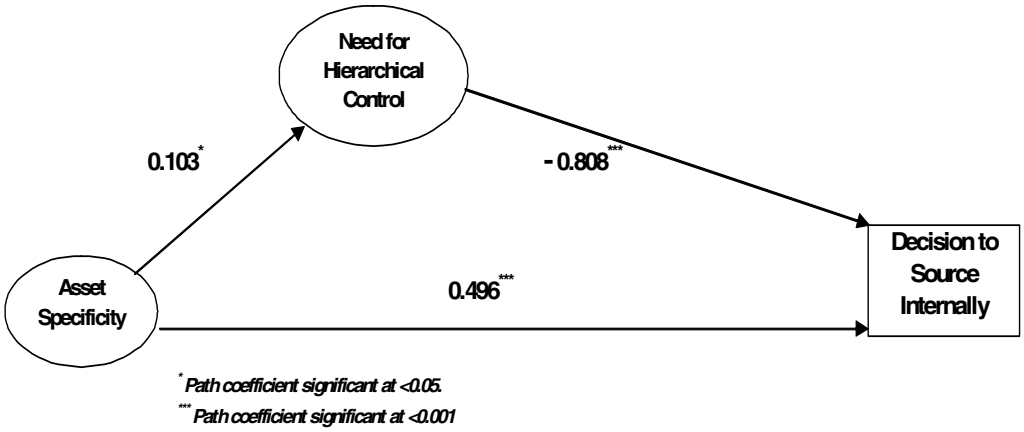


Table 6.6
Fit Statistics for Hierarchical Control v2.0 Model

Model	CMIN/DF	GFI	AGFI	RMR
Research Model	2.544	0.968	0.926	0.061

The results of the fit index scores (see Table 6.6) give overall indication of a "good" fitting model. Three of the four indices (CMIN/DF, GFI, & AGFI) indicate "good" fit while the fourth fit index score of RMR gives indication of "acceptable" fit. Interpretation of the path coefficients on the Hierarchical Control v2.0 model gives clear indication that all paths in this model have significant and appropriately

directed affects. These results give further support for the direct and indirect (through *the need for hierarchical control*) effects of *asset specificity* on the sourcing decision.

Based on the results of the initial path model (Figure 6.1) and the reasoning for the effects or non-effects of *project urgency,* which have been supported with the ad hoc analysis presented, the structural research model (Figure 6.1) was modified to incorporate these findings (see Figure 6.7). This modified research model (v2.5) was then tested with the Group 1 data. The fit index results for the v2.5 path model are presented in table 6.7.

Figure 6.7
Path Analysis for IT Personnel Sourcing Model v2.5

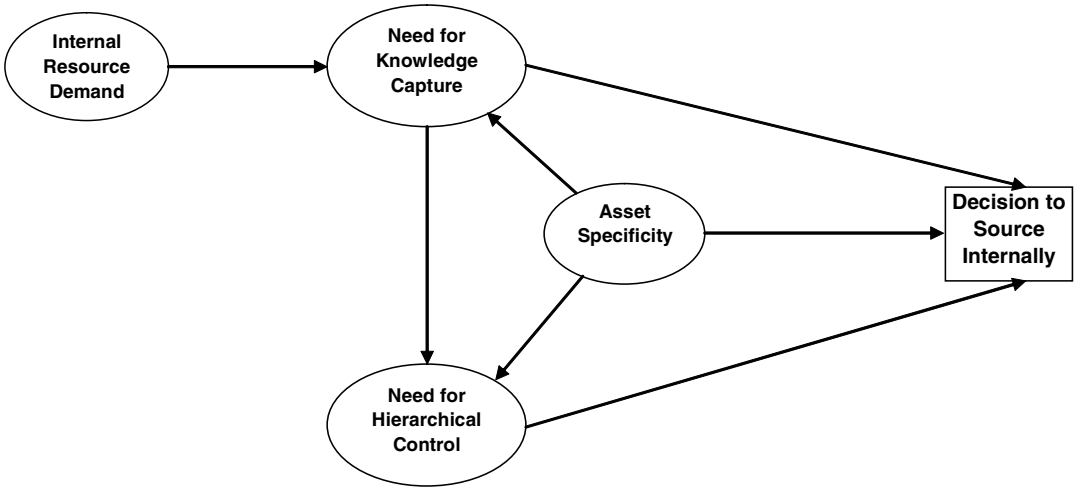


Table 6.7
Fit Statistics for IT Personnel Sourcing Model v2.5

Model	CMIN/DF	GFI	AGFI	RMR
Research Model	6.472	0.842	0.774	0.100

The fit results, of the IT Personnel Sourcing Model v2.5, do not indicate a model with overall "acceptable" fit index scores. Only the GFI score of .842 is within the "acceptable" fit index range, while AGFI indicates "marginally" acceptable fit and both CMIN/DF and RMR give indications of "poor" fit. Based on these fit index scores, interpretations of the coefficient path scores are potentially problematic and difficult to justify. A slight modification to the v2.5 path model (see Figure 6.8 for v.3.0) was made by removing the direct effect from *asset specificity* to the *sourcing decision* and the model tested with Group 1 data.

The fit results, for the IT Personnel Sourcing Model v3.0 presented in table 6.8, now reflect a model with "acceptable" overall fit index scores. The fit scores on the v3.0 model show improvement over the initial path model scores (see Table 6.1) and allow for interpretation of the path coefficients. It would appear that the removal of the *project urgency* variable has created a more stable structure, with all remaining paths showing significant results (see Figure 6.8). Since path calculations are based on the structure of the entire path model, these path results also give indication that the inclusion of the "wash effects" from the *project urgency* variable may have also influenced the effects of other variables in the previously tested path models.

Table 6.8
Fit Statistics for IT Personnel Sourcing Model v3.0

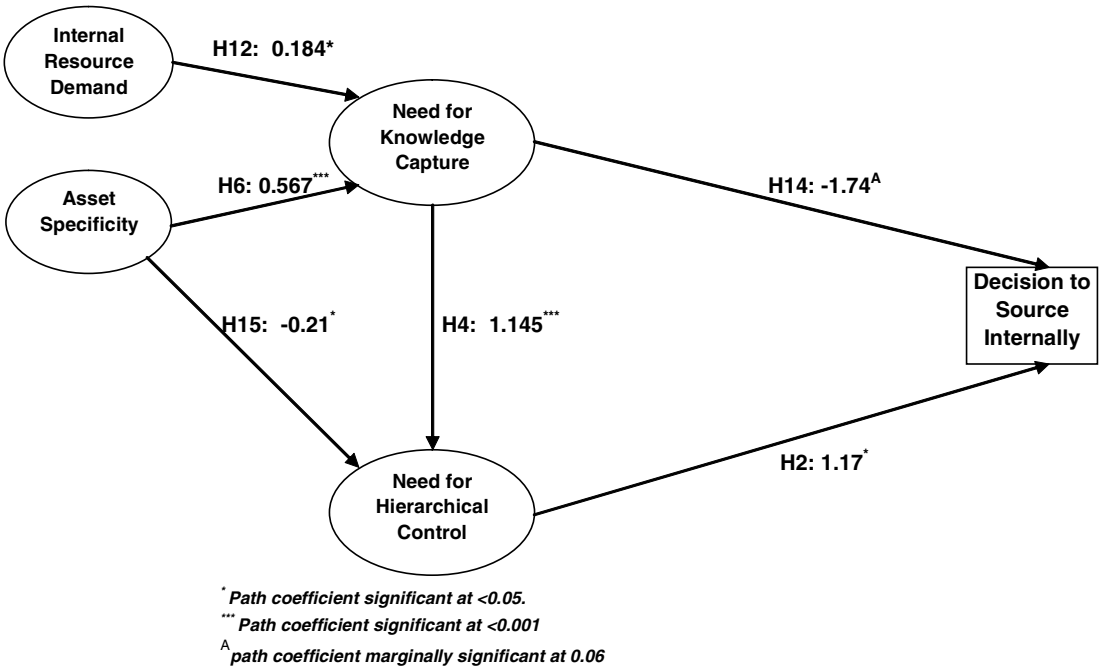
Model	CMIN/DF	GFI	AGFI	RMR
Research Model	4.867	0.872	0.804	0.072

The final section of this chapter discusses the results of the path coefficients on the IT Personnel Sourcing Model v3.0 and utilizes these results in testing the proposed hypotheses from chapters 3 and 5.

6.2 Hypotheses Testing on Modified Research Model

The modified IT Personnel Sourcing Model (v.3.0) tested with the Group 1 data via AMOS is presented in Figure 6.8. The results present a structural model that has acceptable fit indices that have improved over the fit statistics generated from the IT Personnel Sourcing Model v.2.0 (refer to Table 6.1). In contrast to the path results in Figure 6.2, almost all paths are now significant at the 0.05 level or greater, with the one exception (H14) showing significance at the 0.06 level.

