Framing the Domains of IT Management

Projecting the Future . . .
. . . Through the Past

(www.pinnaflex.com/framing)

Edited By
ROBERT W. ZMUD
Michael F. Price Chair of MIS
University of Oklahoma

PINN/FLEX

The Missing Context of Information Technology Personnel: A Review and Future Directions for Research

Soon Ang and Sandra A. Slaughter

In an era of global competition, turbulent markets. and demand for high-quality products at low cost and short cycle times, organizations depend more than ever on information technology (IT). The irony is that effectively designing and deploying IT depends not only on the technology per se but also on the *people* who develop and work directly with it. In this environment, a highly skilled, adaptable IT staff becomes an important asset in the successful exploitation of IT (Clark et al., 1997; Feeny & Wilcocks, 1998). Attracting, developing, and retaining highly competent and motivated IT personnel are thus critical managerial imperatives for the success of any organization that wants to leverage IT. It is no surprise that effectively managing IT human resources has consistently been rated as one of the most important issues in the management of the IT function (Brancheau, Janz, & Wetherbe, 1996).

Since the introduction of IT into the workplace in the 1960s, the world of work for an IT professional has changed dramatically. In the past, developers and maintainers could base a career on their knowledge of COBOL, IMS, and other IBM mainframe tools and systems. Today, however, the primary role of IT professionals

in organizations is to solve business problems and address business opportunities through IT (Ross, Beath, & Goodhue, 1996). IT personnel must be knowledgeable in a range of hardware and software technologies, from mainframe to client-server to Web-based technologies. In addition, the software development process has changed dramatically from customized development of information systems to commercial off-the-shelf assembly and integration of software packages and components. Increasingly, software development is outsourced to consulting firms, independent contractors, vendors, and offshore companies. Thus, the critical skills and competencies of IT personnel as well as human resource management practices are constantly evolving. As a result, the study of IT personnel offers new and exciting opportunities and challenges for research.

In this chapter, we review the major themes of research on IT personnel to date and identify new dynamics and features that are emerging as important issues. Specifically, we find that IT personnel research has focused exclusively on the individual. We describe the disadvantages of this paradigm and assert the importance of anchoring research on IT personnel in the context in which the work is being done. We identify the different aspects of the domain of managing IT personnel in context, drawing upon relevant theoretical perspectives based in economics, management, sociology, and psychology, and conclude by providing an integrative model for IT personnel research.

PRIOR RESEARCH IN IT PERSONNEL

Prior research in IT personnel can be classified into three broad themes: (1) knowledge and skills taxonomies for IT professionals, (2) IT jobs and roles, and (3) IT professionals' career orientations and career pathing (Table 16.1).

Prior work has focused on motivation and quality of work life for IT professionals, in particular IT development professionals such as programmers and analysts. Very little research has focused on IT professionals in IT infrastructure jobs such as computer operators and technical specialists (database administrators, network specialists, etc.). Furthermore, prior work has focused on job satisfaction and turnover as primary outcome variables. Other key personnel-related variables such as individual performance and compensation are sorely missing. Although there have been studies that offer taxonomies of knowledge and skills of IT professionals, relatively little research has been done to systematically link knowledge and skills to topics such as attitudes, behaviors, performance, and IT careers.

As we accumulate more knowledge about internal IT careers, empirical research on external careers is needed. With the exception of Kaiser's study on data processing career paths in the early 1980s (Kaiser, 1983), we have not found recent studies of external careers in IT. Given the myriad and evolving roles and jobs in IT, it is unclear whether there are prototypical career paths in IT, and, if so, what these career paths may be. Thus far, the focus of prior research has been on careers of IT professionals who primarily reside in the IT user organization because that is the context in which many IT professionals are hired. However, with the rapid emergence of a vibrant IT industry in numerous parts of the world, many IT professionals are employed by new IT firms. Whether the knowledge and skill sets, motivations,

TABLE 16.1 Themes in Prior Research of IT Personnel

	Research Objective(s)	Representative Studies	Theory Base(s)	Methodology	Key Findings
Theme 1 Knowledge and skills for IT professionals	Identifying skills and knowledge requirements of IT professionals			Varied	Trend toward broadening of skill sets for IT professionals (technical, business, and managerial skills required)
		Benbasat et al., 1980 Cheney and Lyons, 1980 Green, 1989 Nelson, 1991 Leitheiser, 1992 Lee et al., 1995		Large-scale surveys	
		Feeny and Wilcocks, 1998 Rockart et al., 1996		Intensive case studies based on interviews and observation	
		Todd et al., 1995		Analysis of Secondary data (job ads)	
Theme 2 Jobs and roles of IT professionals	Ascertaining the motivating and demotivating aspects of IT jobs Linking perceptions of IT jobs to behaviors		Varied	Surveys	Varied
		Couger et al., 1979 Khalil et al., 1997 Burn et al., 1994	Job characteristics model (Hackman and Oldham, 1979)		IT professionals have high growth need strength, high need for achievement, low social needs
		Goldstein and Rockart, 1984 Baroudi, 1985 Igbaria and Greenhaus, 1992 Igbaria et al., 1994 Guimaraes and Igbaria, 1993 Igbaria, 1993	Role theory (Rizzo et al., 1970)		IT professionals intend to turn over when there are high role stressors (conflict and ambiguity) in a job
		McLean et al., 1991 Smits et al., 1993	Needs-based theories of motivation (McClelland, 1961)		IT professionals prefer jobs with high creativity, challenge, autonomy, and feedback
		Ferratt and Short, 1988 Ferratt and Short, 1986 Bartol and Martin, 1982			IT professionals do not appear to be significantly different than other professionals

TABLE 16.1 *(continued)*

	Research Objective(s)	Representative Studies	Theory Base(s)	Methodology	Key Findings
Theme 3 Careers of IT professionals	Understanding the internal careers (cognitive and affective attitudes toward job experiences within an organization) of IT professionals Understanding the external careers (career pathing and advancement) in the IT profession		Varied	Large-scale surveys	Varied
		Ginzberg and Baroudi, 1988 Igbaria et al., 1991 Crepeau et al., 1992	Career anchors and orientations (Schein, 1985)		Dominant career orientations for IT professionals include managerial content and technical content; IT professionals with mismatch between job type and career orientation are less satisfied
		Ginzberg and Baroudi, 1988 Loh et al., 1995	Career development (Van Manaan and Schein, 1977)		IT professionals with mismatch between career advancement prospects and career orientation are less satisfied
		Smits et al., 1993 Baroudi and Igbaria, 1995 Igbaria and Wormley, 1995			Race and gender impact the career progression of IT professionals

and career paths of IT professionals in IT firms are similar to those in IT user organizations is an open research question.

