Information technology workforce skills: The software and IT services provider perspective

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Abstract It is now commonplace for an organization to turn to external firms for the provision of IT services and software. As technology advances and the business environment continues to evolve, a key challenge facing IT software and service providers is identifying critical skill sets, both today and in the future. The challenge is compounded as a result of the continuing growth of outsourcing and the increasing demand for technology solutions. This paper explores that challenge through a survey of IT software and service providers. We extend and complement previous studies of non-IT firms by comparing skills sought by non-IT organizations with those of IT services and software providers. Results indicate that, surprisingly, software and services providers place more emphasis on business domain and project management skills than on technical skills. This has implications for the hiring and retention practices of managers, and for academic curriculum and course offerings.

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1 Why study the information technology workforce?

The business environment continues to evolve at a dizzying pace. Advances in technology, emergence of new business practices, and shifting social and geopolitical circumstances have combined to create a "brave new IT world" for organizations. This has raised a host of intriguing challenges for managers and researchers alike. This paper explores one of those challenges: acquiring skilled information technology (IT) professionals. More specifically, it examines the current and future employee skill sets desired by IT software and service provider firms. We focus on providers as a follow-up to previous studies on non-IT firms[1] (Abraham et al. 2006; Zwieg et al. 2006) and because of the projected growth of these organizations as a result of increased demand for technology solutions and outsourcing.

Before proceeding further, a note on the terminology used in this paper will be helpful. While it is not the intent of this paper to provide definitive meanings for the following terms, it will be beneficial to ensure that key concepts are interpreted similarly by the readers, and in accordance with the authors' intent. We define "Information Technology" (IT) as a field about the analysis, design, development, implementation, support, and management of computer-based information systems, composed of software, hardware, people, procedures, and data (Davis and

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[1] "Non-IT firms" are defined as those whose primary business is the production of goods or services other than IT products or services (Abraham et al. 2006).

Olson 1985). Although the terms skills, capabilities, and competencies are often used interchangeably, we differentiate between them as follows. The term "skills" is defined as proficiency in a specific tool or method. It is the most basic level in a hierarchy of proficiencies. We view capabilities as the proficiency to adapt skills to broad sets of activities, and competencies as aggregates of capabilities (Abraham et al. 2006; Gallon et al. 1995). For this study, we will organize related skills into categories.

The use of IT service provider firms, commonly referred to by the generic term 'outsourcing,' is by now a well-accepted means for organizations to meet some or all of their IT needs. More recently, the traditional model of outsourcing has evolved to include offshore outsourcing, a global practice whereby professionals who provide IS services are located in different parts of the world from the firm that uses those services. In either case, the underlying concept is the same. One firm contracts with another for the provision of some or all of its IT functions. We refer to those requiring the services as non-IT, or *client*, firms whose primary business is the production of goods or services other than IT products or services (Abraham et al. 2006).

Client firms and their service providers have different missions. Thus, it seems reasonable to expect that they will require employees with different skill sets. This leads to a series of questions:

1. What skills do client organizations seek in their employees regarding the utilization of IT?
2. What skills do IT software and service providers seek in their employees regarding their IT service offerings?
3. Are there any differences in desired skills between client organizations and IT providers?

To address these questions, the Society for Information Management (SIM), an association of senior IT executives, consultants, and academics, recently sponsored a multi-year study of the IT workforce. In an exploratory study, a team of over twenty international U.S. and European researchers interviewed senior IT executives of client firms regarding their current and future workforce trends and skill requirements, effectively answering the first question (Zwieg et al. 2006). The purpose of this paper is to address the second and third questions by replicating and extending that previous research. This paper focuses on a complementary sample of IT provider firms for purposes of determining what skills IT providers seek in their employees, and identifying any differences between these skills and the skills desired by client firms.

This paper proceeds as follows. In the next section prior research into the IT workforce is reviewed. Then, a series of propositions is developed. They are explored using data gathered from senior managers and executives of IT providers. The results are presented, followed by a discussion of the findings, including implications for managers and researchers.

2 Prior research

There is a lengthy history of studies that confirm IT workforce issues as a key concern of practitioners. An ongoing series of focus groups involving senior IT managers have explored staffing issues since 1990 (McKeen and Smith 1995, 1996, 2003; Smith and McKeen 2006). Another series of studies has consistently identified the workforce as one of the top issues facing IT executives since 1980 (Ball and Harris 1982; Dickson et al. 1984; Brancheau and Wetherbe 1987; Niederman et al. 1991; Brancheau et al. 1996; Luftman and McLean 2004; Luftman 2005, Luftman et al. 2006). One outgrowth of managers' interest in this topic is the development of a large body of research investigating the IT workforce.

A prominent stream in IT workforce research is identifying and classifying skill requirements for IT professionals (Ang and Slaughter 2000). Generally speaking, prior research in this area has resulted in two broad categories of skills; technical, and non-technical. Technical skills basically consist of those skills specific to the IT field, including but not limited to knowledge and competencies associated with hardware, systems and application software, and telecommunications (Cash et al. 2004). The definition of non-technical skills is less precise, but generally includes (1) business skills (e.g., knowledge of the organization's structure, strategy, processes, and culture, and the ability to understand the business environment; Cash et al. 2004; Lee et al. 1995); (2) management skills (for the most part, the ability to perform some variation of the traditional management activities of planning, leading, organizing, and controlling; Lee et al. 1995; Igbaria et al. 1991); and (3) interpersonal skills (sometimes referred to as soft skills, these consist of such things as ability to communicate, ability to work in teams, relationship building skills, and leadership; Cappel 2001/2002; Cash et al. 2004; Lee et al. 1995; Litecky et al. 2004).

