62.1 Introduction

Over time, information system (IS)/information technology (IT) management has come to be understood as referring to more than the technology alone, or even the information systems based upon it. One of the topics in this broadly understood domain is IS/IT personnel. In fact, in 2012, the Association for Computing Machinery (ACM) Computer Personnel Research Conference became 50 years old. The publications from this conference along with papers published in the ACM publication, The Database for Advances in Information Systems, and other journals that publish IS/IT human resource (HR) research, give testament to the sustained interest in the human resource dimension of the computing field. Finally, evidence of the core importance of IS/IT HR is that there is an ACM indexing category for it. Topic K is the computing milieu; within it, K.7 is the computing profession with subcategories including occupations (K.7.1); organizations (K.7.2); testing, certification, and licensing (K.7.3); and professional ethics (K.7.4). Hence, a chapter on IS/IT human resource development and retention clearly has its place also in this handbook.

This chapter is organized as follows. We begin by considering the research to date on the underlying principles for IS/IT human resource development and retention drawn from the extant research. This section is followed by a discussion of IS/IT HR development and retention practices. The final section of this chapter considers emergent themes about IS/IT human resource development and retention that will motivate new research and practice in the future.
62.2 Underlying Principles for IS/IT Human Resource Development and Retention

When considering IS/IT human resource development and retention, an organization’s chief information officer (CIO) faces these major questions:

1. What knowledge, skills, and abilities (KSAs) are needed by the personnel for whom I am responsible?
2. For what length of time would I prefer to retain the personnel for whom I am responsible, and what human resource management practices will support that?

We first consider how answers may differ based on the IS/IT organization’s alignment with the overall organizational human resource strategy. We then review prior research that addresses these questions.

An IS/IT organization consists of the personnel and supporting resources that provide information and communication services to the larger organization. Examples of supporting resources include IT infrastructure, data, and application systems. Under the assumption that answers to the development and retention questions earlier vary systematically based on the IS/IT organization’s alignment with the overall organizational human resource strategy, we first consider research that provides a strategic context for addressing the development and retention questions.

A major decision in an organizational human resource strategy is whether to develop human resources with the desired KSAs from within the organization or to obtain them from the external labor market. The former strategy has been referred to as a “make” strategy and the latter as a “buy” strategy (Miles and Snow 1984; Toh et al. 2008). Similarly, a craft internal labor market (ILM) strategy is similar to the “buy” strategy, whereas an industrial ILM strategy is similar to the “make” human resource management (HRM) strategy (e.g., see Ang and Slaughter 2004). CIOs have long been interested in aligning the IS/IT organization with overall organizational strategy (Luftman and Ben-Zvi 2011; Luftman and Kempaiah 2008). A body of literature on IS/IT strategy, including alignment of IS/IT with business strategy, has emerged (e.g., see Chen et al. 2010). A natural extension is to the IS/IT organization’s alignment with the overall organization’s human resource strategy.

Discussing factors that a CIO should consider when determining whether to internally develop or externally acquire IS/IT personnel and deciding how long to keep them is beyond the scope of this chapter. We assume that the CIO will consider a variety of factors to determine the IS/IT human resource strategy, including the organization’s overall business and human resource strategy. The IS/IT human resource strategy will provide a context for answering the two questions presented earlier that CIOs face with respect to KSAs and human resource management practices needed to support a specific length of employment relationship for IS/IT personnel. We next examine research on KSAs needed in IS/IT organizations. Following that, we review research on human resource management practices designed to retain IS/IT personnel for different lengths of time.

62.2.1 IS/IT Human Resource Development

62.2.1.1 Studies of Knowledge, Skills, and Abilities

Organizations choosing to build (or “make”) their IS/IT personnel through training and development programs would specify the content of their programs based on the answer to the major question facing the organization’s CIO: “What KSAs are needed by the personnel reporting to me?” As would be expected in an environment where the technology changes rapidly, the specific technical skills needed by IS/IT personnel also change rapidly. The required skills vary by specific job title. As Huang et al. (2009) report, Java developers need knowledge in Java, JavaScript, or J2EE and sometimes they need HTML, .NET, or XML knowledge. These specific technical skills were not needed by IS/IT personnel...
in the study reported by Lee et al. (1995); Java had not even been released as a programming language at that time. Besides keeping up with changes in technologies and the associated skills needed to apply those technologies, a challenge for researchers and practitioners has been to specify a set of KSAs that may be used for various IS/IT roles and job titles. Ideally, this set would make it more feasible to identify the mix of KSAs needed by IS/IT personnel in various jobs now and in the future, facilitating planning by CIOs and educators.

Researchers have worked with industry to specify KSAs in various categories, including technical, business, interpersonal, managerial, and project management (e.g., Kaiser et al. 2010; Lee et al. 1995; Trauth et al. 1993). Table 62.1 illustrates KSAs in four such categories reported by Lee et al. (1995). Categories beyond the technical specialties knowledge were defined broadly enough to apply not only in the 1990s, when the study was conducted, but also beyond. Even some of the technical specialties categories are broad enough that they still apply.

A number of researchers have investigated what KSAs IS/IT personnel need (Cheney 1988; Huang et al. 2009; Kaiser et al. 2010; Lee et al. 1995; Nakayama and Sutcliffe 2007). Roles studied include entry-level IS/IT professionals, programmers, analysts, and IS/IT managers. Table 62.2 illustrates results for entry-level IS/IT personnel in high-wage regions of the world (Kaiser et al. 2010). Methods used to identify IS/IT personnel skills have included asking knowledgeable sources (e.g., IS/IT executives/managers, business/user managers, IS/IT consultants), reviewing job advertisements in newspapers or online job postings, and examining practitioner publications.