A final pattern we have detected in prior research on IT personnel is that it has almost exclusively focused on the individual as the unit of analysis. That is, research has examined the influence of individual factors such as demographic differences in gender, race, and age, drawing upon theories from cognitive, organizational, and social psychology to explain the attitudes, behaviors, and performance of IT professionals. Very little research on IT professionals examines the effects of team, organization, industry, and labor market factors.

By ignoring the external environment and the broader context in which individuals function, research in IT personnel encounters a series of dilemmas. One problem is that the focus on individual factors could mistakenly lead to the conclusion that the variance in the behaviors and performance of IT personnel is due primarily to unique individual differences while environmental factors or an interaction between environmental and individual factors may actually explain much of the variance. Furthermore, individual factors are often unpredictable, idiosyncratic, or outside of the influence of organizations, which makes it difficult to link findings to human resource practices. Finally, neglecting the external environment in explaining the responses of individuals is problematic because employees have attachments and relationships not only to their employer's organization but also to the labor market outside those organizations. In fact, labor market developments and organizational practices that buffer labor market pressures may influence a wide range of employee behaviors within organizations.

To embrace the context in IT personnel research, the field must expand its disciplinary roots beyond psychology. Specifically, a focus should be on developing theories that identify relationships between organizational characteristics and individual responses (Jackson & Schuler, 1995). These relationships constitute a *mesoscopic* (Cappelli & Sherer, 1991) or intermediate level of analysis between traditional macro- and micro-level research. We propose in this chapter that understanding the role(s) an IT professional plays in his or her context is the key to a meso-level analysis of IT personnel research. Thus, while prior research has revealed many important, valuable, and intriguing findings about individual characteristics of IT personnel, our understanding of the behaviors and performance of IT personnel will be greatly enhanced with an explicit focus on the varied roles IT personnel play in different contexts.

UNDERSTANDING IT PERSONNEL IN CONTEXT

The term *context* refers to the environmental or situational surroundings associated with a particular phenomenon that help to illuminate it. These surroundings are typically factors associated with units of analysis above those expressly under investigation. For IT personnel research, the contexts in which IT professionals are embedded can be viewed as layers (Figure 16.1), with each layer representing a higher level of analysis including the organization and the external environment. In the following parts of this section, we identify important factors in the external and internal contexts that impact IT personnel research.

FIGURE 16.1   A
Contextual Perspective
of IT Professionals
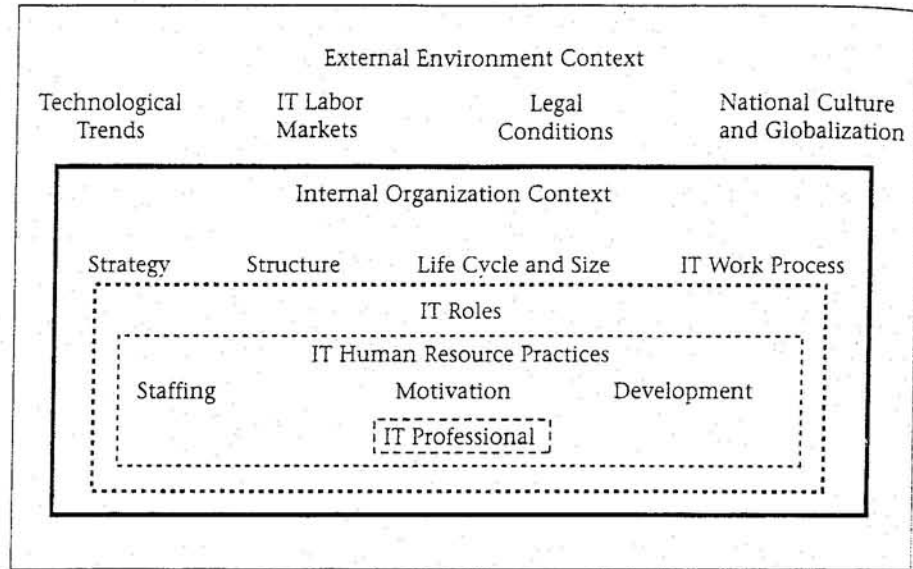
IMPORTANT ELEMENTS OF THE EXTERNAL CONTEXT

As depicted in Figure 16.1, relevant dimensions of the external context for IT professionals include technological trends, labor market conditions, laws and regulations, and national culture and globalization.

Technological Trends

A critical aspect of the external environment that is unique in its impact on IT professionals is the rapid evolution of information technology. New competence-destroying information technologies constantly emerge, and these technologies often have an extremely limited shelf life (sometimes less than a year). This means that, in contrast to other professions in which individuals' competence increases over time with experience, the technical competencies and skills of IT professionals erode quickly in terms of relevance and value.

Furthermore, the relevant skill sets for IT professionals have changed dramatically in ways that are often discontinuous with the past. To illustrate, the software development paradigm and relevant skills have shifted from custom in-house development of mainframe-centric information systems in the 1960s and 1970s to assembly of reusable software objects and packages that are purchased from IT vendors and integrated into complex, distributed IT architectures.[1]

Labor Market Conditions

Employment levels (the demand for labor relative to the supply) impact firms' abilities to attract and retain workers. The widespread infiltration of IT within organizations

and the transformation to a knowledge-based economy have created unprecedented and robust demand for workers highly skilled in the use of IT. According to the Information Technology Association of America (ITAA), the labor shortage for IT workers has become a crisis. A report by the ITAA (1998) estimated the shortage of software development professionals in the United States at 346,000 jobs, representing a 10% gap between supply and demand. Rubin further estimated that the U.S. gap alone will grow to about 1 million by 2002 (see www.hrubin.com). The severe supply-demand imbalance in the IT labor market is likely to have a strong influence on IT compensation, turnover patterns, career paths. and other human issues. For example, innovative recruiting and retention strategies may be needed to attract new IT personnel and retain incumbents, given the dramatic IT labor shortages.

In addition to severe worker shortages, the nature of the IT labor market itself varies in different contexts and geographical regions. This suggests that human resource strategies may need to be customized to fit the characteristics of IT labor markets in different regions. In addition, more and more IT professionals are employed by IT firms rather than by IT user organizations. Labor markets for IT firms may be very different from more traditional employment markets. For example, Saxenian (1996) showed that Silicon Valley represents the epitome of an open labor market. and the corresponding career paths in this market are the antithesis of traditional corporate job ladders.

Legal Environments

Almost all aspects of IT personnel are affected by the legal and regulatory environment. Two legal aspects in particular are likely to affect the management of IT professionals: professional liability for defects in the technology as IT becomes more pervasive and the definition of "employee" with the greater adoption of IT outsourcing by firms.