There are two themes underlying prior research on IT workforce skills. First is the notion that advances in technology and developments in the business environment have driven changes in desired skill sets of IT professionals. For example, one study found that the emergence of e-commerce and subsequent changes in business models led to changes in the skills required of IT professionals (Cash et al. 2004). Another study found that, as technology progresses, employers look for IT employees to have an expanding number and variety of skills (Gallivan et al. 2004).

The second theme is that practically all the prior research on IT workforce skills has examined the topic from the perspective of the individual employee; that is, what skills are necessary for an individual to have a successful IT career (Lash and Sein 1995; Lee et al. 1995; Lee 2005). There is scant research focusing on what individual skills organizations seek in their employees. It should be noted that this is distinct from research into what organizational capabilities and competencies are necessary for a firm to be successful. Organizational capabilities arise from a combination of many factors, including the firm's strategy, structure, technology base, and employee skill sets.

Drawing from these two themes, this paper extends previous research by investigating the specific skills sought by firms, from the organizational perspective. It does so in the context of a specific type of organization—IT service providers. Thus, this paper ventures into a hitherto under-researched area which is becoming more central since the outsourcing market volumes have been and will be steadily increasing. What little research there has been in this area delivers a consistent message—there are differences in the skills sought by IS providers and client firms (Levina et al. 2003; Slaughter and Ang 1996).

Software and IT service providers tend to employ professionals with skills that can be leveraged to develop IS products and services applicable to multiple organizations; in other words, technically-oriented skills. For non-IT firms, retaining such skills internally is not as critical, and may in fact be counter-productive in the face of a dynamic technical environment and an era of globalization (Slaughter and Ang 1996).

Different internal labor market strategies[2] are applied to different types of IT jobs. In general, a *craft* strategy is employed for technical jobs. Viewed from this perspective, technical positions are associated with skills that are non-organization specific (that is, they can be easily transferred from one organization to another). They tend to be filled by individuals hired from outside the firm. Conversely, an *industrial* strategy is utilized for non-technical jobs. Seen in this light, these types of jobs are organization-specific. They are typically occupied by individuals who have been with the firm long enough to acquire high levels of organization-specific knowledge and experience (Ang and Slaughter, 2004). Applying this to provider and client firms suggests that providers will seek technical skills, while clients will prefer non-technical skills.

Recent research findings complement this view. Skills which are perceived as critical for client firms should be retained in-house, as opposed to acquiring them in the market place. They are weighted towards skills that specifically contribute to the core mission of the firm. This includes such business-centric skills as industry knowledge, functional area process knowledge, and business process re-engineering knowledge. Skills that bridge business and technology, such as project management and systems analysis proficiencies were also considered important to be kept in-house. Conversely, skills that are more general and more technology-centric, such as programming, systems testing, and desktop support, were seen as most likely to be outsourced (Zwieg et al. 2006).

Conceptually, identifying and classifying critical IT capabilities may be done in several ways (Lee et al. 1995). One approach is to elicit specific skills from knowledgeable respondents. Then, using statistical techniques such as factor analysis, the skills can be grouped into empirically derived categories (e.g., Igbaria et al. 1991). However, prior research has noted the fluctuation of desired skill sets over time (Gallivan et al. 2004; Litecky et al. 2004). Based on this temporal variance, other scholars who have researched desired skill sets both at a fixed point in time and then projected into a future period—similar to this paper—have deemed the factor analysis approach not appropriate for this purpose (Lee et al. 1995).

A second approach is to use a theoretical foundation to define *a priori* the skill sets. One example of this approach is the categorization of skills according to the theoretical constructs of organizational and functional learning (e.g., Nelson 1991). Another example is the use of the career anchor model to identify skills that shape an individual IT professional's career (e.g., Ginzberg and Baroudi 1988; Lash and Sein 1995; Josefek and Kauffman 2003). From our perspective, however, there are two drawbacks to using a theoretical foundation to define the skill sets a priori. First, theoretically-based IT workforce research does not focus on identifying and categorizing skills per se, but rather on the relevance of those skills to a given problem domain, typically in the context of the individual professional's career. Second, the research has been conducted from the individual professional's perspective, not the organizational perspective. This paper's objective is to identify desired skills from the organization's perspective. Hence this approach is not suitable for our purposes.

A third approach groups skills into categories based on criteria to which respondents—in this case IS managers—can easily relate (Cappel 2001/2002; Cash et al. 2004; Lee et al. 1995). Some researchers favor this approach "because of its content validity, conceptual simplicity, and the ease of relating our findings to…management" (Lee et al. 1995, p. 321). This approach was deemed most appropriate for our purposes, in that it adds an element of relevance to the research that practitioners can appreciate. It also allows us

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[2] Internal labor market strategies consist of the organization's practices, policies, and procedures that govern employee hiring training, and retention (Kerr 1954; Osterman 1984).

to directly compare our results from IT service providers to results from client firms.

3 Skills categorization

For this study, we drew heavily on the list of skills used by Zwieg et al. (2006). We validated the categories used to group the skills through comparisons with prior studies, feedback from practitioners, and review by an expert panel.[3] The skills are more generic than specific, based on the fact that some specific skills identified in previous studies are rare today (e.g., microcomputer operating system skills), and some common current specific skills did not exist when early studies were conducted (e.g., Web development skills). For example, one of the technical skills identified in this study is "programming," as opposed to skills associated with a specific language such as Fortran or Java. See Table 1 for a list of the particular skills used in this study.

Consistent with previous studies, there is a *technical* category that emphasizes skills specific to the IT field (Cash et al. 2004), such as systems development life cycle skills (systems analysis, systems design, programming, and systems testing). In response to concerns voiced by senior IT managers and executives, this category includes security and business continuity skills, along with IT architecture skills (Luftman 2005; Smith and McKeen 2006). Also included are basic support skills such as operations, telecommunications, desktop support/helpdesk, and server hosting. Finally, fundamentals such as operating system, database, and mainframe/legacy skills are also included.