### TABLE 62.1 Categories of Knowledge, Skills, and Abilities

<table>
<thead>
<tr>
<th>A. Technical specialties knowledge</th>
<th>C. Business functional knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network</td>
<td>Ability to understand the business environment</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>Ability to learn about business functions</td>
</tr>
<tr>
<td>Relational databases</td>
<td>Knowledge of business functions</td>
</tr>
<tr>
<td>Fourth-generation languages</td>
<td>Ability to interpret business problems and develop appropriate technical solution</td>
</tr>
<tr>
<td>Systems integration</td>
<td>D. Interpersonal and management skills</td>
</tr>
<tr>
<td>Distributed processing</td>
<td>Ability to work closely with customers and maintain productive user or client relationship</td>
</tr>
<tr>
<td>Data management (e.g., data modeling)</td>
<td>Ability to accomplish assignments</td>
</tr>
<tr>
<td>Structured programming/CASE</td>
<td>Ability to plan and execute work in a collaborative environment</td>
</tr>
<tr>
<td>(computer assisted software</td>
<td>Ability to be self-directed and proactive</td>
</tr>
<tr>
<td>engineering) methods or tools</td>
<td>Ability to work cooperatively in a one-on-one and project team environment</td>
</tr>
<tr>
<td>Decision support systems</td>
<td>Ability to deal with ambiguity</td>
</tr>
<tr>
<td>Systems analysis/structural analysis</td>
<td>Ability to plan, organize, and lead projects</td>
</tr>
<tr>
<td><strong>B. Technology management knowledge</strong></td>
<td>Ability to be sensitive to organizational culture/politics</td>
</tr>
<tr>
<td>Ability to focus on technology as a means, not an end</td>
<td>Ability to plan, organize, and write clear, concise, effective memos, reports, and documentations</td>
</tr>
<tr>
<td>Ability to learn new technologies</td>
<td>Ability to develop and deliver effective, informative, and persuasive presentations</td>
</tr>
<tr>
<td>Ability to understand technological trends</td>
<td></td>
</tr>
</tbody>
</table>


* Top 10, based on projecting KSAs needed 3 years beyond the survey.
As Tables 62.1 and 62.2 illustrate, studies of job skills report that IS/IT personnel need a mix of KSAs, not just specific technical KSAs. To illustrate further, Huang et al. (2009) report that the skills needed for programming jobs include not only technical skills but also KSAs in communication and teamwork. IS/IT professionals who move from specific, technical roles to broader roles need a different mix of KSAs for effective performance in their new roles.

### 62.2.1 Capabilities Based on View of IS/IT Human Resources as Strategic Assets

Another perspective on KSAs needed in an IS/IT organization may be derived from research that takes a view of IS/IT human resources as strategic assets. Much of this work is based on the resource-based view of the firm (Bharadwaj 2000; Chen et al. 2010; Mata et al. 1995; Ross et al. 1996). Bharadwaj (2000) identifies two critical skills of human resources in an IS/IT organization. The first is technical skills, such as programming, systems analysis and design, and competencies in emerging technologies. The second is managerial skills, such as effective management of IS/IT functions, coordination and interaction with users, and project management and leadership. Although these skills are similar to those found in the studies of KSAs reviewed earlier, the view of IS/IT human resources as strategic assets incorporates a competitive perspective not necessarily present in the studies discussed earlier.

The implication is that more successful firms will have IS/IT technical and managerial KSAs that are better than competitors. As a result, they will have capabilities to integrate the IS/IT organization and business planning processes more effectively, conceive of and develop reliable and cost-effective applications that support the business needs of the firm faster, communicate and work with business units more efficiently, and anticipate future business needs of the firm and innovate valuable new product features sooner (Bharadwaj 2000). This competitive advantage is based on these capabilities being difficult to acquire and imitate, implying that the needed IS/IT human resource strategy would be to develop IS/IT personnel with these capabilities internally. A related implication is that from the CIO’s perspective the desired turnover of IS/IT personnel with these capabilities would be low.

### 62.2.2 IS/IT Human Resource Retention

A contextual model of turnover for IS/IT personnel presented by Joseph et al. (2007) contains environmental-level, firm-level, and individual-level factors affecting retention. CIOs should understand factors at all levels, but firm-level factors, particularly human resource strategy and human resource practices for IS/IT personnel, are factors that are most likely to have the ability to influence directly. Human resource practices, in turn, affect individual-level factors. For example, the extent to which IS/IT personnel have opportunities for internal promotion is a practice perceived at the individual level.

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**TABLE 62.2** Top 10 Entry-Level Skills in High-Wage Regions

<table>
<thead>
<tr>
<th>Skill Category</th>
<th>Skill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business domain</td>
<td>Communication</td>
</tr>
<tr>
<td>Technical</td>
<td>Programming</td>
</tr>
<tr>
<td>Technical</td>
<td>Systems analysis</td>
</tr>
<tr>
<td>Technical</td>
<td>Desktop support/help desk</td>
</tr>
<tr>
<td>Project management</td>
<td>Project planning, budgeting, and scheduling</td>
</tr>
<tr>
<td>Business domain</td>
<td>Industry knowledge</td>
</tr>
<tr>
<td>Technical</td>
<td>System testing</td>
</tr>
<tr>
<td>Business domain</td>
<td>Process knowledge</td>
</tr>
<tr>
<td>Project management</td>
<td>User relationship management</td>
</tr>
<tr>
<td>Project management</td>
<td>Working with virtual teams</td>
</tr>
</tbody>
</table>

as an organizational advancement factor, one of the individual-level factors influencing the turnover process in the Joseph et al.'s (2007) model.