Figure 6.8
Path Analysis for IT Personnel Sourcing Model v3.0
w/ Project Urgency Removed



The acceptable fit statistics for the Group 1 data allows for the interpretation of the proposed hypotheses via the path efficient scores. A summary of all the proposed hypotheses from chapters 3 and 5 can be found in Table 6.9. The results of the hypothesis testing for the remaining paths in the IT Personnel Sourcing Model v.3.0 are presented below:

> **Hypothesis 2, Supported:** The path between the need for hierarchical control and the decision to source internally is positive and significant (path=1.17, $p<.05$).
>
> **Hypothesis 4, Supported:** The path between the need for knowledge capture and the need for hierarchical control is positive and significant (path=1.145, $p<.001$).
>
> **Hypothesis 6, Supported:** The path between asset specificity and the need for hierarchical control is positive and significant (path=0.567, $p<.001$).
>
> **Hypothesis 12, Supported:** The path between internal resource demand and the need for hierarchical control is positive and significant (path=1.184, $p<.05$).
>
> **Hypothesis 14, Not Supported:** The path between the need for knowledge capture and the decision to source internally is negative and marginally significant (path = -1.74, $p<.06$).
>
> **Hypothesis 15, Supported:** The path between asset specificity and the need for hierarchical control is positive and significant (path=0.21, $p<.05$).

A review of the theoretical arguments from Chapter 3 confirms the nature of the path coefficients from the Group 1 data. Internal Labor Market (ILM) theory argues for the need to use internal employees as a means towards stronger

organizational control (Doeringer & Piore 1971). Results from the path analysis indicate that as the need for hierarchical control increases a firm will want to source internally for better control (H2), which falls in line with ILM theory. ILM theory also discusses the potential need to develop and increase the internal labor supply as a solution for meeting growing internal labor demands (Camuffo 2002; and Doeringer & Piore 1971). The positive and significant path between internal resource demand and the need for knowledge capture (H12) reflects the ILM sentiment of increasing a firm's internal labor supply.

Table 6.9 Summary of Research Hypotheses w/ Group 1 Data			Path Coefficient
H1:	N.A.T.T.	The greater the organization's willingness to utilize an IT project to develop IT personnel resources, the greater the likelihood of sourcing internally.	n/a
H2:	Supported	The greater the need for hierarchical control over an IT personnel resource needed for an IT project, the greater the likelihood of sourcing this IT personnel resource internally.	1.170*
H3:	N.A.T.T.	The greater the need for knowledge capture the greater the willingness by the organization to invest in developing IT HR capabilities.	n/a
H4:	Supported	The greater the need for knowledge capture the greater the need for hierarchical control.	1.145***
H5:	N.A.T.T.	The greater the need to prevent knowledge leakage, the greater the need for hierarchical control.	n/a
H6:	Supported	The greater the level of asset specificity associated with an IT personnel resource, the greater the need for knowledge capture.	0.567***
H7:	N.A.T.T.	The greater the level of asset specificity associated with an IT personnel resource, the greater the need for the prevention of knowledge leakage.	n/a
H8:	N.A.T.T.	The greater the internal demand for a particular IT personnel resource, the greater the willingness to use the IT project to invest in IT HR.	n/a
H9:	N.A.T.T.	The greater the project urgency, the greater the likelihood of sourcing internally.	n/a
H10:	N.A.T.T.	The greater the project urgency on an IT project, the less willing an organization will be to utilize the IT project to develop IT personnel resources.	n/a
H11:	N.A.T.T.	The greater the project urgency on an IT project, the greater the need for hierarchical control	n/a
H12:	Supported	The greater the internal demand for a knowledge resource the greater the need for knowledge capture.	0.184*
H13:	N.A.T.T.	The greater the project urgency, the lower the need for knowledge capture.	n/a
H14:	Not Supported	The greater the need for knowledge capture, the greater the likelihood of sourcing internally	- 1.740^A
H15:	Supported	The greater the level of asset specificity associated with an IT personnel resource, the greater the need for hierarchical control.	0.210*

Notes: 1. N.A.T.T. = Not Able to Test
2. ^A = p < .06, * = p < .05, *** = p < .01

The results of paths H4, H6, and H15 are all reflections of the knowledge based theory. Knowledge based theory argues for the protection of asset specific knowledge as this type of knowledge is seen as a strategic asset for an organization (Nonaka 1994). The results of the path analysis appear to indicate that the more unique or asset specific the knowledge asset is from an IT project, the stronger the need to capture this knowledge (H6) and the stronger the need to impose hierarchical controls (H15) in order to protect these knowledge assets. As a corollary, when the need to capture this knowledge asset is strong, organizations will naturally want to protect and control these assets by imposing stronger hierarchical controls (H4).

The final hypothesis (H14) was not supported by the results of the path model. While path H14 was found to be marginally significant ($p<.06$), the negative result (-1.74) did not correspond with the predicted hypothesis. The predicted hypothesis reflects the perception of stronger control over an internal labor source (ILM theory) helping facilitate the need to capture or retain new knowledge. Examined in the context of *what sourcing situation brings about the organizational need to capture knowledge*, this original perception for control is incorrect. In the situation where internal sourcing is utilized, there is less urgency in needing to codify or capture the knowledge generated as the internal resource is assumed to still be available in the future (since they are assumed to be an employee of the organization). The opposite sourcing situation, with an external IT personnel resource, will bring about a stronger need to capture the knowledge generated since the external resource is generally contracted for a particular project. With an external resource, their knowledge is only

available during the duration of the project and they will effectively leave with that knowledge, unless it is captured by the organization, when the project is completed. In order to avoid the potential loss of valuable knowledge assets from an external IT personnel resource, firms have a stronger interest in capturing this knowledge (on a priority basis, trying to retain what is expected to eventually leave as opposed to what is expected to stay). The negative result of this path in the model appears to reflect this sentiment. The need to capture knowledge increases when and external sourcing decision is made. Overall, the remaining path results from the IT Personnel Sourcing Model v3.0, provides support for the theoretical arguments presented in Chapter 3. The one exception was hypothesis 14 indicating a significant negative effect. The negative, contrary result appears logical, given the apparent misperception.

Another interesting point to note from these results deals with the coefficient scores for the paths from the *need for knowledge capture* to the *decision to source internally* and for the *need for hierarchical control* to the *decision to source internally.* On both paths, the coefficient scores have both increased from their respective scores calculated in the segmented sub-models (see section 6.1.2). With the Knowledge Capture model, the path coefficient score was -0.596 versus -1.74 in the combined model, while the Hierarchical Control model's path coefficient is 0.65 versus 1.17 in the combined model. It appears that combining the two independent variables of the *need for knowledge capture* and the *need for hierarchical control* into a single model has amplified their effects on the *decision to source internally.*

The implications of the results presented in this chapter are addressed in the final chapter of this study. The limitations of this study, revealed during the course of executing this research study, are also discussed. The final chapter will conclude with potential avenues for further investigation that can help broaden the findings presented in this research study.

Chapter 7. Conclusions

The concluding chapter of this study begins with a review of the Project IT Personnel Sourcing Model's evolution. This is followed by a discussion of the findings from the final research model that emerged. In particular, the findings surrounding the *need for knowledge capture* variable are expressed, with the implications surrounding the *need for knowledge capture* discussed in detail. The chapter concludes with the main contributions derived from this study.

7.1 Summary of Research Results

This research study examined the factors that could potentially affect the IT personnel sourcing decision during the initiation of an IT development effort. Through a succession of statistical analyses, a more focused variation of the originally proposed theoretical research model emerged. Figure 7.1 represents the theoretical model that contains all the variables that were surfaced through interviews and an examination of transaction cost economics, knowledge based theory, and internal labor market theory perspectives. While this theoretical model presented a series of constructs that are believed to influence the IT personnel sourcing decision on IT projects, three of the constructs (internal resource availability, external resource availability, and internal resource demand uncertainty) are deterministic in nature. This determinism limits the testability of these constructs in the overall model. The three deterministic constructs were removed to create the initial research model (see Figure 7.2).