A second category consists of skills relevant to various aspects of the *business domain*, such as relating to the general business environment (industry knowledge), understanding the organization's strategy and structure, and the ability to integrate technology with business needs (functional area process knowledge; business process design/re-engineering). Of particular relevance to IT service providers are skills related to managing stakeholder expectations, managing change, and communicating. Joseph et al. (2006) predicted a curvilinear relationship of firm-specific training and experience with turnover. Applying this finding to our research, one would expect that mid-level IT professionals have more firm-specific training and experience such as business domain skills.

A significant activity undertaken by IT service providers is managing projects. Projects are integral to IT service

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[3] The panel consisted of a subset of the research team. There were six international IT academics and one IT practitioner with primary research interests and experience in IT human resources.

Table 1 IT workforce skills by type

Skills
Technical
Systems analysis
Systems design
Programming
System testing
Database design/management
Data warehousing
IT architecture/standards
Voice/data telecommunications
Operating systems
Server hosting
Security
Mainframe/legacy
Operations
Continuity/disaster recovery
Desktop support/helpdesk
Business domain
Industry knowledge
Company specific knowledge
Functional area process knowledge
Business process design/re-engineering
Change management/organization readiness
Managing stakeholder expectations
Communication
Project management
Project planning/budgeting/scheduling
Project risk management
Negotiation
Project leadership
User relationship management
Project integration/program management
Working with virtual teams
Working globally
Capability maturity model utilization
Sourcing—managing customers
Customer/product/service strategy
Customer selection or qualification
Contracting and legal
Managing customer relationships
Sourcing—managing suppliers
Sourcing strategy
Third-party provider selection
Contracting and legal
Managing third-party providers

providers, ranging from large and complex software package development and implementation to performing routine upgrades to simple customer support systems. As such, it is critical that employees of IT service providers possess a wide range of *project management* skills. Paramount among these is the basic ability to plan, budget, and schedule projects, along with the ability to manage project risk. These are key in any project, of course, but are

especially critical in outsourced projects (Taylor 2006). A complicating factor in outsourced projects is that service provider firms are often engaged in projects spanning multiple locations and organizations, and quite possibly multiple languages and cultures. Thus, skills associated with working globally, and working with virtual teams, are essential. Capability Maturity Model (CMM) skills and the ability to integrate projects are in more demand today than in the past, as are skills associated with coordinating multiple projects (i.e., program management skills). These become more valuable as employees advance beyond the entry level. Finally, tying the bundle of project management skills together is the project manager or leader. A recent study has confirmed that project leadership skills are associated with IT project success (Sumner et al. 2006). Thus, project leadership skills are highly desirable in IT service provider employees.

Skills particular to providers are those that focus on their clients. While one may argue that all IT professionals serve clients, software and service providers depend solely on customer organizations for their livelihood. In contrast, the relationship between an organization's IS function and its internal customers is not as precarious. The customer-facing skills we investigated involve how the provider firm determines its strategies, selects and qualifies its target markets, and manages the resulting relationship (Karmarkar 2004). The complexity of engagements requires contracting and legal knowledge (Lee 1996). The importance of nurturing sourcing relationships has brought new positions of relationship managers in both client and provider firms (Overby 2006). From the service provider's perspective, skills related to *managing customers* play a key role in client satisfaction Levina and Ross (2003).

Although client firms expect providers to fill their skill shortages, in order to secure or retain an engagement service providers may also need to turn to other providers as the source of work for either their internal needs, or more importantly to satisfy their clients (Feeny et al. 2005). IT providers need skills to determine their own strategy for sourcing, along with determining their criteria for selecting vendors. They have the same contracting and legal needs of their clients when the shoe is on the other foot to finalize and monitor contracts with their own providers. In short, service providers also require employees with the skills for *managing suppliers*.

To summarize, the skills used in this study, and their categorization, essentially duplicates the ones used by Zwieg et al. (2006). They were validated by reviewing prior research and soliciting feedback from practitioners and academics. This facilitates a direct comparison between IT service providers (the focus of this study) and client firms (the focus of the Zwieg et al. study).

4 Research methodology

The research team developed a Web-based survey derived from Zwieg et al. (2006) and customized it for provider firms. Participants were solicited from the Society for Information Management membership, researcher contacts, and various organizations focused on outsourcing. An effort was made to broaden the sample to include global representation. Having made a contact in the organization, one of the research team and the contact would determine who in the firm determines human resource strategy. It could be a vice president of human resources, a practice manager, or a chief executive officer. Upon securing permission from these individuals, they were e-mailed a unique identifier and the URL for an online survey. Data collection for this paper ran from October 2006 to April 2007.

There were some differences in how responses were obtained when comparing the use of the Web-based survey in the current study with the personal interviews conducted as part of the Zwieg et al. (2006) study. One difference was the inclusion of three items related to management of the internal IT function in the first study, and the inclusion of four items related to customer-facing capabilities in the second study. Internal IT management was not a relevant issue in the second study and hence these items were not included. Likewise, customer-facing capabilities did not come up in the first study (although user relationship capabilities did). Otherwise, the capabilities included in the first study and the second study were the same.

Perhaps the most important difference in data collection is that the first study used open-ended questions to identify capabilities that were critical and to identify capabilities that were sought in entry and mid-level hires. Respondents were not given a list of specific capabilities to respond to. Instead, interviewers used a key that identified 38 capabilities to code the open-ended answer by checking capabilities mentioned. The Web-based survey, however, provided respondents with a list of all capabilities, grouped according to the five skill categories discussed earlier. Without the prompting provided by the list of capabilities, respondents in the first study tended to identify a fewer number of capabilities as being critical or sought when hiring. An additional difference between the two studies is that the time frame for comparison in the first study was from 2005 to 2008, while it was 2006 to 2009 in the current study. In both studies, however, a 3-year time horizon was used when asking about current versus future needs.