Many human resource management practices that CIOs may consider as part of their human resource strategy have been studied. In the broad domain of management research, Combs et al. (2006) report on the following practices in their meta-analysis of the effects of high performance work practices on organizational performance: flexible work, participation, teams, training, internal promotion, information sharing, compensation level, incentive compensation, employment security, selectivity, HR planning, performance appraisal, and grievance procedures. They reported on these practices because researchers had identified them as high performance work practices and they appeared in at least five studies that could be used in their analysis. Their analysis shows a positive correlation of these practices with retention. For CIOs seeking to develop (or “make”) and retain IS/IT personnel, providing more of these practices would be consistent with the intent of establishing a long-term relationship. For CIOs interested in establishing a short-term relationship with IS/IT personnel, providing less of many of these practices would be consistent with that strategy.

Research in the more focused domain of managing IS/IT personnel has also studied human resource management practices that affect retention. Agarwal and Ferratt (1999) asked CIOs and HR executives to identify effective or innovative practices they used to retain IS/IT personnel. The numerous practices identified were grouped into several categories, which Table 62.3 presents.

Based on their survey work and subsequent case studies of several organizations, Agarwal and Ferratt (2001) reported that organizations seeking to establish long-term relationships with IS/IT personnel

<table>
<thead>
<tr>
<th>Retention Practice Category</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work arrangements</td>
<td>Nature of the work individuals have the opportunity to experience and how they relate to one another</td>
</tr>
<tr>
<td>Employability training and development</td>
<td>Training and development activities provided to IT employees to enhance current skills required by the IT organization or to develop additional skills in current technologies</td>
</tr>
<tr>
<td>Quality of leadership</td>
<td>Training for managers and empowerment or participation of employees</td>
</tr>
<tr>
<td>Sense of community</td>
<td>Activities undertaken to provide IT professionals with the sense of belonging to and being connected with a larger community</td>
</tr>
<tr>
<td>Compensation and benefits systems</td>
<td>Policies that compensate IT employees for work. Includes setting basic compensation levels, incentive pay systems, and bonus systems</td>
</tr>
<tr>
<td>Organizational stability and employment security</td>
<td>The extent to which the business enterprise is financially stable and can offer employment security</td>
</tr>
<tr>
<td>Longer-term career development</td>
<td>Training and development activities made available to IT employees that focus on developing business and leadership skills</td>
</tr>
<tr>
<td>Opportunities for advancement</td>
<td>Career management systems and career paths for IT employees</td>
</tr>
<tr>
<td>Opportunities for recognition</td>
<td>Systems that allow supervisors to recognize and reward outstanding or exemplary performance</td>
</tr>
<tr>
<td>Lifestyle accommodations</td>
<td>Opportunities available to IT employees to adjust work schedules or otherwise help balance competing demands on their time</td>
</tr>
<tr>
<td>Performance measurement</td>
<td>Processes by which IT employee performance is appraised to allocate rewards and identify developmental needs</td>
</tr>
</tbody>
</table>


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use different bundles of human resource management practices than organizations desiring short-term relationships. Organizations desiring a long-term relationship follow a long-term investment strategy. This strategy is consistent with the “make” HR strategy. Organizations following this strategy invest more in career development and security than IS/IT organizations interested in a short-term relationship. Organizations following a long-term investment strategy tailor human resource practices, such as compensation and benefits, to make IS/IT personnel reluctant to leave, for example, by providing longer vacation periods than competitors or profit sharing that is available after staying with the organization a specific period of time. In general, these organizations use human resource management practices that reflect concern not only for productivity but also for employees as individuals. For example, they may have greater employee participation, much more community building, and more lifestyle accommodations compared with IS/IT organizations at the short-term extreme.

Using the categorization of human resource management practices of Agarwal and Ferratt (1999), Ferratt et al. (2005) examined the effect of those practices on turnover. A large sample of CIOs described practices used in their organizations and reported turnover. Factor analysis identified five factors representing the human resource management practices used: (1) work environment and career development, (2) community building, including information sharing and social activities, (3) incentives, (4) employment security, and (5) nontechnical skill recruitment (i.e., the extent to which nontechnical skills are used to recruit IS/IT professionals). The first dimension, work environment and career development, includes practices that provide an attractive work environment for IS/IT professionals (e.g., interesting work, employee empowerment, and promotion from within); in addition, it includes training and development opportunities for technical, managerial, and business KSAs.

Using cluster analysis, Ferratt et al. (2005) found different bundles, or configurations, of practices. One of those, the human capital focused (HCF) configuration, was high on all five human resource management practices. The HCF configuration also had the lowest turnover. Findings for other configurations are discussed in conjunction with the study by Ferratt et al. (2012).