As IT becomes an integral part of organizations and society, defects in information systems can have serious and wide-ranging consequences. IT professionals and their employing firms can be sued not only for breach of contract in system delivery but also for torts of strict product liability and negligence that can arise from poor testing of systems, inadequate warning, or failure to use state-of-the-art technology. For example, see Brannigan and Dayhoff (1981) regarding liability for personal injuries caused by defective medical computer programs and Hagendorf (1990) for errors in computer advisory programs. The fallout from Y2K may yet trigger lawsuits against IT professionals and companies who are responsible for creating and maintaining the systems (Kappelman, 1999).

As outsourcing becomes a common practice in organizations, a number of legal issues that impact the management of IT professionals surface. The legal literature identifies several problems relating to defining the employment status of the professional as either employee or independent contractor (Nimmer, 1985; Reed, 1990). The most common type of IT employment disputes concern restraint of trade (Ang & Endeshaw, 1997). *Restraint of trade* relates to the degree of permitted use of information and skills acquired during the engagement with the employer both during the terms of employment and afterward. Developing software is a highly tacit endeavor. Knowledge about the software developed resides in the heads of software

developers and is seldom explicitly codified. Often, the distinction between skills and knowledge acquired on the job, which professionals are allowed to use for their own purposes, and the proprietary information that they will have to leave behind for the employer is blurred.

Consequently, employers are keen to protect the information generated with the resources they provide the employee or independent contractor by prohibiting any kind of leakage to competitors, including situations in which employees set themselves up independently in the line of activity of the employer. Whether the employers get their way in prohibiting competition and for how long or to what extent has been contested repeatedly. Courts have had to settle these issues by reference to law and public policy. The need to allow skills acquired while under contractual engagements with employers to be transferred to other settings has constantly pushed back the employer's urge to prohibit and constrain contracting parties.

Another IT employment dispute concerns the status of the employee. With increases in the number of contingent IT workers in firms, the importance of effective human resource practices for managing contingent workers as well as permanent workers is highlighted. Of particular concern are the status of hired contract IT professionals and the corresponding rights and obligations they have vis-à-vis the employer and the obligations of the employer by law such as in paying benefits to the professional. The traditional legal test concerning the existence of control or supervision by the employer over the contracting party has increasingly become irrelevant since technology has made the test redundant or irrelevant. The compensation that employers have to pay to permanent workers versus contingent workers, particularly in the form of stock options in the case of IT, has also become a bone of contention, linked as it is with the status of the professional.

National Culture and Globalization

According to Carmel (1999), two important trends increase the importance of national culture and globalization in the external context for managing IT professionals. First is the transition of software development away from the traditional co-located form to global software teams working on the same IT project that collaborate across national borders. Second is the spread of software development activities to newly industrialized and developing nations (Apte & Mason, 1995; Jones, 1994). Part of the motivation for the move across national boundaries is that as IT labor shortages intensify, companies want to scout for the best IT talent regardless of geographic location.

The challenge of managing global software teams or hiring IT professionals from different cultures is that cultural differences affect the work behaviors and performance of individuals in culturally diverse teams and organizations (Kumar & Bjorn-Andersen, 1990). Depending on the diversity of the nationalities and cultures of IT professionals, individuals can differ on dimensions of power distance (attitudes toward hierarchy); individualism versus collectivism (concepts of independent versus interdependent self); risk or uncertainty avoidance; long- versus short-term orientation or Confucian dynamism; and high versus low communication contexts (Hall, 1976; Hampden-Turnver & Trompenaars, 1993; Hofstede, 1991). Such cultural differences may present unusual or unforeseen difficulties in managing IT professionals.

IMPORTANT ELEMENTS OF THE INTERNAL CONTEXT

As shown in Figure 16.1, several factors in the internal environment are salient for IT professionals: organization strategy, structure, life cycle and size, and the IT work process.

Organization Strategy

Strategy is a plan of action for investing resources to develop core competences to achieve long-term goals and objectives. Organizations develop strategies to increase the value they can create for their stakeholders. Both business strategy and IT strategy have implications for the management of IT professionals.

There are many ways of characterizing business strategies. One of the most popular typologies for business strategy is that proposed by Miles and Snow (1978, 1984). They classified organizations as defenders, prospectors, or analyzers. *Defenders* strive to retain market share and position in a stable environment in which firm-specific and deep functional knowledge is required to be competitive. *Prospectors* actively seek to grow by searching for new products and markets. *Analyzers* seek to grow by developing new products internally rather than creating new markets. The business strategy followed by the organization has implications for the flow of its IT human resources. For example, for defenders, deep functional expertise is required to be competitive. Thus, organizations following this strategy focus more on development than recruitment of human resources. In contrast, prospectors focus more on recruitment than development of human resources as they seek to expand into new products and markets.

The objective of IT strategy is to define a plan for the use of IT to achieve or sustain competitive advantage.[2] Specifically, firms create strategies for their IT infrastructure: their portfolio of hardware, software, electronically stored data, and telecommunications. In their groundbreaking research IT infrastructure strategy across 75 firms in nine different countries, Weill and Broadbent (1998) identify four IT strategy types: none, utility, dependent, and enabling. The *none* approach is characterized by firms that have no firmwide IT infrastructure. In the *utility* view, there is a firmwide IT infrastructure; however, IT is not a strategic resource but a utility service run at the lowest cost. In the *dependent* strategy, IT strategy is derived from the current business strategy. In the *enabling* strategy, IT *defines* the business strategy: IT is a core competence and creates strategic options for the firm. The IT strategy impacts the IT human resource strategy. For example, IT professionals in firms with a utility IT strategy are likely to find limited opportunities for promotion and career development because the focus is on cost containment through consolidating data centers and standardizing systems. These firms may find it difficult to attract and retain qualified IT professionals.

Organization Structure

Organization structure describes the allocation of tasks and responsibilities and the linkages and interdependencies between individuals and departments. It designates the nature and means of formal reporting relationships as well as the groupings of individuals within the organization. The impact of organizational structures on the management of IT personnel is particularly salient with the advent of innovative organizational forms.

An ongoing debate ever since the introduction of IT into organizations is where to locate the IT function. In the 1960s and 1970s, organizations achieved economies of scale by centralizing computing resources. In the 1980s, computing resources were decentralized and distributed within organizations in an effort to improve the relevance of IT for end users. Both centralization and decentralization approaches have advantages and disadvantages (Tavakolian, 1991); in the 1990s and beyond, the focus in the organizational design for IT is how to balance achieving economies of scale from centralization while also achieving relevance from a distributed approach. Where the IT function is located in organizations has implications for the management of IT personnel. For example, IT jobs in firms pursuing a centralized approach are likely to require very different skill sets than IT jobs in firms pursuing a decentralized approach.