The survey included three sections that asked questions about the 38 capabilities. The first section asked respondents about the capabilities their organizations need to maintain. The second and third sections asked respondents

to indicate the capabilities they desired in entry level and mid level employees, respectively. An excerpt from the survey is included in the Appendix.

The survey asked three different questions about each capability:

1. Is the capability considered critical currently?
2. Will the capability become critical for its employees over the next 3 years?
3. Will the capability decline in importance over the next 3 years?

While responses to each question were summarized separately, these questions were also used in determining whether a capability would be critical in the future. If a capability was critical today, it was considered to be critical in the future, unless it declined in importance. If a capability was not critical today, it was considered to be critical in the future when a respondent indicated that it would emerge as a critical capability.

Results were computed by counting how many times respondents checked a response to a question and dividing this total by the sample size to yield a percentage. This procedure was applied to the different questions for each of the capabilities. To determine the leading capabilities for each of the questions, we selected the ten highest percentages and included ties when two or more capabilities tied for at the tenth position.

As stated previously, this study is a replication and extension of an earlier exploratory study (Zwieg et al. 2006). The exploratory nature and research design of that study does not lend itself to formal hypotheses development. However, the results of that study, combined with the prior research discussed in Section 2 of this paper, lead to certain expectations, which we have presented as a series of propositions. These are discussed in the following paragraphs, and then evaluated using data from a sample of IT service providers.

Although there are many reasons why firms outsource, the two primary drivers are economic (to reduce expenses) and strategic (to focus on core competencies; Dibbern et al. 2004). Therefore, in order to be successful, an IT service provider must be able to either (1) generate economies of scale by leveraging employee skills to support multiple customers (e.g., generic programming, server hosting, telecommunications), (2) work closely with a specific customer or industry to meet more focused needs, or (3) do both.

The expertise necessary for service providers to offer a broad range of general IT services to multiple customers is based on technical skills specific to the IT industry. It is reasonable to presume that an IT service provider firm will expect its employees to possess these skills. In fact, basic technical skills are often used as a threshold or filtering device to separate desirable prospective employees from undesirable ones, especially at the entry level (Litecky et al. 2004). Furthermore, there is a movement by non-IT firms towards outsourcing non-core or technical skills, while retaining core or business-oriented skills in-house (Slaughter and Ang 1996; Zwieg et al. 2006), adding to the demand by service providers for technical skills. Moreover, while basic technical skills serve as entry-level credentials, over time, IT employees are expected to master additional technical skills (Gallivan et al. 2004). This leads to the first two propositions.

P1 For entry-level employees, IT service provider firms will have more demand for technical skills than client firms.

P2 For mid-level employees, IT service provider firms will have more demand for technical skills than client firms.

Technical skills by themselves are not sufficient for service provider firms to survive and prosper. Service providers also must work with their customers in applying those technical skills in a business context. This involves such customer-centric activities as analyzing user requirements and developing new processes or systems (e.g., systems analysis, systems design, business process design/re-engineering), participating in project teams (e.g., project management, teamwork), and understanding the customer's business environment (e.g., industry knowledge, company specific knowledge, functional area knowledge). While it is desirable for all the service provider's employees to have these capabilities, it is arguably more important for mid-level employees to possess them to a greater extent than entry-level employees, because mid-level employees generally have more interaction with customer employees. Thus, we can deduce proposition 3:

P3 For IT service provider firms, customer-centric capabilities are in greater demand for mid-level employees than for entry-level employees.

We received 104 responses to the survey. Seventy percent of the sample came from North American firms, 5% from firms in Western Europe, and the remainder from offshore locations such as India, Russia, Eastern Europe and Australia. Average firm size in term of full time equivalent employees was 5,466. More than 61% of the firms, however, had fewer than 1,000 employees. Sixty-seven percent of the firms had less than $500 Million USD revenue during the last fiscal year, 18% had revenue between $500 million and $3 billion USD, and the remaining 15% of the firms earned more than $3 billion USD. Seventy-six percent of the respondents were senior or executive level managers, with almost all of the rest (22%) being at the middle management level. The primary

Table 2 Highest ranked skills for IT firms—present and future

Rank today	Percent today	Type	Skill	Rank 2009	Percent 2009
1	79	Project management	Project planning/budgeting/scheduling	4	84
2	78	Business domain	Industry knowledge	1	88
3	77	Business domain	Functional area knowledge	5	83
4	77	Sourcing—customer	Managing customer relationships	10-tie	79
5	75	Project management	Project leadership	2	87
6	73	Business domain	Communication	7	81
7	70	Technical	Systems analysis	10-tie	79
8	69	Technical	Systems design		
9	69	Business domain	Company specific knowledge		
10	69	Project management	User relationship management	6	83
		Project management	Project risk management	3	86
		Technical	IT architecture/standards	8	80
		Project management	Working with virtual teams	9	80
		Business domain	BPR	10-tie	79

business of the responding firms is as follows; 55% provided software services, 36% were IT consulting firms, and 9% focused on IT infrastructure services.

5 Results

5.1 IT service provider firms

Table 2 shows IT firms' top ten highest ranked capabilities considered critical today. Table 2 also shows the capabilities the respondents thought would be most critical in the future. The skills are arranged by rank order for critical skills today. The first column shows the rank order based on the percent of firms that chose that skill. The second column shows the percentage of respondents that considered them critical. The third and fourth columns indicate the skill category, and the particular skill. The fifth and sixth columns indicate how participants projected what skills would be critical over the next 3 years. Although the order

of the top ten skills changes somewhat, there are few differences between the skills considered critical today and those considered critical in the future, with the exception of more skills included in the future due to ties in the rankings.