Ferratt et al. (2012) extended Agarwal and Ferratt (1999, 2001) and Ferratt et al. (2005). Instead of asking CIOs, they asked IS/IT personnel about the human resource management practices used by their IS/IT organizations. Using factor analysis, they found four factors representing human resource practices—work environment and career development, social support, compensation, and security—similar to four of the five used in Ferratt et al. (2005). They used those as clustering variables to identify configurations of human resource management practices. Instead of investigating the relationship of practices to turnover, they investigated their relationship with job search behavior, a precursor to turnover.

What they found was a configuration that was high on all four human resource management factors and low on job search behavior, which is consistent with the HCF finding from Ferratt et al. (2005). They also found a task-focused (TF) configuration that was low on all four factors and high on job search behavior, which is consistent with a TF configuration found by Ferratt et al. (2005). The other configurations they found were consistent with configurations in Agarwal and Ferratt (2001) or Ferratt et al. (2005) with the exception that they did not find a secure configuration (high on security and low on other practices), which was identified in the 2005 study and had turnover between the HCF and TF configurations. What they also found is that the human resource practices in the two extreme configurations—HCF and TF—have synergistic effects. For the HCF configuration that means that job search is less frequent than would be expected from the independently additive effects of the practices, and for the TF configuration job search is more frequent than would be expected. Furthermore, they found that the human resource practices in all other configurations did not have synergistic effects.

The conclusion we derive from these studies is that retention is related to a variety of human resource management practices, including work environment and career development, social support, compensation, and security. These practices independently affect retention, and in extreme combinations (i.e., all high or all low) they synergistically affect retention. Thus, CIOs and the human resource managers supporting them may consider a number of practices independently and in combination to influence retention.
62.3 IS/IT Human Resource Development and Retention Practices

Practice is reflected in the research presented earlier. For example, KSAs that CIOs build or buy may be found in the results of research (e.g., see Tables 62.1 and 62.2). Similarly, human resource practices that CIOs use to retain IS/IT personnel may be found in the results of research (e.g., see Table 62.3). The research reported in the prior section has implications for practice that we discuss later.

We noted earlier that the IS/IT human resource strategy provides a context for understanding development and retention practices for IS/IT personnel. What may not be so obvious is that changes in how organizations use computer technology also provide such a context. In this section, we suggest that our understanding of who belongs in the category of “IS/IT personnel” and what they do has expanded as technology has changed and organizational use of computers has evolved. Discussion of this coevolution later provides this broader context for understanding IS/IT human resource development and retention practices and serves as a bridge to the final section on research issues for IS/IT personnel.

62.3.1 Implications of Research for Development and Retention Practices

An organization pursuing a strategy to buy its human resources from the external labor market would not expend significant resources to train and develop IS/IT personnel. Instead, it would recruit and hire individuals who possess the desired KSAs. Furthermore, an organization pursuing a buy strategy would not expend significant resources to retain these personnel. Instead, it would simply recruit and hire new IS/IT personnel to replace those who leave. On the other hand, an organization pursuing a strategy to build (or “make”) its human resources with the desired KSAs would want to invest significantly in training and development and in other human resource management practices designed to keep those employees from being hired away before the organization has the opportunity to recoup its significant investment in them.

Research on configurations of human resource management practices with respect to IS/IT personnel suggests that the buy and build strategies would have quite different configurations. An implication of findings from that research is that CIOs following a buy strategy and desiring a short-term relationship with IS/IT personnel would implement a TF configuration, which is low on all practices. In contrast, CIOs following a build strategy and desiring a long-term relationship with IS/IT personnel would implement an HCF configuration, which is high on all practices.

Build vs. buy strategies may affect the mix of roles for IS/IT personnel. The mix of roles determines needed KSAs, since KSAs differ by role. Beyond the overall strategy for obtaining human resources, some IS/IT organizations may seek to buy specific KSAs that are not core to their business, for example, via outsourcing, temporary external personnel, or short-term internal hires (Wu and Zmud 2010). They may choose to follow a different approach when obtaining KSAs that are core or necessary for their business strategy. A business strategy that considers the IS/IT organization a strategic asset would be consistent with the resource-based view of IS/IT personnel as strategic assets. An implication would be that IS/IT personnel KSAs that are core or necessary for the business strategy would be developed and retained through using an HCF configuration.

Although not a significant focus in prior studies, change management emerged in Kaiser et al.’s (2010) top 10 skills that are critical to keep within the IS/IT organization, rather than outsource, in high-wage regions of the world. Starkweather and Stevenson (2011) suggest that the ability to deal with ambiguity and change is one of the more important core competencies for project management success. Given the prevalence of changing technologies and organizational change associated with projects involving IS/IT professionals, Markus and Benjamin (1996) have argued for educating IS/IT professionals to become more effective agents of organizational change. An implication for educators is to develop curricula for developing KSAs focused on managing change. Although the IS 2010 model curriculum has some learning objectives and topics on change management (Topi et al. 2010), the focus on change management
could be further developed. The implication for CIOs is that they should work with educators to develop the needed educational changes.

KSAs related to change management, including project management, are important for success not only for IS/IT personnel involved in change efforts but also for end users, particularly user managers responsible for leading change efforts. Besides assuring that IS/IT personnel have needed change management KSAs, an implication for CIOs is that they should extend their focus beyond IS/IT personnel. Since the success of projects significantly involving IS/IT personnel is dependent on users, including user managers, CIOs should extend their role to influence the making or buying of non-IS/IT personnel with KSAs needed for leading change efforts.