Figure 7.1 Theoretical Model

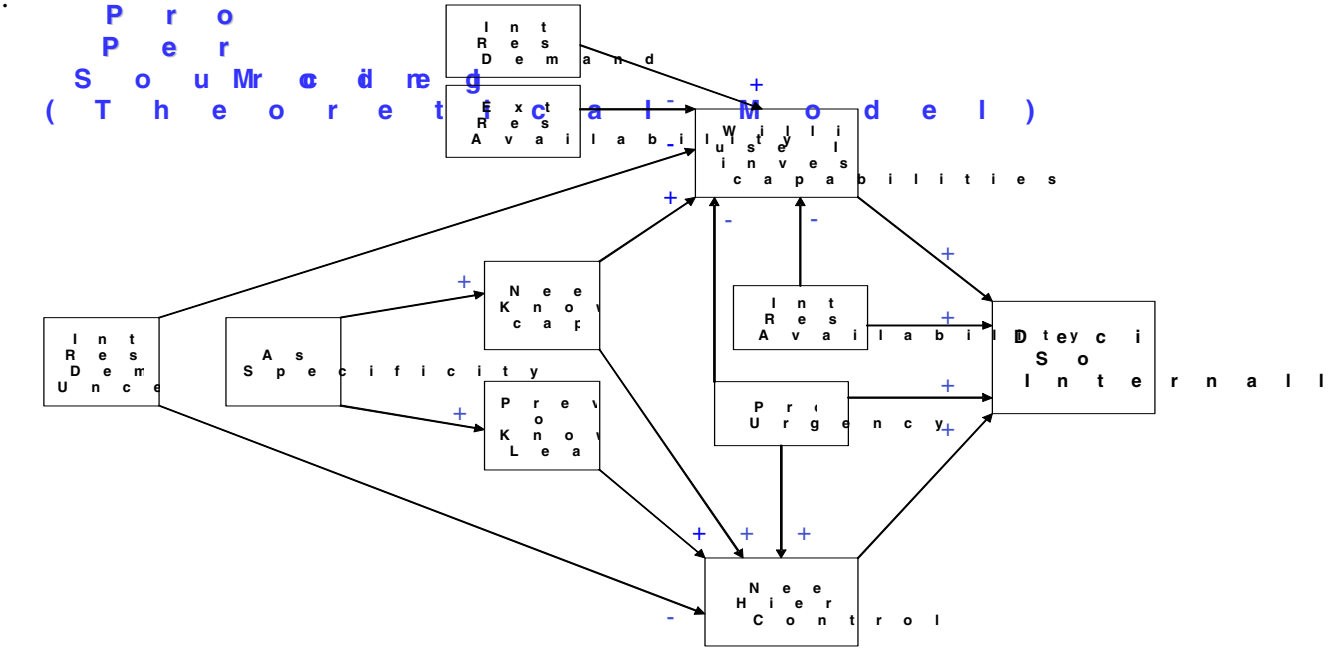
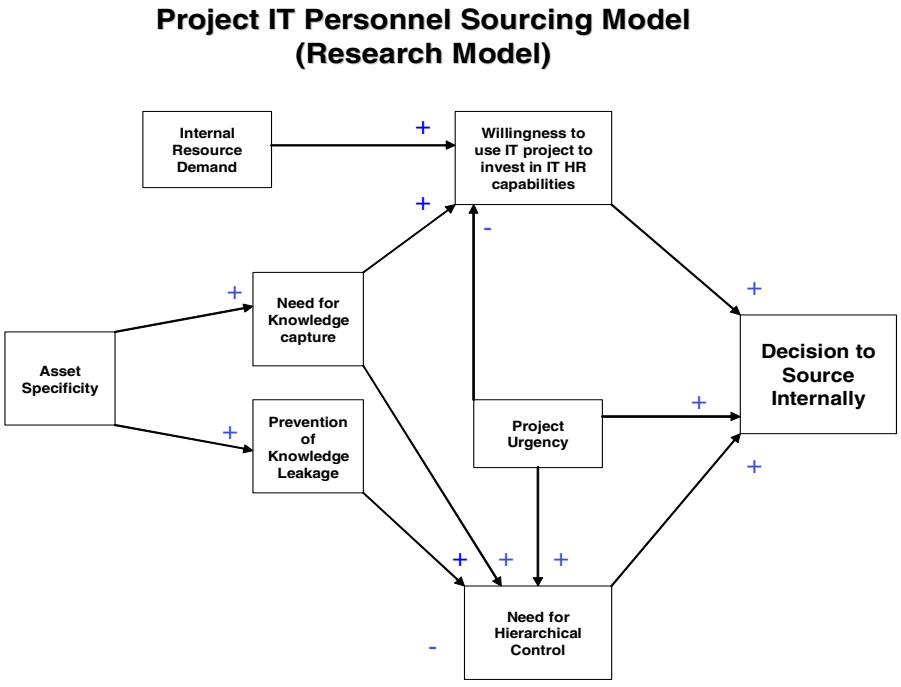
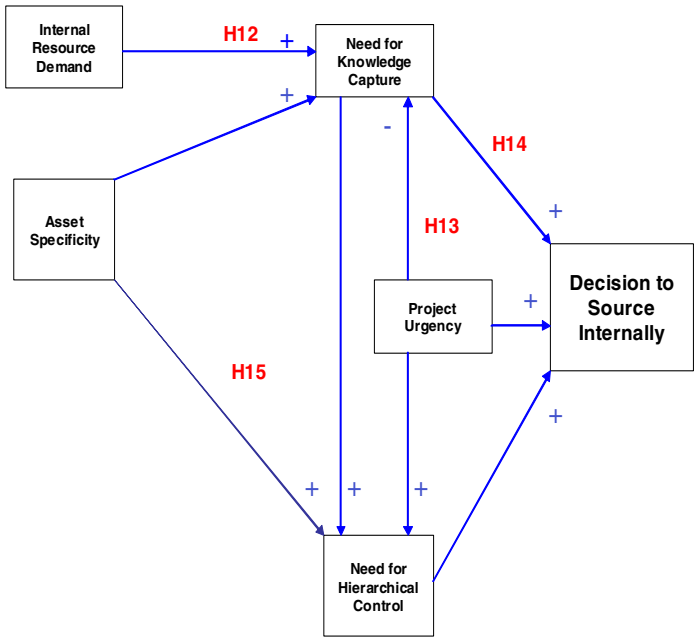


Figure 7.2 Research Model



The analysis of the data collected determined that the *willingness to use the IT project to invest in IT HR* and the *prevention of knowledge leakage* variables were not being captured correctly by the research instrument. This necessitated their removal from the model. Figure 7.3 represents the modified Project IT Personnel Sourcing Model v2.0, with the removal of the two variables in question.

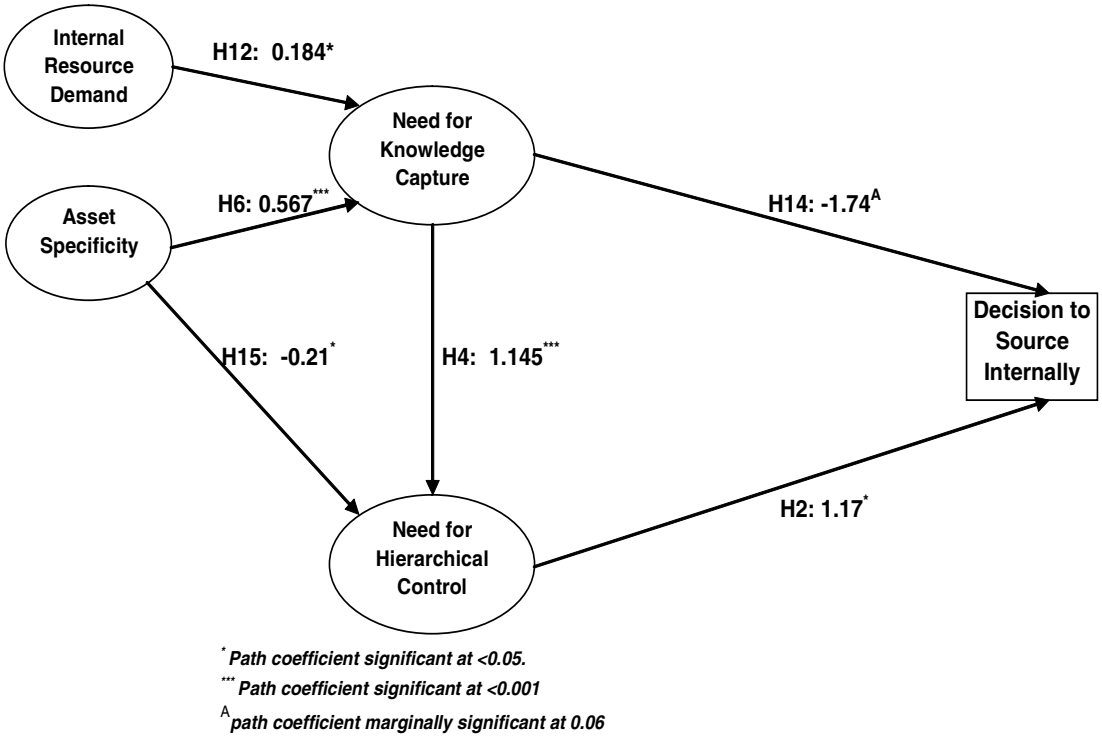
Figure 7.3 Modified Research Model
Project IT Personnel Sourcing Model v2.0



The initial analysis of the v2.0 model indicated some problematic results with the *project urgency* variable. It was determined that this variable was not being perceived in a consistent manner from post-data collection interviews with test subjects. The *project urgency* variable was then removed and a revised version of the

research model (see Figure 7.4) was tested. The revised model (v3.0) was found to be a stable model and a hypothesis testing was conducted with the v3.0 model.

Figure 7.4
Project IT Personnel Sourcing Model v3.0



The model that emerged centralized around the importance of knowledge in dealing with the IT project sourcing decision. The significant factors of *asset specificity, internal resource demand, need for hierarchical control,* and *need for knowledge capture* each reflect and aspect of knowledge in the sourcing decision model. The discussion that follows focuses on the Project IT Personnel Sourcing Model v3.0.

The factor of *asset specificity* deals with the issue of knowledge specificity and its application to the IT project in question. Projects that have high levels of asset

specificity involve a deeper understanding of an organization's inter-related systems (Thompson 1967). This high level of understanding is generally required for integrating the IT project system being developed (Kogut & Zander 1996). When high levels of asset specificity exist, organizations will want to control and capture the asset specific knowledge of interest. The results of the path analysis indicated significant effects from *asset specificity* to both the *need for knowledge capture* and the *need for hierarchical control.* In the context of an IT project, the results support the expectation that IT personnel resources that are regarded as highly asset specific in nature will create a need for the organization to want to retain the knowledge generated by the project. In order to retain this knowledge, the organization will want to capture this knowledge (*need for knowledge capture*) and control (*need for hierarchical control*) the application of this knowledge.