The skills primarily include business domain and project management capabilities. Only one technical skill is included during both time periods: systems analysis. This skill, albeit categorized as technical, also requires elements of business domain and client-facing skills. One technical skill—system design, another skill with business domain and client facing overtones—appears in the 'today' skills, but not in the future skills. A different technical skill, IT architecture and standards, is present in the future skills list.

For 2009 there are few projected changes in the general make-up of desired skills. Business domain and project management skills still predominate, although there is a trend towards more project management capabilities, such as project risk management and project planning, budgeting and scheduling. Other additions include working with virtual teams, along with IT architecture and standards.

Table 3 Lowest ranked skills for IT firms—present and future

Rank today	Percent today	Type	Skill	Rank 2009	Percent 2009
1	48	Sourcing—vendor	Managing third party providers		
2	47	Technical	Continuity/disaster recovery		
3	47	Sourcing—vendor	Contracting and legal	2	63
4	44	Project management	CMM utilization	3	59
5	43	Technical	Voice/data telecommunications	1	63
6	40	Technical	Desktop support/help desk	7	46
7	37	Technical	Operations	8	43
8	36	Technical	Operating systems	9	38
9	33	Technical	Server hosting	6	46
10	32	Technical	Mainframe/legacy	10	27
		Sourcing—customer	Contracting and legal	4	59
		Technical	Programming	5	49

Table 4 Entry-level skills desired by IT firms

Rank	Type	Skill	Percent
1	Technical	Programming	59
2	Business domain	Communication	57
3	Technical	System testing	55
4	Business domain	Functional area knowledge	47
5	Project management	Project planning/budgeting/scheduling	46
6	Business domain	Industry knowledge	44
7	Project management	User relationship management	43
8	Project management	Working with virtual teams	43
9	Technical	Systems analysis	42
10	Technical	Desktop support/help desk	41

Furthermore, it is interesting to note the IT firms' lowest ranked skills, both current and future (see Table 3). Technical skills predominate in both time periods, indicating that these types of skills are not considered critical by our respondents. This is somewhat surprising, given that the respondents are all from IT service providers, whom one might naturally expect to value technical skills.

Table 4 presents the entry-level skills desired by IT provider firms. These show less technical skills than expected. The lower percentages in this table compared to Tables 2 (most critical skills) and 5 (mid-level skills) can be interpreted two ways. One, it could be that a number of our responding firms do not hire at the entry-level. Two, there could be a greater variation in entry-level skills desired by the responding firms than in skills considered critical (Table 2) or skills desired in mid-level employees (Table 5).

The results for desired mid-level skills in provider firms are shown in Table 5. There is a greater emphasis on project management and business domain skills. Even the technical skills included reflect a shift away from primarily technical capabilities and towards more customer-facing skills. This provides support for proposition 3.

We also asked IT provider firms to tell us what skills were emerging or becoming increasingly important. Table 6 shows the top ranked ones. The top two ranked emerging skills clearly show an emphasis on a global model of development, indicating an expectation that offshoring in some form will continue to play a significant role in IT service delivery in the foreseeable future.

Finally, we asked IT provider firms what skills were declining in importance because they will become irrelevant, automated, or outsourced to other IT firms. Most of these declining skills shown in Table 7 are in the technical category. Nine of the ten skills declining in importance are also among the capabilities that received low rankings for being critical now and in the future (see Table 3). This suggests that these skills are increasingly becoming commoditized. They may be necessary to an IT service provider firm, in the same sense that electricity is, but they are not viewed as providing competitive advantage.

5.2 Comparison of IT firms and non-IT firms

Tables 8, 9, and 10 contain results for skills from the current study on IT firms and comparable results for client firms from the prior study (Zwieg et al. 2006) on critical skills for the future, entry-level, and mid-level skills.[4]

Table 8 compares the rankings of the top critical 2009 skills for IT firms with the highest-ranked critical 2008 skills for client firms. The results indicate that, overall, IT organizations perceive no more need for technical capabilities than their clients. Both types of firms had only one technical skill among their top ten critical skills. IT firms placed more emphasis on project management skills by including more of these skills among the highest ranked critical skills and by the somewhat higher rankings for these items.

With regard to new hires, the comparison shown in Table 9 reveals that, while both types of firms rank programming and system testing highly, client firms tend to be much more interested in technical skills than the firms to which they outsource. Provider firms place much greater emphasis on project management skills, and rank business domain capabilities higher, than do client firms. This indicates that the first proposition is not supported.

Table 10 shows that the results for mid-level hires at IT firms are very similar to those of client firms. Project management and business domain skills predominate. The three technical skills that are in the top ten—systems analysis, systems design, and IT architecture/standards—are arguably the technical skills that require the most knowledge of and interaction with both project management and the business domain, and hence fit well with the other highly ranked skills. Although the exact rankings differ somewhat, both types of firms agree on nine of the top ten desired skills. This indicates that there is virtually no

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[4] Please note that the original study of client firms asked the respondents to list desired skills, while the survey of IT firms presented respondents with a list of skills derived from the original study. This may account for some of the differences in results.

Table 5 Mid-level skills desired by IT firms

Rank	Type	Skill	Percent
1	Project management	Project planning/budgeting/scheduling	78
2	Project management	Project leadership	76
3	Business domain	Industry knowledge	74
4	Business domain	Functional area knowledge	74
5	Project management	User relationship management	73
6	Project management	Project risk management	71
7	Business domain	Communication	68
8	Technical	Systems analysis	66
9	Technical	Systems design	66
10 (tie)	Project management	Working with virtual teams	63
10 (tie)	Technical	IT architecture/standards	63
10 (tie)	Project management	Negotiation	63

difference in the skills desired by IT and client firms for mid-level employees. Thus proposition 2 is not supported.