The KSAs discussed in prior research have included knowledge of technological trends and technology as a means rather than an end. In the context of an organization’s business strategy, understanding how IT may be used to maintain and improve the organization’s competitive position could be critical to organizational success. An implication for CIOs is that their responsibility for internally developing or externally acquiring KSAs regarding information technologies may go beyond IS/IT personnel. They may need to work to influence managers throughout their organizations to identify and adopt IT to support business processes, with the goal of improving the organization’s competitive position.

### 62.3.2 Coevolution of Organizational Computer Use and IS/IT Personnel

Human resource practice related to IS/IT worker development and retention has coevolved along with the evolution of computing. During the postwar 1950s and 1960s computer technology migrated from exclusively military applications to also include business applications, which became widespread with such computers as the IBM 360. This first expansion of computer use was accompanied by terminology changes as *business data processing* entered the lexicon to characterize the use of the computer to solve finance, accounting, and operations research problems. And accompanying this new use of computers came an expansion in the personnel responsible for operating them. These first IS/IT personnel were required to have the specialized skills of credentialed computer scientists and engineers to create the programs that solved business problems and retrieved business information for others. By the mid-1970s, the pent-up demand for better and more timely information to support management decision making led to the reorientation of IS/IT in organizations as *management information systems* (MIS) and the emergence of IS/IT personnel with MIS degrees from business schools. It also coincided with the emergence of a new generation of smaller and more accessible computers. Two technological innovations that made information more accessible and timely for management decision making were Fourth Generation Languages and minicomputers.

The 1980s and 1990s witnessed increased miniaturization of technology and the merger of computing with communicating. Along with these technological innovations, came new personnel who were part of the computing labor force: *end-user computing personnel* and *data communications personnel*. Thanks to the portable “personal” computer that ran on off-the-shelf software, business people with limited knowledge about computer technology were now able to use them. This represented one of two “revolutions” of this time period: the end-user revolution. The second “revolution” was the telecommunications revolution that resulted from a combination of technological and policy changes. The technological innovations were packet switching, network interoperability, and open protocols. Policy change came in the form of global deregulation of telecommunications that served to increase competition and innovation. Whereas the end-user revolution of the 1980s was enacted primarily in the computing domain, the end-user revolution expanded in the 1990s into the telecommunications domain. By the 1990s, the World Wide Web, commercialization of the Internet, and conceptualization of national information infrastructures led to a further expansion of computer use—and associated computer personnel—signaled by the term *electronic commerce*.

Key technological trends of the 2000s and 2010s have centered around the convergence of telecommunications and computing, mobility, cloud computing, social media, and the ubiquitous IT capabilities...
that have resulted. Hence, the evolution of IT has resulted in an ever-expanding definition of IS/IT personnel. In the twenty-first century, personnel in this expanded role definition increasingly have come to be labeled as the *IT worker*. These individuals are distributed throughout the organization. Some are IS/IT specialists reporting to other business functions, some work in the centralized IS/IT department of a company, and some work for both new and established IT companies such as IBM, Microsoft, and Google. Finally, given the widespread accessibility of user-friendly computing thanks to PCs, the web, and mobile devices, a new community of IS/IT consumers outside of businesses has emerged.

### 62.4 Research Issues Related to IS/IT Professionals

Future research will be motivated by drivers of technological evolution, environmental forces, and questions that CIOs face. The pace of technological change shows no sign of slowing down. Mobility, ubiquity, and convergence appear to be the dominant technological trends for the foreseeable future. Further, the implications of social media are just beginning to be realized. At the same time, environmental forces such as increased globalization and an unstable economy will increasingly affect workforce development and retention. Unanswered and newly emerging questions related to needed KSAs and human resource practices for retaining IS/IT professionals for an appropriate length of time will be affected by these technological and environmental forces and will drive future research.

Technological trends and environmental factors will exacerbate the increasingly fuzzy line between users and “IT professionals” as they are increasingly labeled.* Hence, even as the two major IS/IT human resource development and retention questions facing CIOs will remain, new interpretations of these topics are entering the research space and new challenges will emerge. New areas for IS/IT human resources research relate to IS/IT workforce identity in the face of ubiquitous computing, end-user technical sophistication and empowerment, workforce diversity, globalization of the IS/IT workforce, and global economic instability. Hence, the research challenges that this part of the information systems field will face in the future will expand accordingly.

### 62.4.1 Expanding Boundaries of the IS/IT Profession

New forms of IS/IT work are resulting from new technologies and new uses that are discovered for them. This, in turn, leads to a broader definition of the IS/IT professional and new roles for these individuals. Subsequently, while existing topics related to development and retention will remain (e.g., Joshi and Kuhn 2011), new IS/IT human resource research topics will compete for center stage.

#### 62.4.1.1 Multiple IS/IT Disciplines and Paths to an IS/IT Career

While in the 1950s and 1960s the path to an IS/IT career had a single development path, by the 1970s this was changing. A bifurcation of computing work was in evidence, which further broadened the scope of who was considered to be a “computer person.” There was a growing recognition of different categories of “computer personnel”: some worked at companies such as IBM while others worked within the information systems departments of companies. This division, in turn, led to the evolution of an additional development path.