Innovative organizational forms (such as cross-functional teams, matrix organizations, virtual organizations, and divisionalizing IT) impact the allocation of decision rights, roles, and responsibilities for IT professionals. This can affect motivation, incentives, and performance appraisal. For example, divisionalized firms (the IT subsidiary form) are more likely to emphasize results over process than those structured around functional departments, reflecting greater integration across units and a more externally oriented focus.

Organization Life Cycle and Size

Organizations vary in size and traverse through a number of developmental stages. As firms change, their managerial priorities are likely to change and will in turn have implications for IT human resource management. Similar to other entities, organizations progress through various development stages such as start-up, growth, maturity, and decline (Baird & Meshoulam, 1988). The kind of IT human resources needed in each stage may be quite different. For example, CIO positions in IT start-up firms may require very different skill sets and managerial styles than CIO positions in mature IT firms. Performance assessment criteria may also be quite different for IT professionals in firms that are in different stages of the life cycle. From a human resource strategy perspective, start-up firms may emphasize recruitment and selection while mature firms may emphasize development and retention strategies.

Firm size is also likely to have a significant impact on IT personnel. Larger organizations have the resources and can achieve economies of scale from implementing more sophisticated human resource practices. Thus, the scale and scope of IT human resource practices are likely to vary with organization size. IT professionals in large firms are likely to be compensated more and have greater opportunities for training and development due to more highly developed internal labor markets in large firms. On the other hand, smaller organizations may need to adopt more innovative practices to attract and retain IT professionals to compete against the larger firms for scarce IT human resources. The relevant roles for IT professionals could also differ in large and small firms: IT professionals in small firms may need to play broader roles because the jobs may be less specialized.

IT Work Process

The IT work process refers to the activities required to transform user (customer) specifications into information technologies and systems. These activities can vary

along several dimensions, including the degree to which tasks are routinized and predictable, and the types and levels of knowledge required to effectively perform different tasks. Each of these dimensions can impact the management and research of IT personnel.

User specifications for information systems are by their very nature quite unpredictable and uncertain. This uncertainty leads to unpredictability in IT project tasks and instability in project scope. IT development tools, methodologies, and process improvement programs (such as ISO9000-3 and the capability maturity model) attempt to standardize project tasks and to reduce the variance in project outcomes (Paulk, 1995). Such standardization could improve the IT professional's ability to estimate reasonable project deadlines and to deliver on schedule and within budget. Thus, it is possible that the adoption of development tools and methodologies as well as process improvement programs could significantly improve the morale of IT professionals. On the other hand, IT professionals may believe that these methodologies are restrictive and inhibit their creativity.

A second dimension of the IT work process that is relevant for the management of IT personnel includes the different types and levels of knowledge required to effectively perform different activities. In contrast to other professionals, IT professionals need cross-functional business knowledge as well as specialized technical, managerial, and interpersonal skills. Furthermore, the development, maintenance, and infrastructure tasks are quite distinct in nature and require different capabilities. The widespread adoption of outsourcing is also likely to dramatically impact the activities, competencies, motivation, and performance of IT personnel. With outsourcing, IT personnel shift from internal development work to performing tasks involved with the selection, contracting, and monitoring of vendors.[3]

FUTURE RESEARCH DIRECTIONS: IT PERSONNEL IN CONTEXT

In the preceding sections, we examined prior research on IT personnel. We found that it has generally anchored on the individual, exploring many of the human resource issues solely from the perspective of the individual. We then identified the importance of context (both external and internal) and delineated important dimensions of these contexts in terms of their consequences for IT human resource practices.

In this section, we build an integrative model (Figure 16.2) and outline a future research agenda for the management of IT professionals. We begin by considering IT roles in context. Roles are the basic building blocks of organizations and must be both internally consistent and congruent with contextual factors such as business strategies and labor market conditions. As indicated in Figure 16.2, roles can fully or partially mediate the effects of external and internal contextual factors on IT human resource practices. We propose new directions and strategies for research on IT personnel that consider the direct effects of contextual factors as well as the indirect effects mediated through roles in terms of the stages within the natural progression of the human resource life cycle of staffing, motivating, and developing IT personnel. Finally, we consider the individual-, organizational-, and macro-level outcomes associated with the management of IT personnel in context.

FIGURE 16.2   An Integrated Model for IT Personnel Research in Context
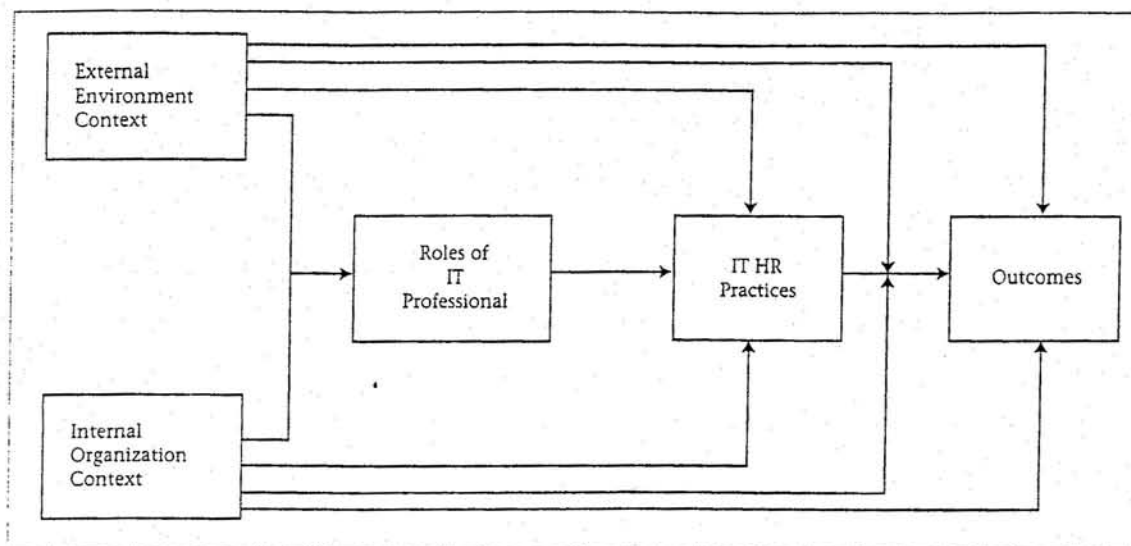
IT ROLES IN CONTEXT

A *role* is an interdependent component in an organizational system (Katz & Kahn, 1978). It is a comprehensive pattern for behavior and attitudes: Roles in organizations are those designed explicitly to accomplish some function and are often formalized by means of a job or position description (Robey, 1982). To be effective, roles must be clearly defined and communicated in the organization so that the expectations and evaluation of the behaviors required of the role are unambiguous. We first consider the impact of the external and internal contexts on IT roles; then we outline research strategies for examining IT roles in context.