The second significant factor of *internal resource demand* focuses on the potential reuse and future need for the knowledge resource provided by the IT personnel in question (Reagans 2003). When high levels of internal demand for a particular knowledge resource exists, organizations tend to want to capture or retain the knowledge resource in demand. The results of the path between *internal resource demand* and *the need for knowledge capture* were significant and reflect the desire to capture knowledge for reuse. In the IT project sourcing context, the results support the notion that the expected reuse of key knowledge from a particular IT personnel resource will create a need to retain this knowledge.

The third factor of significance, the *need for hierarchal control,* arises from the desire to retain and control important knowledge assets for internal use (Nonaka & Takeuchi 1995; and Thompson 1967). Organizations typically have a strong desire to control key knowledge assets for competitive purposes (Nonaka 2001). Results from this factor indicated significant effects on the sourcing decision. The significant results support the notion that organizations will want to control and determine how key knowledge resources are to be applied to current and future IT projects.

The final variable of significance, the *need for knowledge capture,* represents the firms need to codify and capture important knowledge assets (Nonaka 2001). The results of this factor indicated significant effects on the *decision to source internally.* Though significant effects were found with the *need for knowledge capture* on the sourcing decision, they were contrary (in the opposite direction) to the expected results. The reasons for these contrary finding are discussed in the next section.

7.2 Implications of the "Need for Knowledge Capture" Results

This section discusses the implications that can be drawn from the results of the knowledge capture variable. First, discussions regarding design issues that have emerged in light of the *knowledge capture* results are presented. This is followed by a discussion of the significant yet contrary findings from the *knowledge capture* factor. are analyzed. Reasons for the contrary finding, along with their implications, are discussed in detail.

7.2.1 Research Design Issue(s)

The result of the knowledge capture variable may reflect a design issue with this research study. While the original conception of the research design presented the knowledge capture construct as a variable that needed to be considered for an IT project sourcing decision, the research design presented the knowledge capture variable after the sourcing decision process. The study was segmented into two distinct components; first was the presentation of a scenario upon which a sourcing decision is based and second, the use of a questionnaire.

The scenarios presented IT projects that indicated project urgency constraints, internal demand drivers, and asset specificity issues. Based on these factors, the respondents made an IT personnel sourcing decision. The factor of knowledge capture was not presented as part of the initial "sourcing decision process". Instead, knowledge capture was presented in the questionnaire portion of the study, after the scenarios and after the sourcing decision had been determined by the respondent.

Instead of considering the issue of knowledge capture as part of the sourcing decision, respondents were asked to consider knowledge capture after the sourcing decision had been made. It is probable that the contrary path results on knowledge capture reflect this design issue. Based on the current research design, knowledge capture is considered an ancillary-decision to the project sourcing decision. Two potential solutions to this issue are to either (1) incorporate the knowledge capture variable into the scenarios or (2) have respondents make the sourcing decision after the questionnaire has been completed.

The current research design does not match the proposed research model. One might say the research design's fit to the research model is "marginal" at best. Based on the current design, the knowledge capture variable may even be considered a dependent variable that is influenced by the sourcing decisions made (along with the *internal demand* and *asset specificity* constructs). The following section discusses the interpretation of the contrary knowledge capture results in light of the design limitations presented.

7.2.2 Knowledge Capture: What does it mean

The distinct finding on the *need for knowledge capture* clearly indicates the importance of retaining knowledge, but the negative result runs counter to the originally hypothesized notion that an internal sourcing decision helps facilitate the desire to capture and retain IT project knowledge. Based on the design limitation discussed in the previous section, the results stem from how the issue of knowledge capture is interpreted after a sourcing decision has been decided upon.

With an external sourcing decision, organizations have a desire to capture the knowledge prior to the termination of an IT project. This is attributed to the temporary nature of the external personnel resources as opposed to the internal personnel resource. The negative path coefficient result makes theoretical sense from an Internal Labor Market (ILM) theory perspective, as external employees are assumed to leave an organization upon a projects completion, thus taking with them

their IT project knowledge (Doeringer & Piore 1971). In order to prevent this expected knowledge loss, organizations will want to capture this knowledge.

The original conception of the knowledge capture construct was based on the knowledge based view (KBV), where external sourcing decisions would make sense when there is little or no need for knowledge capture (Nonaka 2001; Thompson 1967). Given the path results of this study, both KBV and ILM can be theoretically applied to knowledge capture, from different perspectives. When considering the sourcing decision, KBV potentially explains how knowledge capture can influence the sourcing decision. After making a sourcing decision, ILM theory appears to explain the results seen in this study. When project managers have decided on utilizing an external project resource, there appears to be a strong need to capture the knowledge these external personnel resources possess. In light of the results discussed in this section and in prior sections of Chapter 7, the following section will present suggestions drawn from these results.

7.3 Suggestions for Future Research & Practice

The following sections will present suggestions that can be drawn from this research study. First, the implications of the results and their meaning for practice are discussed. This is followed by suggestions for future research related to the IT personnel sourcing decision.

7.3.1 Suggestions for Practice

The main implications of this research study highlight the importance of knowledge assets. With modern organizations now concentrated on collective work efforts reflected through project teams (Lindgren et al. 2003), the need to capture the knowledge that emerges from project teams is crucial (Drucker 1998). The need for knowledge capture can be crucial with the highly-knowledge based work done on IT development efforts (Lindgren et al. 2003, and Starbuck 1992). The results from this study reflect the strong importance for knowledge retention and control.

Project managers dealing with IT development efforts need to be cognizant of the knowledge issues surrounding any projects they lead. Prior to the initiation of an IT project, project managers need to be aware of personnel who will utilize or possess key knowledge assets during the course of the development effort. When necessary, project managers should develop methods to monitor and retain these key knowledge assets. If effective plans for monitoring and retaining key knowledge assets are not in place, they can lead to the eventual loss of strategic knowledge assets which may potentially be detrimental to an organization.

7.3.2 Suggestions for Future Research

As with any research study, the results of this study are subject to certain limitations. First, the length of the instrumentation employed may have caused subject fatigue issues. While the results of the study showed significance in regards

to certain factors, this was only seen with the Group 1 data. With Group 2 data, results did not fall in line with the Group 1 findings, and attempts at confirming the theoretical research model with Group 2 data were unsuccessful. Subject fatigue may have been a major cause for this data inconsistency.

Two examples of post-data collection interviews state: (1) *"…just to let you know, I kind of answered the last set of questions a bit quickly at the end and didn't read them as carefully."* (2) *"I thought the second set of questions was tedious and repetitive."* From these comments, it would appear that subject fatigue may have contributed to the inability to utilize Group 2 data. In order to help minimize these effects in the future, a smaller and more concise research instrument will be required.

A second issue regarding the design of this study deals with the integrated scenario analysis, questionnaire methodology utilized. As discussed in section 7.2.1, it is important to carefully determine how the factors in a model are related prior to incorporating them into a mixed research design. Future utilization of the integrated vignette and questionnaire design approach will require careful consideration of how the constructs of interest are to be measured. In addition to these design suggestions, extensions to the current study may help shed more light on the IT personnel sourcing decision.

Potential extensions for future research can attempt to integrate the factors that were dropped from the initial research model. These factors include *willingness to utilize the IT project to develop IT HR, project urgency,* and *knowledge leakage.* While limitations with the current research instrument prevented an examination of

these variables, researchers such as Abdel-Hamid (1989) have pointed to the importance of time constraints and the need for utilizing IT projects as training domains. A number of impromptu post-test interviews also surfaced the additional factors of resource experience and resource quality which could also potentially impact the sourcing decision. These factors, and possibly some others, could further extend and refine the IT sourcing decision process.

Another extension considers issues of IT cost and size. While this study did not consider the effects of cost and size, variations in IT project budgets and IT project size may induce different sourcing decisions. Basili and Beane (1981) discuss the impacts of project size when considering the utilization of different models in determining personnel estimates for IT projects. The effects of project budgets have been seen in several studies that deal with predicting IT project costs (i.e. Gallagher 1994; Abdel-Hamid 1992; Whieldon 1982) based on project size and scope parameters. In these studies, the importance of cost issues is strongly emphasized. It would seem probable that size and cost constraints could potentially influence the IT personnel sourcing decision.

The duration and evolution of an IT project presents another consideration for extending the examination of the IT project sourcing decision. Abdel-Hamid (1989) and Basili and Beane (1981) discuss the need to employ different measurement models when changes occur during an IT development effort. As Abdel-Hamid points out in his study on IT project staffing (1992), the different stages during the life-cycle of an IT project require different considerations. These considerations can effect the

procurement and deployment of project staff resources (Abdel-Hamid 1989). The application of Abdel-Hamid and Basili and Beane's logic to the sourcing decision process makes practical sense. As this study only looks at the initial sourcing decision during the start of an IT project, studying the sourcing decision process over the course of a project's entire life-cycle will provide a more complex model that may present a more comprehensive view of the entire sourcing process. These proposed research extensions attempt to further enhance our understanding of the complexities surrounding the IT project sourcing decision.