The earliest educational path into a career in computing—in the 1950s and 1960—was through computer science. In the 1970s, with the broadening of the focus of computing beyond computation into business applications, programs of study in business schools—MIS—began to appear. Throughout the 1980s, the dominant educational paths were computer science and information systems (the latter was also called MIS or computer information systems). Then, as the century was coming to a close, a third educational path emerged. The information school—or iSchool—movement grew out of computer

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* The term “IT professional” here is meant in the broadest sense of subsuming “information systems professional” and, hence, is meant to be equivalent to “information professional.”
science programs that were adding human issues—such as human computer interaction—to their curricula, as well as library science programs that were increasingly adding computer science and information systems perspectives to their programs. Finally, educational programs—called informatics—emerged that enabled individuals to study computer applications for settings other than business data processing (e.g., healthcare and government).*

As a consequence of this educational splintering, there is an IS/IT human resource development research challenge to better understand the relationship among these different educational paths and the similarities and differences among the KSAs that graduates from these programs will possess. Additional research issues relate to workplace development and retention issues. How will individuals from these varied educational backgrounds relate in the workplace? What additional corporate training will be needed to smooth out differences? With respect to retention, the more in-demand the area, the harder it will be to retain individuals with that expertise, assuming supply does not keep up with demand. Hence, there is a need for research to better understand how to retain these individuals.

### 62.4.1.2 IT Industry versus IT Occupation

The educational divide that was introduced in the 1970s signaled a larger IT career divide that is coming to considerably greater recognition in the twenty-first century, as explained later. In the late 1970s, the first major clarification about the IT labor force was published. This clarification emerged from a nationwide study conducted in 1977 that sharpened our emerging understanding of the IT labor force. A report to the U.S. Department of Commerce (Porat 1977) introduced the concept of an “information economy” and defined it as that portion of the labor force that is engaged in the production of information and information tools. This analysis divided the IT labor force into the primary information sector and the secondary information sector. The primary information sector includes IT workers engaged in the production of information and information tools—such as those who work at computer manufacturers, telecommunications companies, or software development firms. It includes those workers engaged in the production of information processing and communication hardware, software, information systems and services, and information content. In contrast, the secondary information sector includes that portion of the IT labor force that is engaged in information processing work in some other industry—such as banking or healthcare. Whereas the output of the primary information sector is the information or information tools such as computer software or communications technology, the output of the secondary information sector is a noninformation good/service such as healthcare, education, or government services (Trauth 2000, p. 5). While similar work such as programming occurs in both sectors, those in the secondary information sector are not considered to be part of the IT industry. Rather, they can be considered to be part of the IT occupation.

The development of IS/IT professionals and the enactment of their career paths increasingly occur along the lines of this division. Those individuals interested in careers in the primary information sector would most likely study computer engineering, computer science, and sometimes information science/informatics. Those inclined toward employment in the secondary information sector would study (management/computer) information systems, information science, and informatics. As a result, a number of IS/IT human resource development and retention issues are emerging that require further research.

While the distinction between primary and secondary information labor forces was articulated 35 years ago, it has not been fully incorporated into the development of IS/IT professionals. Further, the emergence of multiple educational paths (as outlined in Section 62.4.1.1) exacerbates the situation. Hence, there is a need for research to provide a better understanding of the human resource dimensions of the primary and secondary IT labor forces. This research will accompany the growing distinction between careers in the IT industry and careers in the IT occupations, and the number of different IT “disciplines” in which one could prepare for either career path. For example, Trauth et al. (2007) examined the implications of this labor force distinction for the notion of an industry cluster. Their conclusion

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* The School of Informatics and Computing at Indiana University is one such example.
is that in regions without a high density of firms in the primary information sector, Porter’s (2000) notion of “industry cluster” would not be helpful. In response, they introduce the concept of an “IT occupational cluster.” In addition, although Gallagher et al. (2010) suggest that the same KSAs are needed by all IT professionals, we suggest that more research is needed in better understanding the difference between the KSAs required of students intending upon careers in Google, for example, and students intending upon a career in health informatics.

62.4.1.3 Lateral Entry from Other Disciplines

The growing ubiquity of technology and a generation of increasingly sophisticated users is leading to an increasingly porous boundary between IS/IT professionals and lay people. The emergence of highly computer literate “power users” of IT is resulting in the growth of lateral entry into the IS/IT profession from other fields. And it is leading to yet another widening of the boundary that marks the IS/IT professional. The resulting IS/IT human resource research issues center around the development and career paths for these individuals. Although recent research has provided new insights into the career paths of individuals in the IT workforce (Joseph et al., 2012), many unanswered questions remain. Is this lateral entry occurring through formal education during career preparation (e.g., through students taking a double major or a minor in IS/IT) or is this lateral entry occurring in the workplace? Research is needed to learn the dimensions of this phenomenon and the implications for IS/IT workforce development both in universities and in companies. Further, additional research is needed about the integration of these “lateral entrants” into the IS/IT departments of companies. Research is needed that focuses on both management of the IS/IT workers and worker development to smooth out differences in educational backgrounds and fill in gaps in knowledge and skills. Finally, research is needed about the “make or buy” decisions relative to such training. Examples of questions of interest to IS/IT managers would be whether to fund employees to pursue an existing professional masters degree, contract with universities to provide a specialized degree tailored for a firm’s employees, or hire experienced workers who have already completed specific educational programs.