Effect of Context on IT Roles

As new technologies emerge, current roles change or become obsolete and new roles appear. For example, the emergence of electronic commerce has resulted in a new senior executive role: chief e-commerce officer. Existing technical roles (such as programmer) may expand and become more complex as the IT professional of the twenty-first century must be conversant in multiple (old and new) technologies and platforms. The severe supply-demand imbalance in the IT labor market is also likely to have a strong influence on IT roles. For example, roles may need to be redesigned or new roles created to attract new IT personnel and to retain incumbents. Furthermore, with the development of a vibrant IT industry, new roles emerge for IT professionals in IT firms.

As IT becomes a critical component of the business strategy for firms, roles of IT professionals can change. For example, CIOs must develop *leadership* abilities

and take the initiative to set business goals and directions as well as technology strategy. Thus, it is important to reanalyze the role of CIOs as leaders using concepts of transformational leadership (visionary and charismatic) and to examine how CIOs contribute to the value of the organization. Because of the unique position of the CIO, the role of the CIO as a leader is a challenging one. Unlike leaders from other functional areas, a CIO must juxtapose between technical leadership as well as business leadership.[4]

Alternative sourcing strategies for performing IT work impact roles. For example, a recent study by Ang, Wong, and Soh (1999) suggested that when an IT organization undergoes outsourcing, the survivors of the outsourcing suddenly experience an upsurge in role stressors—including role overload, ambiguity, and conflict. In outsourcing, previous subordinates of project leaders—analysts and programmers—are transplanted to the outsourcing vendor. Suddenly, the project leaders, the survivors of organizational change, have lost their subordinates, must undertake responsibilities that previously belonged to their subordinates, and must learn to manage their previous subordinates as vendors. Supervisory skills may not necessarily translate smoothly to vendor management skills.

Research Strategies for Studying IT Roles in Context

Roles can be studied either at a micro level, using the methodologies from cognitive psychology or industrial organization (IO) psychology, or at a more macro level, using methodologies from sociology.

From a cognitive psychology perspective, studies could examine the knowledge structures, cognitive strategies, and processes of high performers in emerging roles. The primary aim of such studies can be to facilitate the progression of a novice IT professional to an expert by understanding how novices and experts function and by evolving strategies to close the gap between the two. Studies of this nature can rely on protocol analysis as a way of producing an account of the latent problem-solving processes embedded within the minds of the professionals (Ericsson & Simon, 1984).

Because of the micro orientation, methodologies from cognitive and IO psychology tend to focus on the individual and to ignore the context within which the individual is embedded. Accordingly, researchers must consciously design and take into account the various contexts in which IT professionals work. For example, researchers could analyze the similarities and differences in the roles of programmers working in different technological environments (e.g., mainframe-based systems versus client server versus multitiered architectures; Web-based, object-oriented environments versus COBOL environments). Or researchers could examine systems analysts working in different labor markets (e.g., IT user organizations versus IT vendor firms) or in different industry sectors (e.g., public- versus private-sector firms).

Unlike methodologies from psychology, methodologies from sociology are more macro-oriented and are therefore more context embedded. Future research from a sociological perspective could undertake ethnographic studies of new roles. Exemplars of ethnographic studies of roles have been conducted by Barley and his associates (Barley & Bechky, 1994; Barley & Orr, 1997; Orr, 1996). Ethnographies portray work life in the social setting and examine in detail the activities of professionals at the workplace. Failing to understand the roles of IT professionals may lead not only to an unrealistic picture of the IT development process but also to a misrepresentation and stereotyping of IT work. Without detailed (and accurate) information on IT

work, it is difficult to attract people to the profession given stereotypical images of what IT professionals know and do.

STAFFING IN CONTEXT

Staffing involves bringing new IT professionals into the organization and making sure they serve as valuable additions to the workforce. The goal of staffing is to match, or align, the abilities of the job candidate with the roles defined by the firm. After defining the roles required and identifying the competencies required to fill the roles, individuals are recruited and selected to match those roles. In the following sections, we examine the impact of the contextual environment for the staffing of IT professionals. We consider the impact on job analysis first and then on selection activities. We conclude with a discussion of strategies for research on staffing in context.

Job Analysis

Once IT roles have been defined by an organization, they are formalized by means of a job description, which includes a summary of the basic tasks making up a job. These tasks are identified using a systematic job analysis. The dynamic external and internal environments for IT professionals serve to create new roles and alter existing roles by expanding, changing, or reducing their content. As such, systematically analyzing and reanalyzing the content for new and changing IT roles is an imperative.

Selection

Once roles and jobs are understood, the next task is to find people to *fit* the roles. Personality is a complex set of inherent dispositional and emotional characteristics that can be used to uniquely identify a person. Although prior research on the usefulness of personality measures has been pessimistic (e.g., Mischel, 1968; Weiss & Adler, 1984), recent research in IO psychology has seen a resurgence of the importance of personality in predicting job fit and job performance. The inherent belief is that people do, in fact, have long-term dispositional traits that make them particularly suited for certain jobs and influence their behavior in work settings. Specifically, research has been extremely productive when thousands of potential traits are reduced to a small number of factors, particularly the "Big Five" dimensions of extraversion, emotional stability, agreeableness, conscientiousness, and openness to experience (see Mount & Barrick, 1995) for a meta-analysis of studies linking personality to performance).

Research Strategies for Studying Staffing in Context

Researchers could undertake a systematic job analysis of new and existing roles in IT across different external and internal contexts (e.g., chief e-commerce officers in public- and private-sector firms). Thus far, skills inventory studies have been conducted based on inductive, free-recall, and focus group discussions on the possible skill sets of IT professionals. Recent job analysis methodologies from IO psychology

offer deductive methods to systematically reduce each role to a logically coherent set of tasks and job clusters (see Peterson & Jeanneret, 1997). The methodologies are especially suited for assessing role changes, role overload, or role underload. For example, one could study IT project leaders' roles before and after IT outsourcing to assess whether their roles have expanded or contracted in scope.

Selection research could continue from the IO discipline by examining personality and dispositional characteristics and their relationship to job fit and performance. For example, tolerance for ambiguity is a desirable trait for programmers since by nature programming has requirements that are incomplete, conflicting or contradictory requirements (Hohmann, 1997). Given the complexity and variety of work environments facing IT professionals, additional research must be done to understand the appropriate personality profiles fitting the various kinds of IT roles found in different external and internal contexts.