7.4 Contributions

The main contributions of this dissertation center on the study's confirmation of the effects of the knowledge variables influencing the IT project sourcing decision and a better understanding of the IT personnel sourcing decision. Utilizing an integrated theoretical approach that drew from *internal labor market theory (ILM), knowledge based theory (KBV),* and *transaction cost economics (TCE),* the effects of *asset specificity, internal resource demand, need for hierarchical control,* and *need for knowledge capture* on the IT project sourcing decision were all found to be significant. While the current research model may not fully incorporate the design limitations discovered during the course of this study, the path analytic results of the model did confirm the expected effects of *asset specificity, internal resource demand, need for hierarchical control,* and *need for knowledge capture.*

Along with confirming the effects of the variables in the research model, this research study gives insight into the IT project sourcing phenomenon. Few studies have attempted to understand what factors drive the sourcing decision a project manager makes on IT project efforts. From this study, we were able to determine that knowledge and its various aspects are of major importance when considering the sourcing question. In sum, this research study presents a nascent view of the IT personnel sourcing decision and links the importance of retaining and capturing knowledge to the IT project sourcing decision. Future efforts in studying this decision process should attempt to refine a more complete understanding of the complexities involved in the IT personnel sourcing decision process.

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Appendix A. Interview Questions

IT Project Sourcing: Interview Guide
Focus at level of: Sr. Project Managers, Program Managers

1) Can you tell me a little bit about your professional experience?

   The intention of this question is to get a general sense of the subjects IT experience; possible work experiences on IT projects, roles played on IT projects.

2) In general, how would you characterize the nature of software development Activities within your organization?

   Trying to find out how software development (IT projects) fits into the context (social norms) of the organization that the subject is working for.

Please consider the following 2 scenarios:

SCENARIO 1
A firm has decided to initiate a significant IT project. After careful consideration of the issues surrounding the project, a decision has been made to staff the project, primarily with internal personnel.

SCENARIO 2
A firm has decided to initiate a significant IT project. After careful consideration of the issues surrounding the project, a decision has been made to staff the project, primarily with external personnel.

Now, based upon your experiences:

3) Please describe a significant IT project that was staffed primarily with internal personnel.
4) What were the issues and rationale behind the staffing decision that was reached in this project?

5) Please describe a significant IT project that was staffed primarily with external personnel.
6) What were the issues and rationale behind this staffing decision?

7) In looking back at the two situations (internal vs. external) you have described to me, were there any differences in how the decisions were reached? Did you consider different issues in regards to internal vs. external projects?

   With this set of questions, we are trying to get the subjects to describe an internally staffed IT project and an externally staffed IT project from their own experiences. We also want to see what issues and what rationale were used in reaching the internal vs. external staffing decision. The last

question is directed at probing for any differences that occurred in reaching an internal staff decision vs. an external staff decision (or vice versa).

Now, consider the following scenario:

SCENARIO 3
A firm has decided to initiate a significant IT project. After careful consideration of the issues surrounding the project, the appropriate staffing decision is believed to be staffing the project primarily with internal personnel. However, the final staffing decision that was made was to staff the project primarily with external personnel.

8) Have you ever experienced a similar situation? If so, could you please describe it and explain the rationale behind the decision(s)?

9) (If they don't mention it) Have you ever experienced a reverse situation, where external staffing was recommended or seemed appropriate, but internal staffing was utilized instead? If so, please explain?

This set of questions is intended to look into situations where one type of Staffing was desired or seemed appropriate but the reverse form of staffing occurred. Trying to get the subject to describe any similar experiences and why the situation occurred.

If the issues of strategic, core IT competencies, or resources are not mentioned during the subjects discussion of the various IT project types they've experienced, then bring them up through the following questions.

10a) You did not mention "strategic importance" as one of the key factors in determining how to staff the IT projects you've described to me, does it play a part in the staffing decision relative to the different projects you've described to me?

10b) How are you/your organization defining strategic importance? Can you give me an example of a strategically important IT project in your organization?

10c) You did not mention "IT core competencies" as one of the key factors in determining how to staff the IT projects you've described to me, does it play a part in the staffing decision relative to the different projects you've described to me?

10d) How are you/your organization defining IT core competency projects? Can you give me an example of an IT core competency project in your organization?

10e) You did not mention "IT resources" as one of the key factors in determining how to staff the IT projects you've described to me, does it play a part in the

staffing decision relative to the different projects you've described to me?

10f) When there are not enough internal resources (personnel) to staff an IT project appropriately what is usually done in your organization?

10g) What types of IT resources do you consider for the IT projects your organization works on? Examples?

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11) In general, how would you characterize the development of IT personnel within your organization?

This question attempts to get a general sense of the training methods the Subject's organization is using in enhancing the skills of their IT personnel.

12) What types of skills do you or your organization look to develop within your internal IT staff? How is this development achieved?

13) You mentioned [or did not mention] accessing external personnel on IT projects to gain access to new IT knowledge for your internal staff:

(IF not mentioned) Does your organization utilize external staffing resources to broaden their IT knowledge base? If yes, please describe this process to me.

14) *[assuming they mentioned the use of external staff]* What are the strategic objectives of your organization in establishing relationships with external sources (consulting firms, etc.) of IT personnel? What are you trying to achieve with this these relationships?

15) What are the considerations given towards hiring external personnel? Characteristics you (your organization) is looking for? Concerns?

The idea here is to see how they view the use of external personnel. Is this just a convenient means of getting IT personnel when needed or are there strategic implications behind these relationships. For example, using these relationships to hire external personnel with the possible intentions of keeping them on full-time, if they work out or using them are sources of new IT knowledge for the organization.

16) Are there any other issues about IT projects or IT project staffing that you'd like to discuss?

Appendix B: Interview Transcripts

Interview Subjects A & B

Background:
(L)Subject A: Hertz 5 years (PM on Business side, liaison between IT and the business) worked for Fleming 3.5 years (manager of project office: dealing with resource allocation).
(A)Subject B: Fleming (PM for 7 years, in UNIX support group moving over to project office, where met Lori) at Hertz now (PM of MIS group).

Scenario 1 (Internal staffing):
(L) One major project comes to mind, from Fleming, a project with K-Mart for $4.8-$4.5billion. It was a very large business contract. Because of that we had some very serious, serious, serious work to do……Ann was actually the project manager for this project.

(A) The project was all internally driven due to time constraints and the fact that we needed people to know our systems……We didn't have time to get outside developers up to speed on our systems.

(L) Something like 500 programs had to be drastically changed. It was I don't know…It was a sizable effort, similar to a Y2K effort: like having to go through every system for a Y2K project. Definitely a priority 1 project. It was an incentive project with target goals that had to be met.

(W) So the key reason for internal staffing was the fact that knowledge about the internal systems was key, due to time constraints?

(A) That's right. With the time constraints we needed people who knew our systems and we couldn't get outside developers up to speed with the cost and time constraints placed upon the project.

Scenario 2 (External staffing):
(tape very fuzzy) transcribed from notes:

Lori describes a project that Fleming had more external people on in a company in CA. due to the fact that the external people had more knowledge about the business processes and the existing systems within this CA company.

(A) Thing that comes to mind would be projects that deal with various software packages that we would purchase. In these instances, we would need a large contingent of external people to come in and install the package and help tailor it to integrate with our systems.

Scenario 3 (Internal to External staffing):

(L) Nothing really comes to mind. I can't really imagine that situation every occurring.
(A) Yeah, I don't see that every happening.

Strategic & Core:

Strategic importance:

(L) What we did at Fleming was gather all the projects at the project office that needed to be worked on, working with the CIO, who worked directly with the steering committee to prioritize projects based on strategic business initiatives. Making sure that the IT #1 project was the business #1 project.

We would make sure everyone working on a project knew what the priority was, and all the issue behind that.

When we staffed projects, we had staffing surveys that told us the skills and competencies of the people available. And we had tables one could query to find out if skills sets were available & whether or not people were available to work on the projects.

(A) I think that pretty much says how we did things at Fleming.

(W) You mentioned strategic importance as the way to look at projects, how does/did your organization define strategic importance & were projects prioritized based on strategic importance?

(L) At Fleming the way we would go about it was through the executive committee. At Fleming there were usually 4-5 strategic goals for the year and projects were aligned to those goals for the year and projects were approved by that executive committee.

(W) Examples?

(L) One was a Portal Project, where we needed to develop a portal for our customers to access on-line ordering. We were dealing with customer orders, fulfilling their needs, promotions, & everything. I think it was like a priority 3 project

(A) Yeah, the strategic committee would have to agree on the priorities of the projects. Members of the committee come from all areas of the company.

(L) Yeah, the CEO, CIO, and the Executive VP of each functional area of the company.

Core IT Competence (fuzzy partially from notes):

(L) We define it only as skill sets among our IT staff. Our most important valuable resource or asset. I would say the IT competency was the ability to be flexible, and adaptable, and the ability to learn.

Not Enough Internal Resources?