62.4.1.3.1 Globalization and Offshoring

Another expansion of the boundaries of the IS/IT worker has occurred geographically. The movement toward offshore outsourcing began in the 1970s with the first tentative steps by computer hardware manufacturers in high-wage countries such as the United States to low-wage countries such as Ireland (Trauth 2000). Gradually, the offshore work grew to software development and then to information systems processing so that by the 2000s this was a major part of a company’s IS/IT labor force strategy. The original “buy” decision with respect to the IS/IT labor force was to hire people with the needed KSAs or to outsource to a firm which could provide them. But in the past 30 years the outsource decision has become more complex as it quite often means offshore outsourcing. This globalization of outsourcing has produced a host of IS/IT human resource issues and accompanying themes requiring further research (Kaiser et al. 2010).

Research themes in this domain are related to differences in national IT infrastructure, the role of IT in a nation’s economy, public policies related to IT use, and cultural differences. These themes, in turn, need to be connected to identification and enactment of the new KSAs needed to successfully navigate in a global IS/IT workplace. For example, Huang and Trauth (2008, 2010) have focused on issues related to negotiating differences among people from different nationalities in offshoring work groups as well as how different ethnic or national groups react to varied human resource policies. They have done so through examination of cultural influences on the coordination of IS/IT work in geographically and temporally distributed workplaces, and cross-cultural management issues. Other research focuses on differences in the IS/IT profession at the country level.* Many of these studies focus on international samples of IS/IT workers in emerging economies such as China or India, with sporadic reports from

* Journal of Global Information Management is replete with research studies in this vein.

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Southeast Asia, Africa, or South America. This leaves much room for conducting further research into similarities and differences in the preparation of IS/IT workers and their work practices.

62.4.1.4 Diversified Workforce Composition

The movement toward offshore outsourcing that was firmly in place by the turn of the century was an early indicator of another force shaping IS/IT human resource development and retention in the twenty-first century: recognition of the need for a more diversified IS/IT labor force. Recognition of this need is accompanied by a considerable new research agenda for the field.

62.4.1.4.1 Diversity and Workforce Development

The early stereotype of an IS/IT professional (and indeed the image presented) was a middle-class white man with short hair, white shirt, and dark tie. This button-down image eventually gave way to more relaxed images of a computer professional, but they were still men and still white. The mandate for the twenty-first century IS/IT workforce coming from government, underrepresented groups, and private sector firms is for a radical makeover of the IS/IT labor force. In the future, the task of ensuring a supply of qualified IS/IT personnel is increasingly bound up with issues of diversity. As the use of IS/IT spreads and deepens in societies, the IS/IT profession is challenged with meeting the demand to enlarge the IS/IT workforce by recruiting and retaining personnel from historically underrepresented groups (Panko 2008).

Trauth (2011, pp. 561–562) explains that the motivation for greater human diversity in the IS/IT profession comes not only from labor force needs but also from environmental forces. First is the consumer argument. In an information society, in which all citizens are engaged in the consumption of information products, it is crucial that the varying needs of the entire consumer base be represented. The impending retirement of the baby boom presents the second, the demographic argument. The departure of a significant component of the workforce is compounded by the shift in countries such as the United States from a white majority. This trend coupled with projected growth in the IT sector over the next 10 years will produce a labor force demand that cannot be satisfied by white men alone. The third motivation for greater diversity is the innovation argument. As commodity production increasingly shifts to low-wage countries, developed countries are increasingly turning to innovation for economic sustainability. Greater divergent thinking resulting from more diverse groups of people in a supportive environment should lead to greater innovation. Indeed, Florida (2002) documented a connection between tolerance of diversity and the recruitment and retention of individuals with technology talent. Finally, there is the equity argument: all individuals, regardless of gender or ethnicity or other identity characteristics, should have the same opportunities to pursue a career in the IS/IT field.

Accompanying the desire to diversify the IS/IT workforce is the need for research to better understand what is keeping segments of society from entering the IS/IT workforce. An understanding of the barriers is the prelude to intervention efforts that must then follow on and be assessed. With a few exceptions, it was not until the late 1990s that IS/IT personnel research began to consistently include diversity. This is when the question of gender and ethnic diversity in the American IS/IT workforce was raised in research presented at IS/IT conferences. For example, as of 2011 the ACM SIGMIS Computer Personnel Research conference has included 43 papers on the topic of gender and the IS/IT workforce. But with the exception of a paper in 1971 and two in 1995, the remainder of the papers were presented since 1997. In recognition of the growing importance of this theme in IS/IT workforce research, the 2003 conference theme was diversity. While the need for research on gender issues and interventions continues (Trauth 2012; von Hellens et al. 2012), the new frontier for diversity research is race, ethnicity, socioeconomic class, and their intersection with gender (Trauth et al., 2012).

62.4.1.4.2 Diversity and Workforce Retention

Closely aligned with the need for research on the barriers to preparation for and entry into the IS/IT profession is the need for research into workforce retention issues as they relate to a more
diversified population. Bias and resistance to women and underrepresented minorities is one fruitful avenue of workforce retention research. Another is the influence of work life balance on retention. This topic has historically only been applied to women in the workplace. But the Millennials, including those in the IS/IT workforce, represent a different kind of worker from the baby boomers (Trauth et al. 2010). This generation of workers—men and women alike—is interested in work life balance. Another dimension of this research area is the cohort of seniors, who may have come out of retirement to reenter the labor force or who may want to work for the pleasure of it, and on their own terms. What motivates such workers and what it takes to retain them are not yet fully understood.