IT staffing can also be studied from a more macro-level perspective. To understand the antecedents predicting the choice of different IT staffing strategies or when different staffing practices are more or less effective, it is also necessary to consider the direct influence of the external and internal contexts. For example, investment in IT recruitment is likely to vary with employment levels. When the IT labor supply is tight, organizations may adopt more expensive, innovative, and intensive recruiting strategies for their IT professionals. Alternatively, firms could relax their hiring standards as a means to fill vacant positions. Recruiting effectiveness may be lower under conditions of tight IT labor supply. Macroeconomic studies using econometric analysis of firm-level data on IT professionals would be useful to tease out the effects of the external context on staffing activities.

MOTIVATION IN CONTEXT

Individual performance in organizations is a function of motivation as well as skills and abilities. Individuals can choose to vary their behaviors in response to conditions at the workplace, including incentives and disincentives that are built into the organization's reward system. The goals of motivation are to define and provide mechanisms in the workplace to evaluate employee performance and to design reward systems to motivate desired behaviors. In the following sections, we examine the impact of the contextual environment for the motivation of IT professionals. We consider the impact first on the motivating aspects of roles, then on performance appraisal, and finally on compensation. We conclude with a discussion of strategies for research on motivation in context.

Beyond JCM

Job design characteristics provide opportunities and constraints for work activity. In a recent review of the area (Kelly, 1992), the job characteristics model (JCM) (Hackman & Oldham, 1979) still stimulates a considerable amount of research. However, the most frequently noted limitation of the JCM is that it does not include relevant dimensions of the work context. This becomes particularly evident in the context of advanced manufacturing technology (Wall et al., 1990). For example, Jackson et al. (1993) showed that additional measures must be developed within the JCM to assess constructs that reflect contextual work aspects such as control

over time and methods, monitoring and problem-solving demand, and production responsibility. Analogously, in IT, the work context has changed significantly in terms of increasing automation and outsourcing of the development process. While prior applications of JCM to IT professionals have suggested that IT work is motivating, it is not clear whether IT developers would perceive these new dimensions of the IT work context to be as motivating.

Performance Appraisal

Performance appraisal refers to the assessment and measurement of employee behaviors relative to the behaviors required by the employee's role in the organization. The dynamic external and internal environments for IT professionals serve to create new roles and alter existing roles. Performance appraisal approaches must be designed and redesigned to fit these new and changing IT roles. For example, the study of Bell Atlantic by Clark et al. (1997) illustrates how performance appraisal must change to fit new IT roles. Bell Atlantic adopted the "centers of excellence" organizational design to foster "change-ready" capabilities in the IT organization. The roles of IT professionals in this new organizational design were very different from traditional IT roles, and Bell Atlantic adjusted its performance appraisal approach to fit these new roles. Specifically, a 360-degree performance appraisal behavioral approach was implemented so that performance in IT roles was assessed by peers, IT managers, and clients.

Compensation/Rewards

The salary paid to IT employees, as well as other job benefits, depends in part on how well these professionals perform in their roles. Other factors influencing compensation are contextual and include the relative worth of each role within the firm (in the internal labor market), external labor market conditions and prevailing wage rates, and the type of pay system used.

Labor supply and demand cause the wages for some jobs to be higher than for others, even though the jobs may be of similar difficulty, responsibility, and so on. In IT this is particularly the case when there are labor shortages for certain technical skills. For example, programmers experienced in COBOL may be compensated less than programmers experienced in XML because the supply of qualified workers in Web technologies is low relative to demand. The level of wages is also influenced by the competitive wage in the local area. Even after the value of a job has been determined and the local and regional wage differences are taken into consideration, one person may be paid more for the same job than another person, depending on seniority in the company, level of individual performance, the level of group performance (if the individual is part of a work group), and the level of organization performance (if the firm uses profit-sharing systems).

Research Strategies for Studying Motivation in Context

There are a number of strategies for studying motivation in context. For applications of JCM, it is evident that relevant dimensions of the IT work context must be operationalized and included in the model. Given the increasing automation, teamwork, and level of outsourcing in IT development, it is necessary to add constructs

to the JCM to assess the motivating potential of these contextual work characteristics. Longitudinal studies of IT roles (such as developers and project leaders) using an expanded JCM would be interesting in determining whether IT jobs today are as motivating as in the past and predicting the motivating potential of new IT roles. In addition, a meta-analysis of studies (Kelly, 1992) examined the relationship between JCM and job satisfaction and job performance and has questioned the accepted proposition from job design theory that job redesign will affect both satisfaction and performance. Instead, Kelly suggests that there is a twin-track model in which satisfaction and performance are influenced by different determinants, the former by changing dimensions of job content and the latter by other organizational context variables not adequately taken into account by the job characteristics model. Thus, the twin-track model suggests a further extension of the job characteristics model in IT to include different contextual factors, depending on whether job performance or job satisfaction is studied.

Performance appraisal can be studied from the IO psychology paradigm. Basic research questions concern how the performance of IT professionals can be appraised and what types of performance appraisal approaches are best suited to different kinds of IT roles. Appraisal can focus on traits, behaviors, or accomplishments. Under trait approaches, a performance appraiser rates an employee on traits such as friendliness, efficiency, and reliability. Behavioral approaches such as the critical incidents method involve recording specific employee actions. Outcome approaches such as management by objectives rate what the employee is supposed to accomplish on the job. Another research question concerns who is best suited to appraise performance (superiors, subordinates, clients, peers) for new and changing IT roles.

Because compensation is directly influenced by contextual factors as well as role factors, research must take into account the multilevel determinants of compensation. That is, to understand the antecedents of compensation, it is important to analyze factors at multiple levels of analysis, including the effects of different labor markets, regions, and organizational pay systems as well as the performance of the individual in the IT role. A fundamental research question could address the relative impact of the external context and organizational context versus individual factors in determining compensation. For example, are similar IT roles (such as systems analysts compensated differently in IT firms and IT user firms? In public and private companies? These questions could also be examined longitudinally by studying compensation patterns for a particular IT role (such as a programmer) in different settings over time. Other important areas for research concern the efficacy of different incentive systems. For example, under what conditions is a broad-banding approach more effective than other approaches such as individual performance-based, seniority-based, or profit-sharing incentive schemes?