6 Discussion

6.1 Technical and non-technical skills

The results are consistent across the three analyses of skills: overall critical skills, entry-level, and mid-level. In all of these, for IT provider firms, technical skills are not as important as other types of skills. They rank the lowest as a group of skills in comparison to the groups of business domain, project management, and sourcing capabilities. This is counterintuitive, given that one would reasonably expect firms whose core business is providing IT products or services to attach a high degree of importance to skills that are fundamental to doing so. Upon reflection, however, it may be that our respondents, who are senior managers and executives, view technical skills as necessary to achieving their mission, but not critical in the sense that those skills lead to a competitive advantage. In other words, basic technical skills such as the ability to program are

essential, but do not differentiate one firm from another in the same sense that project management or business domain skills do. Thus, they may be perceived as a necessary but not sufficient condition.

The findings are also consistent with research on client firms (Zwieg et al. 2006). Again, this is somewhat surprising because in that study client firms indicated that they would primarily seek technical skills from their providers. In fact, six of the top eight skills identified as critical to keep in-house by client firms are also in the top ten critical skills identified by provider firms. Project management capabilities predominate. Reflecting on this finding leads to the implication that the provider firms are more interested in higher-level IT work (e.g., systems integration) than 'commodity' work such as programming and basic development. This reinforces the growing perception that many offshore firms desire to move up the value chain beyond programming. They see their future in the higher level work. Furthermore, most of the offshore outsourcers now have US and European locations, making virtual teamwork skills even more important. Domestic provider firms with offshore locations are also quickly learning to appreciate skills necessary for working virtually.

Table 6 Skills emerging in importance/becoming more critical

Type	Skill	Percent
Project management	Working with virtual teams	64
Project management	Working globally	63
Technical	IT architecture/standards	59
Business domain	Industry knowledge	56
Sourcing—vendor	Managing third party providers	56
Business domain	Change management	55
Business domain	BPR	54
Business domain	Communication	53
Technical	Security	51
Project management	User relationship	51

Table 7 Skills declining in importance

Type	Skill	Percent
Technical	Mainframe/legacy	40
Technical	Programming	35
Technical	Operating systems	24
Technical	Desktop support/help desk	24
Technical	Server hosting	22
Technical	Operations	18
Technical	System testing	15
Project management	CMM utilization	14
Technical	Voice/data telecommunications	13
Sourcing—customer	Contracting and legal	9

Table 8 Critical skills for IT firms and client firms

IT firms rank 2009	IT firms percent 2009	Type	Skill	Client firms rank 2008	Client firms percent 2008
1	88	Business	Industry knowledge	6-tie	65
2	87	Project management	Project leadership	6-tie	65
3	86	Project management	Project risk management	8	64
4	84	Project management	Project plan/budget/scheduling	1	76
5	83	Business domain	Functional area knowledge	2	72
6	83	Project management	User relationship management	_a	_a
7	81	Business domain	Communication	_a	_a
8	80	Technical	IT architecture/standards	_a	_a
9	80	Project management	Work with virtual teams	_a	_a
10-tie	79	Technical	Systems analysis	4-tie	66
10-tie	79	Business domain	BPR	4-tie	66
10-tie	79	Sourcing—customer	Managing customer relationships	_b	_b
_a	_a	Business domain	Company specific knowledge	3	69
_a	_a	Technical	Systems design	9	63
_a	_a	Business domain	Change management	10-tie	59
_a	_a	Sourcing—vendors	Managing third party providers	10-tie	59

[a] These skills were not in the top 10
[b] This skill was included only in the current study

Respondents had mixed views about programming skills. Approximately as many firms designated it as a critical skill as those that designated it as a skill declining in value. There are several possible explanations for this, depending on the role of IT in the respective firms. An organization with highly specific processes and/or products will have a greater demand for programming skills. Another interpretation is that organizations where the respondent indicated the importance of programming was declining may specialize in the higher level analysis and design rather than basic development work (e.g., programming and systems testing) because they believe the higher level work will be more lucrative. These firms may outsource the programming they need to complete projects for clients. In addition, some domestic providers may feel threatened that offshore firms are moving up the value chain. Consequently, they are responding by honing their expertise in higher level areas rather than compete with development work where offshore organizations have a labor arbitrage advantage and a growing reputation.

Table 9 Comparison of entry-level skills desired by IT firms and client firms

IT firms rank entry level	IT firms percent entry level	Type	Skill	Client firms rank entry level	Client firms percent entry level
1	59	Technical	Programming	1	48
2	57	Business domain	Communication	5	29
3	55	Technical	System testing	3	35
4	47	Business domain	Functional area knowledge	_a	_a
5	46	Project management	Project plan/budget/scheduling	_a	_a
6	44	Business domain	Industry knowledge	10-tie	19
7	43	Project management	User relationship management	_a	_a
7	43	Project management	Work with virtual teams	_a	_a
9	42	Technical	Systems analysis	2	44
10	41	Technical	Desktop support/help Desk	6-tie	27
_a	_a	Technical	Systems design	4	33
_a	_a	Technical	Voice/data telecommunication	6-tie	27
_a	_a	Technical	IT architecture/Standards	8	25
_a	_a	Technical	Database design/management	9	23
_a	_a	Technical	Operating systems	10-tie	19

[a] These skills were not in the top 10

Table 10 Comparison of mid-level skills desired by IT firms and client firms

IT firms rank mid-level	IT firms percent mid-level	Type	Skill	Client firms rank mid-level	Client firms percent mid-level
1	78	Project management	Project plan/budget/scheduling	1	56
2	76	Project management	Project leadership	2	55
3	74	Business domain	Industry knowledge	7-tie	44
4	74	Business domain	Functional area knowledge	9	42
5	73	Project management	User relationship management	4-tie	48
6	71	Project management	Project risk management	3	52
7	68	Business domain	Communication	_[a]	_[a]
8	66	Technical	Systems analysis	4-tie	48
9	66	Technical	Systems design	6	45
10-tie	63	Project management	Work with virtual teams	_[a]	_[a]
10-tie	63	Technical	IT architecture/standards	7-tie	44
10-tie	63	Project management	Negotiation	_[a]	_[a]
_[b]	_[b]	Project management	Project integration/program management	10	41

[a] These skills were not in the top 10
[b] This skill was included only in the prior study

6.2 Entry level and mid-level skills

The types of skills IT provider firms desire for entry-level employees are more diverse than those desired by client firms, which are primarily technical. One possible interpretation of this disparity is that client firms view entry-level positions as a training ground or place to prove one's worth more so than IT firms. Another possibility is that the emphasis on client-facing or customer-centric skills for provider firms implies that these organizations expect their employees to be able to work well with customers from day one. In fact, many domestic consulting firms now do take new hires to client sites soon after their orientation and training are completed, even if they have formal training programs.