62.4.2 Environmental Influences on IS/IT Development and Retention

The evolution of IS/IT human resource research and practice does not exist in a societal vacuum. It is shaped not only by technological innovation but also by environmental forces. In the early part of the twenty-first century, environmental influences such as global terrorism and economic instability have shaped IS/IT human resource behavior. The emergence of global terrorism as the century dawned and increasing awareness of the value and risks associated with organizational investments in IS/IT have spawned the growth of a new strain of IS/IT professional: the information security expert. Such individuals are employed by both government and the private sector to protect precious information and technology resources from attack. Hence, there has been the concomitant growth of educational programs in security and risk assessment to prepare a cadre of IS/IT professionals to fill these positions.

In similar fashion, the global economic crisis during the first and second decades of this century has resulted in changes in IS/IT organizations as firms have closed, merged, and depended more heavily on IS/IT to produce internal efficiencies. The call to do more with less is familiar to CIOs and IS/IT personnel alike (Watson 2009). Depending on how it is managed, this call could lead to work exhaustion and turnover of IS/IT personnel (Moore 2000). In a weak economy IS/IT workers may find it more difficult to change jobs, however. At the same time, IS/IT organizations may find they can less readily implement human resource practices—even if they wanted to do so—that would make employment with them more attractive. Research is needed that examines human resource management practices of IS/IT organizations and their effects within the context of each organization's overall human resource strategy over various cycles of economic conditions. It would be informative to include in that research examination of at least the correlates of changing labor market conditions throughout the economic cycles. Of particular interest in this part of the research would be the effect of IS/IT worker undersupply and oversupply on turnover and the ability of IS/IT organizations to implement human resource practices that lead to a desired level of turnover. Given the expanding view of who IS/IT workers are, determining labor market supply and demand for IS/IT workers could be challenging. Further, there is a need for research into creative responses to these economic pressures. For example, Beekhuyzen and Bernhardt (2006) describe an innovative IS/IT human resource practice that shifts the focus from the traditional “one-firm–one-role-centric” employment to “multiple-firm–one-role-centric” shared employment across micro and small enterprises in Australia. Employment sharing is the converse of job sharing. Whereas the latter refers to a labor arrangement in which two or more individuals share one full-time job, the former refers to one person working in multiple organizations.

62.5 Summary

This chapter examined IS/IT human resource development and retention from the perspective of a CIO’s questions concerning the appropriate (1) KSAs required of the organization’s IS/IT personnel and (2) human resource practices to support the employment relationship with those personnel. We expect CIOs to answer these questions in the context of their organization’s human resource strategy.
That could lead them to "build" or "buy" KSAs and, correspondingly, implement human resource practices designed to maintain a long- or short-term employment relationship with IS/IT personnel.

We expect CIOs seeking a long-term relationship with productive IS/IT personnel to follow a "build" strategy. Human resource practices supporting a "build" strategy are those providing greater security, more career development, and, in general, greater outcomes for IS/IT personnel who remain with the organization for a longer period. In contrast, we expect CIOs whose organizational human resource strategy is to "buy" KSAs to use human resource practices that provide less security, less career development, and, in general, fewer outcomes that would lead IS/IT personnel to remain with the organization for an extended period of time.

As technology changes, technical KSAs needed by IS/IT personnel will change. Needed business, interpersonal, managerial, and project management KSAs will depend on the mix of IS/IT personnel roles. That mix is influenced by the make or buy decision.

Besides the organization’s human resource strategy, other factors influence the context within which CIOs decide on the KSAs needed by IS/IT personnel and the human resource management practices to support the employment relationship with IS/IT personnel. We discussed three such factors: the evolution of IT, the changing understanding of IS/IT personnel, and environmental forces. Given the trajectory of these forces, we expect them to continue as influential factors in the future.

In this chapter, we have also made several assumptions that might be examined and potentially revised in the future. First, we have assumed that the IS/IT organization seeks to align its human resource practices with the organization’s overall human resource strategy. In the future, this basic assumption could be challenged as other determinants of IS/IT human resource strategy clearly emerge from research or practice. Second, we have assumed that two divergent approaches to acquiring KSAs—make or buy—are determined by this alignment and will drive the implementation of human resource practices. Under a resource-based view of the IS/IT organization, IS/IT capabilities are considered strategic assets that provide sustainable competitive advantage. Such resources take time to develop and are considered hard to imitate. Buying these KSAs would not be consistent with a resource-based view of the IS/IT organization. Thus, we assume that when the IS/IT organization is viewed as a strategic asset KSAs are developed rather than bought. Future research could challenge this assumption as well. Finally, we have assumed that an IS/IT organization follows a single human resource strategy. But future conditions could force reexamination of this assumption. As intimated in the discussion of scarce KSAs, it continues to be necessary to understand the challenges that are associated with having more than a singularly focused strategy that implies a single build or buy approach to acquiring KSAs and a single set of human resource management practices for IS/IT personnel.

Radical changes in IS/IT human resource development and retention best practice and research may arise not only from rethinking underlying assumptions guiding research and practice but also from significant environmental influences. An example is the increased concern about information security, resulting from global terrorism and global hacking, that has inspired the rapid development of a specialty—information security—within the IS/IT profession. Finally, the spread and duration of global economic cycles may result in a significant rethinking of the employer–employee relationship for IS/IT personnel. Hence, the need for IS/IT personnel research to inform practice will be greater than ever in the future.

Further Information


References