DEVELOPMENT IN CONTEXT

Because many of the skills required of IT roles are acquired or improved with on-the-job training and experience, it is important in developing talent in IT professionals to consciously structure the roles and the progression of roles an individual undertakes in an IT career. The goal of development is to help the firm meet its immediate human resource needs based upon the roles defined in the organization

and to ensure that the firm's employees are ready to meet future needs for new and changed roles. In the following sections, we examine the impact of the contextual environment for the development of IT professionals. We consider the impact first on training and then on career paths and planning. We conclude with a discussion of strategies for research on development in context.

Training

As IT roles emerge and change, training can be used to help existing employees to acquire the skills needed to fill these roles. The constant pace of technological change has impacted the technical skills required for existing roles and for new roles. A primary question that arises is how training approaches can best be designed to teach incumbents the technical skills required for new and changing IT roles. For example, for which technical skills are different methods (such as classroom training, role playing, programmed instruction, simulation, or behavior modeling) most effective?

To facilitate the advancement of IT professionals to higher-level roles (such as systems analyst, project leader, senior executive), it is also important to consider how the "soft" skills of IT professionals can be developed. Although the soft (i.e., nontechnical) skills of IT professionals are recognized as important for job performance, there are few guidelines on how to conceptualize, measure, and develop soft skills. The irony is that organizations often select and recruit IT professionals based solely on technical skills, yet soft skills are needed to advance to higher level job positions. Although IT professionals with good technical skills may perform competently in their roles as programmers in the early stages of their careers, they may not perform as well when they become systems analysts or project leaders.

Paradoxically, although soft skills are rated as important, there is still a widely held perception among organizations that soft skills among IT professionals are "nice to have," not "must have." It appears that organizations are more concerned with sourcing for and retaining IT personnel with hard technical skills. Nevertheless, if companies begin to pay greater attention to soft skills, there is a strong possibility that IT professionals with the requisite soft skills may contribute more effectively in their deployment of technical skills. One of the impediments in incorporating soft skills in the training of IT professionals is that soft skills remain a nebulous concept. Unlike technical skills, for which one can become certified through pencil-and-paper tests, soft skills are more difficult to assess and calibrate.

Career Pathing and Planning

Career paths trace the training outcomes and job transitions of individuals over their work lives. The professional career path represents the observable history of how individuals have been socialized into roles. The typical professional career path is likely to change if the diversity of organizational settings leads to diversity of interests and demographic diversity among professional workers (Kunda, 1992). In IT, the variety of organizational settings and the emergence of new professional roles have increased dramatically in recent years. The growing use of outsourcing and the emergence of IT firms have opened mobility alternatives to in-house salaried careers within IT user organizations. New technologies have created new IT roles (such as Webmaster, knowledge officer, e-commerce officer) that provide new career opportunities for IT professionals.

Research Strategies for Studying Development in Context

Research on the training of IT professionals in technical and soft skills could be conducted from the paradigms of cognitive and IO psychology. An essential task is first to develop assessments of skill sets required for IT roles so that it is clear what skills are required. These assessments can also be used to evaluate the efficacy of different training approaches. For example, the Guttman approach to behavioral rating scales can be used to identify and rank the major dimensions of job behaviors and skill sets that are used to evaluate IT professionals (Arvey & Hoyle, 1974). Recent research by Joseph, Ang, and colleagues (Joseph & Ang, 1999; Joseph, Ang, & Tan, 1997) illustrates how work on the measurement of practical intelligence and tacit knowledge at work by cognitive psychologists (Wagner & Sternberg, 1985) can be leveraged to develop and validate a computer-based psychological instrument that diagnoses and assesses soft skills of IT professionals. Using the knowledge-based approach of eliciting behaviors in critical work situations, they find that soft skills of IT professionals can be categorized into three areas of management and self-regulation: managing self, managing careers, and managing others. The findings also suggest that significantly high levels and a mix of soft skills are required of IT professionals when they face complex work situations that involve managing multiple stakeholders: superiors, subordinates, peers, users, clients, and vendors in a myriad of intraorganizational versus interorganizational contexts. Future work must continue to explore both the assessment and development of soft skills required of IT professionals.

As we have noted, research on external career paths for IT professionals is limited. The new mobility opportunities created by diverse organizational settings and new IT roles suggest a number of interesting and important research questions to study. One question raised by research on diverse professional settings is whether the labor market for professionals is segmented by function into elites and practitioners. Elites represent a small percentage of knowledge producers for the professions, whereas the nonelite practitioners consume and apply the knowledge produced and disseminated by elites (Friedson, 1984). In IT, the elite is represented by firms such as Microsoft and start-up firms that offer new IT products and services; nonelite practitioners are those who use the IT tools to serve the needs of IT user organizations.

Another question one could ask as organizational settings diversify is whether there are systematic differences in career paths for those recruited in different professional roles in different settings. A key question to be addressed by future research is whether professionals with different characteristics are more likely to spend their careers in some specific organizational contexts rather than in others and what motivates such choices. Another related question is whether there is significant and typical career mobility across diverse work settings, and, if so, what the consequences are for those who move between settings. Such movement may be a highly significant indicator of fragmentation and segmentation in professional work. Alternatively, if the boundaries between organizational settings are relatively permeable and show no consistent pattern of career movements, this would suggest that professionals have been able to maintain a relatively coherent occupational (Saxenian, 1996) labor market tied to generalist knowledge.

A further extension of this question is whether mobility across organizational contexts is more valuable for a professional career than mobility within specific contexts. Sometimes a specific organizational context may constrain a professional's

individual movement. For example, Ang and Slaughter (1998) found that consulting firms are open to job mobility at all levels. Individuals can enter the consulting firm as either an apprentice or a guru. However, in many IT user organizations, the entry to more senior managerial positions is often closed to external parties, thereby restricting the inflow of external talent. Mobility also is constrained by the age or number of years of experience of the IT professional.

A key to understanding the impact of contextual factors on IT careers is to engage in systematic comparisons of the career mobility of IT professionals and others who work in the same organizational settings. In situations in which organizations establish the agenda for the context of professional work, there should be divergent mobility patterns in different organizational settings. However, this is only part of the comparison that is needed. Researchers should also examine the question of whether the career patterns of professionals are distinctive. If there is considerable isomorphic pressure from employing organizations, IT professional career mobility will look like the career mobility of other white-collar employees, implying that IT professional norms are not well established or have been subordinated.

IT PERSONNEL OUTCOMES IN CONTEXT

As reflected in our integrative model in Figure 16.2, a number of outcomes are relevant to the study of IT personnel in context. In this section, we identify outcomes at the individual-, organization-, and macro-levels of analysis and discuss research strategies for studying IT personnel outcomes in context.