At the mid-level, the demand for project management capabilities is no surprise. Project management is a necessity for the bulk of sourcing engagements, and may involve managing clients' employees on teams. The increasing emphasis on certifications and project management experience is apparent in job listings. Managing virtual teams is an acquired skill. Client firms would naturally look to their sourcers for more expertise in this capability than they might have in house. The high ranking of IT architecture and standards reflects the pervasiveness recently of frameworks such as the Information Technology Infrastructure Library (ITIL—a widely accepted formal approach to IT service management) and Control Objectives for Information and related Technology (COBIT—a framework of best practices for IT control and management).

Comparing mid-level needs of client and provider companies shows few differences. They are almost identical. This may be heartening to a generation that has little organizational loyalty. They not only can easily change jobs but they could easily transfer from a client firm to a provider firm and vice versa multiple times during their career. These career choices present more options to the individual.

6.3 High ranking and emerging skills

Two skills are highly valued by IT firms, appearing in the top ten skills across the board (highest ranked capabilities present, future, entry-level, mid-level, and emerging in importance). Both of these are from the business domain category; industry knowledge, and communication. The importance of industry knowledge could stem from two sources. One, some providers' strategy is to target specialized vertical markets where industry knowledge is valuable (i.e., niche differentiation). Two, providers in general seek to achieve economies of scale. Hiring employees knowledgeable in a particular industry is one way to leverage the firm's knowledge base. As for communication skills, they are fundamental and vital to several other desired skills from the other categories, including systems analysis (technical), working on projects and with teams (project management), and managing customer relations (sourcing—managing customers).

A global world is more reflected in the provider firms than the client firms. This could be due to the number of offshore organizations in the sample and the preponderance of domestic firms that have captive centers in global locations. This may explain the high ranking of sourcing capabilities such as managing third-party providers. It appears that many of the outsourcing firms also outsource to other outsourcers and that skills related to this practice

are important enough to appear in the higher ranked capabilities.

The importance of security is rising and shown as an important skill for organizations offering IT services. Occurrences of change management, business process re-engineering, and IT architecture and standards are not surprising because these issues are important aspects of implementing IT to support the value chain outside the organization (e.g., Enterprise Resource Planning and Customer Relationship Management systems), as well as recent developments such as Service Oriented Architecture, Net 2.0, and the Information Technology Infrastructure Library (ITIL). They may also signal intentions on the part of IT service providers to move up the value chain from programming to involvement in the full set of development activities, and for partnering with client organizations on larger-scale initiatives involving multiple application areas where these capabilities would be critical.

6.4 Implications for the IS community

The percentages for skills considered to be declining in importance (Table 7) were lower than the percentages for skills considered to be increasing in importance (Table 6). This finding reinforces the conclusion of Gallivan et al. (2004) who found that as technology evolves and new technologies emerge, employers expect their employees to add more and more skills to their repertoire, while maintaining the skills they already possess.

The lowest ranked skills for the future are mostly technical (Table 3). The occurrence of contracting and legal skills, and CMM utilization skills in this group could indicate that these are not an issue for most organizations. The CMM is perceived by some as a marketing tool rather than a true strategic differentiator, perhaps because CMM adherence is beginning to permeate the workforce. Mainframe legacy skills appeared as the lowest ranked skill, both present and future. This could portend unfortunate future consequences, given the pending baby-boomer retirements. It may be that sourcing firms do not see this market as lucrative, perceiving the mainframe as dead. Or if they do see it as lucrative market, they may be doubtful that they can service it, given there are few people with these skills, many of whom are nearing retirement, while the younger generation is not being trained in mainframe skills. The overall implication of this study—that IS provider firms value business-oriented skills more than technical ones—was somewhat unexpected. Upon further reflection, we now believe this should not have come as a surprise. Years of research have indicated that non-technical skills are more valuable to internal IT departments than technical skills. The fact that the IS 'department' now resides outside the organization should not diminish the value of those skills.

In fact, recent research has suggested that IS providers should possess a collection of core capabilities based on technical and non-technical skill sets (Feeny et al. 2005). Thus future researchers should feel comfortable in extending past studies on internal IS skills and capabilities to the sourcing realm.

One of the largest concerns of IT management is being able to hire and retain valuable talent. With fewer people in the workforce pipeline and impending baby-boomer retirements, coupled with increasing demand for technology, managers will have more difficulty acquiring needed skills. The similarity of what client companies and IT industry companies want in their skills portfolio means that competition for talent will be across these two types of firms more so than in the past when client firms sought technical skills from their providers. The implication for individual career development is that one can easily move back and forth from a client organization to a provider with no hazards to career growth or limiting opportunities.

Although client firms said they wanted technical skills in their entry-level professionals, provider firms were less concerned about these capabilities for their entry-level professionals. Because of this the provider companies may have an easier road grooming their entry-level candidates to become business analysts and project managers than their clients will. This may very well add more impetus to the outsourcing/offshoring movement, and quite possibly lead to a self-fulfilling prophecy whereby a steady growing number of IT jobs move from client firms to service providers.