(L) Couple of factors, one would be (1) how important was the project (2) flexibility due to time. If there were time issues and there were skill set that we needed we would be willing to pay for external resources.
(A) Depending on how critical the project was we would free-up resources from other projects and if it was really necessary we would get the resources from external sources.

Personnel (training/straffing?) (fuzzy tape from notes)

(L & A) Just people who are willing to work and be flexible and adaptable are what we look for in our IT staff. There really isn't a specific skill set we are looking to develop but people are encouraged to learn new skills sets they think important or necessary.

(L) We just had a training, intensive, program with 5 new hires at Hertz. We brought them in and trained in classrooms, and also had them go out on hertz sites to train and learn about the systems that operate at the rental sites. But it is usually hard to schedule training since we are so busy. A lot of times we have rely on the project team to get people up to speed or standard.

(A) There is a lot of on the job training. We also have a mentoring program that pairs people together. Where one individual trains another. Usually on the job training that transfers the knowledge over. Now at Fleming there was more pressure to get the projects done, less time to train on the job, and at Hertz, projects tend to be longer term 2-3 years and mentor-training is possible.

(L) At Fleming in the development area, it was important to have people that knew coding and also business processes. They needed to talk to the people in the various departments or areas of the organizations. They had to be able to communicate effectively.

(W) Do you do this knowledge transfer with external hires?

(A) Yes, and we work together with this individually to get the knowledge transfer that we want from them.

Strategic Objectives of Organization with outsourcing relationships?

(L) We've had alliances with companies like CGI just help out in certain situations. Also when we use or buy packages, it is pretty rare that we would not use some of that company's proprietary knowledge or expertise to help us in integrating the system. However, we generally don't like to go outside of our control base in using external personnel.

Considerations in external hires concerns?
(L) Cost is always a factor, depending on the organization like hiring from IBM maybe more costly versus other firms. At Fleming we did utilize the external hire and look at them as potential people to bring in internally.

(A) Though there are some cost considerations that may occur. Some contracts stipulate penalties if we were to hire or take away their employees. So there is the penalty written into a number of these contracts that these external sources use to protect themselves.

Other issues
(L) I'm surprised that you didn't ask about turnover issues regarding projects. Turnover is one of the biggest problems with IT projects. With new personnel coming in there is the cost of getting them up to speed, delays in the project. A very big problem, especially, 3-4 years ago, when IT turnover was very high. People would get new jobs, and leave or members on teams would get fired, etc. Essentially, this just adds to the staffing dilemma as all that knowledge about the project, the business, etc. is lost when that person leaves.

Interview C
(Thursday 3/4 7pm-7:31pm: limited to 30 minutes by interviewee)

<u>Background:</u>
(S) Subject C: I'm actually; my degree is actually in computer science and agricultural economics, double degree I got that in OSU back in '85. I didn't realize I was doing project management for my entire career until 1997. Project management hadn't really been formalized until PMI came out & I started reading a number of articles. In '97 I made the career choice to do full-time project management. First 18

years of my career I did primarily IT decoding and technical work. I've done work ranging from coding up to managing: managing vendors, managing project teams of up to 75 folks and implementing systems in Oracle, UNIX, AS400, warehouse management systems, merchandising systems & also dealing with business transformations.

Nature of Software Development in Company
(S) CGI has a very formal framework, they call the CPMF (current project management framework) they give you a framework for performing project management. They give you tools, templates for assessing and doing project management. For every project, they require you to build a project plan, which as you know is more than just a Microsoft project plan. It is actually formulates how you are going to do your project, which includes your work plan. There is a very clear differentiation between your project and work plan. It's a very detailed plan. On a scale of 1 to 10 I'd put it at a 7 on the maturity model in regards to how well they do project management.

Scenario 1 (Internal staffing):
(S) From our work we very seldom do internal projects. We are a professional service organization. We do projects for clients. If you are talking about projects that we do for ourselves internally, we typically don't to that. If you are talking about projects for clients we've done several implementations for clients.

(W) Talk about projects, from your perspective, those you've done for clients.

(S) We've done several large projects where we have been responsible for most everything from beginning to end. We usually organize in teams. And within teams we further segment into smaller teams, where team leads have responsibilities for specific parts of the project. Typically, we have a technical architect engaged at the beginning of projects, a business architect engaged at the beginning, and a project manager. So we typically have this core of 3 on most projects.

The business architect is accountable for making sure that all the business requirements are correctly captured & usually it is this person who generally becomes the champion for the business requirements throughout the development cycle.

Conversely, the technical architect is accountable for making sure that the technology implemented fits within the parameters and specifications required by the client or stakeholder. In some cases the business requirements are at odds with the technical requirements.

Sometimes we manage project teams of people who are chiefly from the client, sometimes we manage vendors, who provide personnel resources as well.
I don't know if this gets towards answering your question(s).

(W) Actually, I think this is all interesting information. Why don't you describe projects where you've had primarily your own staff and another situation where you've had to utilize staffing sources outside your organization?

(S) Right, obviously in a perfect situation you would like to have everyone you need to use on a project on-hand. There are essentially 2 situations when we need to go outside: (1) when we need a skill-set that is missing, we obviously have to go outside to acquire this skill-set; (2) sometimes your stakeholders require that you use other additional vendors.
By definition of project, you will always have to have external people involved.

Scenario 3 (Internal to External staffing or reverse):

(S) No, that really goes to you building your project plan. You know what you need and where to get your personnel resources. I don't ever see this happening.

The only time a reverse has happened to us is when they've brought in a vendor to work with us, but the vendor doesn't work out and then they come to us and say "we will let you take over and finish the project". *(Primarily external at start but change to internal)*

Personnel (training/staffing?)
(S) They actually have a very comprehensive training programming and allocate budgets for this. There are 4 development tracks for people as well. Depending upon what you are interested in, you align yourself to the appropriate development tracks

(W) Concerns or issues with brining in new people?

(S) Sure, we are a consulting firm, so we look for people with lots of experience in the particular business skill we are interested in. We are looking for very senior level people also we look for people who are able to present themselves very well, speaks very well, able to interact well with people, excellent communications ability.

<u>Not Enough Internal Resources?</u>

(W) You mentioned earlier that you had to go to outside sources when you didn't possess the necessary skills. When you do go outside are there any strategic objectives in establishing or utilizing external sources?

(S) Probably not too comfortable about talking too much about this. Umm let me backup, tell me again what you are trying to do with your research project?

(W) I'm focusing in on IT project staffing issues……..as you've read in the e-mail Lori and I sent to you.

(S) Oh, I see now. I get quite a bit of e-mail every-day, don't assume I've read all my e-mail. I just thought that you were looking at project management from a more management & technical perspective. Well in that case just erase the answers I've given you during the beginning part of this conversation.

(S) The context of what you are interested in is why do we staff projects the way we do. I get that, ok. Well that's an easy answer. We are really a *projectized* organization. Which means that we have a pool of resources and we staff our projects based on the availability of the resources. We staff our projects based on current availability of resources, within our current staff base.

If we encounter projects where we don't have the necessary resources on staff or are not available, then we will go to outside resources to back-fill that.

One key thing about our type of organization is that we can't afford much bench-time. Another thing about us is that we really don't have a home, we go from project to project and if you don't have a project, you are in danger of being let go. That's just the definition of consulting.

That's why we have very lean staffing, we usually don't have over-staffing. Another thing about our organization is that we have 22,000 people world-wide, so we can pull resources from around if they are available and we need them. If there are resources we don't have in our current office, we can go outside of our office in the U.S. and Canada & around the world and access to additional resources.

Now, if that doesn't work we can pull from other firms that we do have relationships with but because we are such a large organization we can generally pull and find what we need internally.

As we grow our business, we make very deliberate choices, and given today's economy we try very hard to not have any bench time.

(W) Why don't we go back to the scenarios with the little time we have left and have you comment again, on any issues that you might have left out the first time.

(S) Right, typically we want to work with our own people since (A) they are a known quantity, we know what we are getting from these individuals and (B) you also give you self a higher-probability of success [from using people you've worked with before and are comfortable with]. That's why you do internal.

Very seldom, in the context of our work environment, do we have entirely internal people. Very often we work along with a clients business representatives and we will also have outside vendors, depending on the project. And you know, that's just the way it works.

(S) In regards to staffing priorities. It's a first come first served issue. So whatever projects come 1st, we staff that project with the best available resources.

OK thank-you for your time & I'd better let you get back to work.

Interview D (Tuesday 3/9 4:15pm-5:00pm)

Background:
(B) Subject D: I've been with HP since 1985, since coming on to HP I've started out in the technical ranks as a systems engineer, then technical consultant, and then project manager, and then now I'm a global program manager. I've come up through the technical support side of the house, into consulting through the outsourcing side of the business where I currently run a program management office in the outsourcing office. I have managed a number of large of projects for HP over the years, in several different industries; travel, state local government, banking, just kind of the gamut. Currently managing a PMO that has some oversight into the larger outsourcing deals we get into. And basically what we do is review the deals before they are put out to bid, then we review them again before the contract goes out the door to make sure they meet HP's corporate objectives. We make sure we bid on project's that hit our sweet sport, making sure they hit HP's profit and review objectives.