Outcomes at Different Levels of Analysis

At the individual level, attitudes and behaviors represent an individual's responses to various human resource practices as well as contextual contingencies. Relevant attitudinal outcomes include constructs such as job satisfaction, organizational commitment, and job stress. Behavioral outcomes include job performance, extra-role behaviors, and turnover. At the organizational level, there are human resource management outcomes as well as business outcomes. Examples of human resource outcomes include retention rates, hiring rates, grievance rates, absenteeism, and employee morale. Business outcomes include firm performance, market share, return on investment, and return on assets. At the macro level, outcomes include such aspects as productivity in different industry sectors or countries, quality of life, and human capital development.

Research Strategies for Studying Outcomes in Context

In studying the outcomes of IT personnel in context, research must be explicitly designed to consider the effects of factors at multiple levels of analysis. For example, research examining the turnover behavior of IT personnel should consider labor market contextual factors (such as availability of jobs in a region or relative supply/demand imbalance for a particular skill set), organization contextual factors (such as whether the individual works in a public or private firm), and human resource strategies (such as staffing and training policies), and individual factors (such as job satisfaction). Data must be collected at multiple levels of analysis, and strategies to conceptualize models and analyze data at multiple levels of analysis are needed to determine the multilevel effects of contextual factors on outcomes. It may be useful to design

studies of IT personnel based on the research strategies used in educational psychology. For example, hierarchical linear modeling research designs have been developed by Bryk and Raudenbush (1992) to study the impact of regional factors, public/private school, and teaching practices on student achievement. Such approaches may be usefully adapted to the study of IT professionals.

It is also important to examine the relationship between IT human resource outcomes and business outcomes, particularly as IT grows in strategic importance to firms; that is, how do IT employee turnover rates, morale, work attendance, and grievance rates relate to net profit, return on investment, and market share? However, establishing and measuring the relationships between human resource management outcomes and business outcomes is a tricky endeavor because one must control for the many other factors (such as industry, capital/labor ratio, and company size and age) that can influence business performance. It may be useful to design studies based on the approaches used to investigate the effects on business organizations of employee unionism and collective bargaining. For example, using a standard microeconomic framework of analysis, researchers have statistically measured the effects of unionism on wages and fringe benefits, productivity, capital investment, research and development expenditures, firm profitability, and market value (measured by stock prices); for example, see studies by Becker and Olson (1986), Clark (1984), Hirsch (1992), and Voos and Mishel (1986).

CONCLUSIONS

In this chapter, we have examined the research on IT professionals. We have seen that many studies of IT professionals thus far suffer from percept-percept bias. That is, researchers tend to apply existing theories (in particular, micro-level theories) to IT personnel. The challenge is to move beyond studies that apply only theories from other fields and instead to use the IT context to revise, modify, and develop theories. It is our contention that the area of IT personnel can progress significantly if research moves away from questions about individual differences and focuses instead on the organizational, environmental, and situational contexts that differentiate the reactions of IT professionals to their workplaces. Shifting the focus from the individual to the context has a number of implications for IT personnel research. In the following sections, we elaborate the theoretical implications and methodological issues suggested by a contextual perspective of IT personnel.

IMPLICATIONS FOR RESEARCH

To examine *context* in research of IT personnel requires consideration of additional theoretical perspectives beyond those from cognitive psychology or IO psychology. In the economics literature, human capital theory, transaction costs theory, and agency theory may be useful theory bases. For example, human capital theory refers to the productive capabilities of workers (Becker, 1964). The skills, experience, and knowledge of workers are valuable to organizations because workers constitute the organization's human capital and, thereby, its productivity and flexibility. The human resource costs related to securing human capital assets from the market and motivating, monitoring, and retaining them can be considered human

capital investments made in anticipation of future returns (Lewin & Mitchell. 1995). In human capital theory, contextual elements such as labor market conditions, business strategy, and technology are important because they can impact human resource costs or the value of the anticipated returns from investment in human capital.

Macro-level theories such as institutional theory and resource dependence theory focus on the relationship between an organization and its external constituencies. These theories may be useful in helping to understand why organizations adopt similar IT human resource strategies. For example, institutional theory (Zucker, 1977. 1987) asserts that organizations in institutionalized environments are pressured to become similar. This suggests that organizations may adopt certain IT human resource practices because they are imitating the practices of leading organizations in their environment.

To fully understand IT personnel in context requires consideration of multiple theoretical perspectives as well as theories that can cross levels of analysis. Future research needs to recognize that the internal and external contexts can moderate the effects of IT human resource practices on outcomes. Furthermore, theories from economics, sociology, psychology, and organizational behavior must be adapted to fit the unique contexts of IT personnel. To illustrate, human capital theory presumes that the value of human capital increases with job experience, ceteris paribus. However, in IT we have seen that the rapid change of IT leads to obsolescence of technical skills absent constant training in the newest technologies. This suggests that the value of IT human capital (at least technical IT human capital) erodes with experience, contrary to what human capital theory would predict. Thus, the boundary conditions within which human capital theory holds for IT personnel must be specified; for example, the predictions of human capital theory may be valid only for managerially oriented IT roles or for IT roles in IT user organizations or for IT roles in public sector firms.

Methodologically, there are significant measurement and analytical challenges to studying contextual factors. A major difficulty is defining and measuring the relevant constructs and dimensions in the external and internal contexts. That is, methodologies must switch from treating context as sources of error variance to explicitly incorporating relevant dimensions in models. For example, as we noted earlier, the job characteristics model must be expanded to include characteristics that are relevant for the work and organizational contexts. However, it may be difficult to identify the relevant dimensions of these contexts and the relationships between them. Analytical challenges and opportunities abound as well. First is the need to consider outcomes and factors at multiple levels of analysis. For example, models predicting individual compensation need to assess the effects of determinants at multiple levels of analysis (such as the organization, industry, labor market, and geographical region). Analytical techniques such as multilevel modeling are useful for this kind of analysis; however, it can be challenging to collect sufficient data at multiple levels of analysis to assess the effects of different contextual factors.

CONCLUDING REMARKS

Researchers interested in the changing contexts of IT professional work face an exciting, new, and complicated empirical world for their research. We hope our review

will stimulate new generations of researchers to enter an area of study that represents a unique interface between organizational theory, social stratification, and historical analysis of institutional change in IT professional work.

ENDNOTES

1. See the chapter on software origins by George for a description of how software development has changed.
2. See the chapters by Sambamurthy on business strategy and by Weill and Broadbent on managing IT infrastructure that describe the strategic role of IT.
3. The chapter by Kirsch on project management identifies software skills needed in IT projects. The chapter by Lacity and Willcocks on IT outsourcing describes the relationship between the vendor and client in IT outsourcing.
4. See the chapter by Ross and Feeny on the CIO for an analysis of the role of the CIO and how it has evolved.