Research needs to study these trends longitudinally to monitor changes. A different approach is to measure at the individual level rather than at the organizational unit of analysis.

6.5 Limitations

When considering these results some limitations of the study should be kept in mind. First, the data for this paper was collected between October 2006 and April 2007. A second round of data collection is ongoing at the time of writing. Thus, while we expect the additional data to confirm the findings reported in this paper, at this point they must be considered preliminary.

Secondly, the time frame difference between the first phase and the second phase should also be noted. The 2005 data collection was performed during a time when the job market was beginning to revive from a recession. While skill needs were changing during that period, one can imagine that those skill needs may be changing even more rapidly in the next 18 months when the second phase data collection occurred.

A third limitation of the comparisons of the two data sets is that the first phase had few global locations outside of the

United States, while the second data set collected from IT service providers had much more international representation. Because the second data set has not only a more global representation but also some significant representation from offshore outsourcing countries (in particular, India and Russia), one would expect more emphasis on technical skills such as programming and testing that require less face-to-face client interaction. Inclusion of firms from offshore outsourcing countries also infers that they are doing business globally and not just in their domestic sphere. This necessitates competencies for professionals to work virtually and appreciate cultural differences.

Finally, the methodology used in this paper is a comparison of rank-ordered lists. Although this is not a sophisticated statistical analysis technique, it captures the essence of our research objectives. It accurately reflects basic truths and trends as conveyed by the respondents. Reports about the IT landscape using similarly straightforward analyses have informed the IT community (academics and practitioners) about workforce trends in the past (Ball and Harris 1982; Brancheau et al. 1996; Brancheau and Wetherbe 1987; Dickson et al. 1984; Luftman and McLean 2004; Luftman 2005; Luftman et al. 2006; Niederman et al. 1991).

The implications for individuals, hiring firms, and institutions of higher education are clear. Individuals should acquire a set of diverse skills that include not only technical ones, but business-related and 'soft' skills as well. Organizations must be aware of pending shortages of and competition for well-rounded and qualified individuals, and implement training and retention programs to attract and retain capable employees. Colleges and universities must make curriculum changes to better prepare students for this new reality. Finally, the IT industry as a whole must communicate the message to the world at large that there are and will continue to be rewarding career opportunities for IT professionals.

7 Summary

The research describes fundamental shifts in the nature of capabilities and skills of IT professionals. Although IT professionals have been highly valued for their technical expertise, business acumen and the ability to manage projects are essential not only for IT professionals in non-IT firms but also for those professionals whom they contract for services to enhance their staffing. These characteristics are in demand at mid-level careers and increasingly for entry-level hires. Organizations will need to groom IT professionals to develop these skills and to work with educational institutions to convey the importance of the changing skill needs.

Appendix

Survey excerpt

(Note: The actual survey was conducted via the Internet. The following represents a portion of that survey. It is intended to give the reader a basic understanding of the survey's wording and format.)

****

This set of questions focuses on the capabilities your organization wants to maintain. Please answer the following questions for your organization unit.

The following tables ask about critical IT capabilities for your organization unit. There are sections on technical, business domain, project management, and sourcing capabilities in the rows, along with three columns related to changes over time.

Critical 2006: Check the boxes of IT capabilities your organization has decided are CRITICAL (most important) to obtain from employees in 2006. Please do not include those sourced from contractors.

Emerge/more critical 2009: Check the boxes of IT capabilities your organization expects will EMERGE in importance by 2009 and/or become MORE CRITICAL to obtain from employees.

Decline 2009: Check the boxes of IT capabilities your organization expects will DECLINE in importance by 2009 because they will become irrelevant, automated, or outsourced.

Technical	Critical 2006	Emerging/ more critical 2009	Decline 2008
Systems analysis			
Systems design			
Programming			
System testing			
Database design/management			
Data warehousing			
IT architecture/standards			
Voice/data telecommunications			
Operating systems			
Server hosting			
Security			
Mainframe/legacy			
Operations			
Continuity/disaster recovery			
Desktop support/helpdesk			
Other technical capabilities that are Critical for 2006			
Other technical capabilities that will Emerge/Be more critical for 2006			
Other technical capabilities that will Decline by 2009			

Business domain	Critical 2006	Emerging/ more critical 2009	Decline 2008
Industry knowledge			
Company specific knowledge			
Functional area process knowledge			
Business process design/re-engineering			
Change management/ organization readiness			
Managing stakeholder expectations			
Communication			
Other business domain capabilities that are Critical for 2006			
Other business domain capabilities that will Emerge/ Be more critical for 2006			
Other business domain capabilities that will Decline by 2009			

Project management	Critical 2006	Emerging/ more critical 2009	Decline 2008
Project planning/budgeting/ scheduling			
Project risk management			
Negotiation			
Project leadership			
User relationship management			
Project integration/program management			
Working with virtual teams			
Working globally			
Capability maturity model utilization			
Other project management capabilities that are Critical for 2006			
Other project management capabilities that will Emerge/ Be more critical for 2006			
Other project management capabilities that will Decline by 2009			

Sourcing—managing customers	Critical 2006	Emerging/ more critical 2009	Decline 2008
Customer/product/service strategy			
Customer selection or qualification			
Contracting and legal			
Managing customer relationships			
Other sourcing capabilities that are Critical for 2006			
Other sourcing capabilities that will Emerge/Be more critical for 2006			
Other sourcing capabilities that will Decline by 2009			

Sourcing—managing suppliers	Critical 2006	Emerging/ more critical 2009	Decline 2008
Sourcing strategy			
Third-party provider selection			
Contracting and legal			
Managing third-party providers			
Other sourcing capabilities that are Critical for 2006			
Other sourcing capabilities that will Emerge/Be more critical for 2006			
Other sourcing capabilities that will Decline by 2009			

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