Nature of Software Development in Company
(B) "We" don't do a lot of software development activities. We do in some areas. HP services, kind of the umbrella organization for the organization I'm in has 3 components: consulting integration, managed services (group I work for), and customer services which is your break-fix organization.

On the consulting integration side, the tend to get into more software development but what they really do is go into a customer's organization and say "what do we need to do to provide you with the solution and if they entails providing you with some software, then they will bring some folks in". Typically that will be in a sub-contract type mode.
We do have some capability of doing that as a service to our customer, and sometimes that's done through some off-shore type services we have. Actually, we bought a company not too long ago, off-shore, that does a lot of that type work.

As far as the internal work we do for ourselves, we don't do a lot of software development activities internally. We actually use the same people we use for our

clients to do our own IT. In fact one of the real interesting things about how HP is setup for our own internal IT, is that we actually outsource our own IT department. Up until last year we were our own largest outsourcing client. If that makes sense, we outsource to ourselves. We are doing what's called in the industry as eating our own "dog food". We sell outsourcing services, but we are also selling it to ourselves. It's really good because it allows us to get some services our clients get, which are typically very, very good, and it also allows us to develop our own people.
Scenario 1 (Internal staffing):
(S) From our work we very seldom do internal projects. We are a professional service organization. We do projects for clients. If you are talking about projects that we do for ourselves internally, we typically don't to that. If you are talking about projects for clients we've done several implementations for clients.

(W) Talk about projects, from your perspective, those you've done for clients.

(S) We've done several large projects where we have been responsible for most everything from beginning to end. We usually organize in teams. And within teams we further segment into smaller teams, where team leads have responsibilities for specific parts of the project. Typically, we have a technical architect engaged at the beginning of projects, a business architect engaged at the beginning, and a project manager. So we typically have this core of 3 on most projects.

The business architect is accountable for making sure that all the business requirements are correctly captured & usually it is this person who generally becomes the champion for the business requirements throughout the development cycle.

Conversely, the technical architect is accountable for making sure that the technology implemented fits within the parameters and specifications required by the client or stakeholder. In some cases the business requirements are at odds with the technical requirements.

Sometimes we manage project teams of people who are chiefly from the client, sometimes we manage vendors, who provide personnel resources as well.
I don't know if this gets towards answering your question(s).

(W) Actually, I think this is all interesting information. Why don't you describe projects where you've had primarily your own staff and another situation where you've had to utilize staffing sources outside your organization?

(S) Right, obviously in a perfect situation you would like to have everyone you need to use on a project on-hand. There are essentially 2 situations when we need to go outside: (1) when we need a skill-set that is missing, we obviously have to go outside to acquire this skill-set; (2) sometimes your stakeholders require that you use other additional vendors.

By definition of project, you will always have to have external people involved.

Scenario 3 (Internal to External staffing or reverse):

(S) No, that really goes to you building your project plan. You know what you need and where to get your personnel resources. I don't ever see this happening.

The only time a reverse has happened to us is when they've brought in a vendor to work with us, but the vendor doesn't work out and then they come to us and say "we will let you take over and finish the project". *(Primarily external at start but change to internal)*

Personnel (training/staffing?)
(S) They actually have a very comprehensive training programming and allocate budgets for this. There are 4 development tracks for people as well. Depending upon what you are interested in, you align yourself to the appropriate development tracks

(W) Concerns or issues with brining in new people?

(S) Sure, we are a consulting firm, so we look for people with lots of experience in the particular business skill we are interested in. We are looking for very senior level people also we look for people who are able to present themselves very well, speaks very well, able to interact well with people, excellent communications ability.

Not Enough Internal Resources?

(W) You mentioned earlier that you had to go to outside sources when you didn't possess the necessary skills. When you do go outside are there any strategic objectives in establishing or utilizing external sources?

(S) Probably not too comfortable about talking too much about this. Umm let me backup, tell me again what you are trying to do with your research project?

(W) I'm focusing in on IT project staffing issues……..as you've read in the e-mail Lori and I sent to you.

(S) Oh, I see now. I get quite a bit of e-mail every-day, don't assume I've read all my e-mail. I just thought that you were looking at project management from a more management & technical perspective. Well in that case just erase the answers I've given you during the beginning part of this conversation.

(S) The context of what you are interested in is why do we staff projects the way we do. I get that, ok. Well that's an easy answer. We are really a *projectized* organization. Which means that we have a pool of resources and we staff our projects

based on the availability of the resources. We staff our projects based on current availability of resources, within our current staff base.

If we encounter projects where we don't have the necessary resources on staff or are not available, then we will go to outside resources to back-fill that.

One key thing about our type of organization is that we can't afford much bench-time. Another thing about us is that we really don't have a home, we go from project to project and if you don't have a project, you are in danger of being let go. That's just the definition of consulting.

That's why we have very lean staffing, we usually don't have over-staffing. Another thing about our organization is that we have 22,000 people world-wide, so we can pull resources from around if they are available and we need them. If there are resources we don't have in our current office, we can go outside of our office in the U.S. and Canada & around the world and access to additional resources.

Now, if that doesn't work we can pull from other firms that we do have relationships with but because we are such a large organization we can generally pull and find what we need internally.

As we grow our business, we make very deliberate choices, and given today's economy we try very hard to not have any bench time.

(W) Why don't we go back to the scenarios with the little time we have left and have you comment again, on any issues that you might have left out the first time.

(S) Right, typically we want to work with our own people since (A) they are a known quantity, we know what we are getting from these individuals and (B) you also give you self a higher-probability of success [from using people you've worked with before and are comfortable with]. That's why you do internal.

Very seldom, in the context of our work environment, do we have entirely internal people. Very often we work along with a clients business representatives and we will also have outside vendors, depending on the project. And you know, that's just the way it works.

(S) In regards to staffing priorities. It's a first come first served issue. So whatever projects come 1st, we staff that project with the best available resources.

OK thank-you for your time & I'd better let you get back to work.

Appendix C. The Scenarios

Introduction to Scenarios:

When completing this survey:

Imagine that you have recently joined a new firm as the project manager for a number of in-house systems development efforts. The firm has a staff of IT personnel that deal with in-house development efforts. On average, IT projects within the firm are given 6-month timeframes.

You will be presented a set of four IT Project Initialization scenarios. Please review each scenario carefully.

As the new Project Manager, it is your responsibility to consider how you want to staff an analyst/programmer IT personnel resource that can help your team deal with the project described in a particular scenario.

You can either staff this particular IT personnel resource with an internal employee from your firm's IT group (INTERNAL) or with an external contract employee from outside of your firm (EXTERNAL).

At the end of each scenario you will be asked to make a sourcing decision for the particular IT personnel resource. Please base your decision(s) strictly on the information provided in each scenario; the information and your decision for the first scenario have no bearing on the second scenario.

(Hi Asset Specificity / Hi Project Urgency / Hi Internal Demand)

Scenario 1: SALES & SUPPORT PROJECT 1 : SCOPE STATEMENT

PROJECT OBJECTIVE
- ➢ Major revision of the firm's Sales & Support system.

DELIVERABLES
- ✓ A fully functional Sales & Support System that can:
  - o Pull-up current, real-time customer information
  - o Display potential options that the current customer may wish to add to their existing contract(s)
  - o Provide an interactive set of screens detailing the various options offered by the firm

TECHNICAL REQUIREMENTS
- ✓ A strong understanding of the firm's current IT systems.
- ✓ The ability to integrate the new system with all the appropriate existing systems within the firm.
- ✓ A strong understanding of the various products and services offered by the firm.

LIMITATIONS AND DEADLINES
- ✓ The project must be delivered quickly and has been given a 3-month time-frame.
- ✓ The skills and capabilities needed to meet the technical requirements of this project are expected to be used extensively with some current and future IT projects.

(Hi Asset Specificity / Hi Project Urgency / Lo Internal Demand)

Scenario 2: SALES & SUPPORT PROJECT 2 : SCOPE STATEMENT

PROJECT OBJECTIVE
- ➢ Major revision of the firm's Sales & Support system.

DELIVERABLES
- ✓ A fully functional Sales & Support System that can:
  - o Pull-up current, real-time customer information
  - o Display potential options that the current customer may wish to add to their existing contract(s)
  - o Provide an interactive set of screens detailing the various options offered by the firm

TECHNICAL REQUIREMENTS
- ✓ A strong understanding of the firm's current IT systems.
- ✓ The ability to integrate the new system with all the appropriate existing systems within the firm.
- ✓ A strong understanding of the various products and services offered by the firm.

LIMITATIONS AND DEADLINES
- ✓ The project must be delivered quickly and has been given a 3-month time-frame.
- ✓ The firm currently has no IT projects in the foreseeable future that will require the skills and capabilities needed to meet the technical requirements of this project.

(Hi Asset Specificity / Lo Project Urgency / Hi Internal Demand)

Scenario 3: SALES & SUPPORT PROJECT 3 : SCOPE STATEMENT

PROJECT OBJECTIVE
- Major revision of the firm's Sales & Support system.

DELIVERABLES
- ✓ A fully functional Sales & Support System that can:
  - Pull-up current, real-time customer information
  - Display potential options that the current customer may wish to add to their existing contract(s)
  - Provide an interactive set of screens detailing the various options offered by the firm

TECHNICAL REQUIREMENTS
- ✓ A strong understanding of the firm's current IT systems.
- ✓ The ability to integrate the new system with all the appropriate existing systems within the firm.
- ✓ A strong understanding of the various products and services offered by the firm.

LIMITATIONS AND DEADLINES
- ✓ The project has been given an extended time-frame of 12-months for completion.
- ✓ The skills and capabilities needed to meet the technical requirements of this project are expected to be used extensively with some current and future IT projects.

(Hi Asset Specificity / Lo Project Urgency / Lo Internal Demand)

Scenario 4: SALES & SUPPORT PROJECT 4 : SCOPE STATEMENT

PROJECT OBJECTIVE
- Major revision of the firm's Sales & Support system.

DELIVERABLES
- ✓ A fully functional Sales & Support System that can:
  - Pull-up current, real-time customer information
  - Display potential options that the current customer may wish to add to their existing contract(s)
  - Provide an interactive set of screens detailing the various options offered by the firm

TECHNICAL REQUIREMENTS
- ✓ A strong understanding of the firm's current IT systems.
- ✓ The ability to integrate the new system with all the appropriate existing systems within the firm.
- ✓ A strong understanding of the various products and services offered by the firm.

LIMITATIONS AND DEADLINES
- ✓ The project has been given an extended time-frame of 12-months for completion.
- ✓ The firm currently has no IT projects in the foreseeable future that will require the skills and capabilities needed to meet the technical requirements of this project.

(Lo Asset Specificity / Lo Project Urgency / Lo Internal Demand)

Scenario 5: DATABASE PROJECT 1 : SCOPE STATEMENT

PROJECT OBJECTIVE
- To construct an off-site back-up database system for the firm.

DELIVERABLES
- ✓ A fully functional database system that can:
  - Act as a back-up to the firm's current DB system.
  - Store up to 200 terabytes of data

TECHNICAL REQUIREMENTS
- ✓ The ability to design a database system that can house 200 terabytes of information.
- ✓ The ability to bring-online the backup DB-system, within minutes of the current DB-system going down.
- ✓ The ability to design a database system that can be continuously updated.

LIMITATIONS AND DEADLINES
- ✓ The project has been given an extended time-frame of 12-months for completion.
- ✓ The firm currently has no IT projects in the foreseeable future that will require the skills and capabilities needed to meet the technical requirements of this project.

(Lo Asset Specificity / Hi Project Urgency / Hi Internal Demand)

Scenario 6: DATABASE PROJECT 2 : SCOPE STATEMENT

PROJECT OBJECTIVE
- To construct an off-site back-up database system for the firm.

DELIVERABLES
- ✓ A fully functional database system that can:
  - Act as a back-up to the firm's current DB system.
  - Store up to 200 terabytes of data

TECHNICAL REQUIREMENTS
- ✓ The ability to design a database system that can house 200 terabytes of information.
- ✓ The ability to bring-online the backup DB-system, within minutes of the current DB-system going down.
- ✓ The ability to design a database system that can be continuously updated.

LIMITATIONS AND DEADLINES
- ✓ The project must be delivered quickly and has been given a 3-month time-frame.
- ✓ The skills and capabilities needed to meet the technical requirements of this project are expected to be used extensively with some current and future IT projects.

(Lo Asset Specificity / Lo Project Urgency / Hi Internal Demand)

Scenario 7: DATABASE PROJECT 3 : SCOPE STATEMENT

PROJECT OBJECTIVE
- To construct an off-site back-up database system for the firm.

DELIVERABLES
- ✓ A fully functional database system that can:
  - Act as a back-up to the firm's current DB system.
  - Store up to 200 terabytes of data

TECHNICAL REQUIREMENTS
- ✓ The ability to design a database system that can house 200 terabytes of information.
- ✓ The ability to bring-online the backup DB-system, within minutes of the current DB-system going down.
- ✓ The ability to design a database system that can be continuously updated.

LIMITATIONS AND DEADLINES
- ✓ The project has been given an extended time-frame of 12-months for completion.
- ✓ The skills and capabilities needed to meet the technical requirements of this project are expected to be used extensively with some current and future IT projects.

(Lo Asset Specificity / Hi Project Urgency / Lo Internal Demand)

Scenario 8: DATABASE PROJECT 4 : SCOPE STATEMENT

PROJECT OBJECTIVE
- To construct an off-site back-up database system for the firm.

DELIVERABLES
- ✓ A fully functional database system that can:
  - Act as a back-up to the firm's current DB system.
  - Store up to 200 terabytes of data

TECHNICAL REQUIREMENTS
- ✓ The ability to design a database system that can house 200 terabytes of information.
- ✓ The ability to bring-online the backup DB-system, within minutes of the current DB-system going down.
- ✓ The ability to design a database system that can be continuously updated.

LIMITATIONS AND DEADLINES
- ✓ The project must be delivered quickly and has been given a 3-month time-frame.
- ✓ The firm currently has no IT projects in the foreseeable future that will require the skills and capabilities needed to meet the technical requirements of this project.

Appendix D. The Questionnaire Items

Manipulation Checks:

(Project Urgency = 1-3; Internal Resource Demand = 4-6; Asset Specificity = 7-9)

1. The firm would like the project to be completed as quickly as possible.

2. The timeframe given for the project creates pressure to complete the project as quickly as possible.

3. There is a sense of urgency associated with the completion of the project.

4. The abilities of the IT personnel on the project are highly likely to be required on future IT projects.

5. There is likely to be strong demand, from other IT projects, for the abilities of the IT personnel required on the project.

6. The IT personnel needed for the project will have skills that will be useful on other future IT projects.

7. It is necessary for team members working on PROJECT A to understand how the system being developed will integrate with the firm's business processes

8. The nature of the project requires that team members have a thorough understanding of the firm's business processes.

9. Knowledge of the firm's business processes and their related systems will be necessary to the IT personnel working on the project.

Hierarchical Control:

(Opportunism issues = 10-12; Employee loyalty & Identifying with firm = 13-15)

10. The firm needs to take strong measures to ensure that the personnel working on the project conform to the firm's culture and norms.

11. The firm might bear substantial risk if the team members working on the project behave inappropriately.

12. The project requires close oversight by the firm in order to reinforce the need for team personnel, to act appropriately on the project.

13. It would be very advantageous if all the personnel working on the project felt a strong sense of belonging to the firm.

14. Instilling a strong sense of belonging to the organization will give the firm stronger control over the project personnel.

15. It is crucial to instill a strong sense of loyalty to the firm on the part of the personnel working on the project.

Knowledge Capture:

16. It is essential that the knowledge to be gained by project members, from working on the project, be captured so it may be applied to future development efforts within the firm.

17. It is important that the knowledge gained by project members, from working on the project, can be transferred or be captured in a form such that it can be retained within the firm.

18. The experiences and understanding gained by project members, from working on the project, needs to be retained for competitive purposes.

19. It is important that the firm capture the knowledge gained by project members while completing the project.

20. It is crucial that the experiences gained by project members, from working on the project, be communicated to other personnel within the firm.

Knowledge Protection:

21. The firm must restrict the flow of information about the project to individuals not employed by the firm.

22. The sensitivity of the project compels the firm to prevent the knowledge gained by project members from flowing outside the firm.

23. The firm must adopt stringent policies and procedures for protecting the knowledge gained by project members from the project.

24. Due to the nature of the project, the firm must restrict the access, of individuals not employed by the firm, to the knowledge gained by project members.

25. The organization needs to protect the knowledge, gained through working on the project, from being acquired by other organizations'.

Willingness to Use IT Project to Invest in IT HR Capabilities:

26. Committing the project as a platform for developing the skills and abilities of project team members working on the project is very appropriate.

27. The desirability to train the individuals working on the project can be accommodated within the scope of the project.

28. Providing training to team members while they work on the project is feasible.

29. The additional cost and effort required to develop team members working on the project is acceptable.

30. The inclusion of additional training activities during the development of the project is practical.

Appendix E. Modifications to Scenario & Questionnaire Design

Changes to Scenarios (Vignettes)

1. The vignettes designation has been changed to "scenarios" to keep things simple. Several subjects commented on the dislike of the word "vignette".
2. Phrasing that detailed setting-up an encryption system for the database has been removed. Respondents felt the encryption system signaled a project that had highly sensitive information. This was counter to the intended use of the *database project scenarios* as unimportant development efforts.
3. The various sections of the vignettes (Deliverables, Technical Requirements, and Limitations and Deadlines) have been balanced for both the database development and sales & support development projects.
4. To add a little more background regarding the organization and help clarify the project urgency manipulation, the "Project Scenarios" section has been slightly expanded to include some information regarding IT project development within the organization.

Changes to Questionnaire

5. On manipulation checks, question 7 has been reworded to state "business processes" as opposed to "business infrastructure".
6. To help clarify the project urgency manipulation, additional information and background have been added to the scenarios.
7. Question 20 (no longer in Appendix D.) about training has been dropped. Factor analysis results indicated the item did not load with it's related items. Further examination of the question revealed the context of the question did not matc the the other questions relating to the same construct.
8. Knowledge capture and knowledge leakage questions have been reworded to reflect the level of importance attributed to a project. Respondents indicated they did not feel the questions did not directly address issues regarding project importance.