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ABSTRACT

The increasingly global sourcing[1] of information technology (IT) work is prompting fundamental changes in the availability of IT skills needed in both client and vendor organizations. In the summer of 2005 the Society for Information Management (SIM) sponsored of an international data collection effort by 20 researchers[2], is, who investigated how these factors affect the skills, capabilities and experience available to the IT organization within firms, that the IT workforce pipeline.

This paper uses that data to conduct an analysis of the IT skills and capabilities that are valued by top management of IT organizations and understand how those skills and capabilities are acquired. The analysis focuses on:

- Skills and capabilities hired in house versus those acquired through sourcing
- Trends in full-time equivalent (FTE) numbers through 2008 looking at how FTEs are distributed among in-house, independent contractors and service providers

KEYWORDS (REQUIRED)

IT workforce, outsourcing, sourcing, workforce pipeline, declining university enrollments.

INTRODUCTION

This is a challenging time for the IT workforce with declining university IT enrollments, pending baby boomer retirements and reallocation of the full-time equivalent workforce between global sourcing and in-house employment. The SIM membership, made up of primarily CIOs is vitally concerned about these factors and their impact on the profession. Thus, SIM sponsored a data collection effort to support analysis of workforce trends. An executive summary of the comprehensive report of the SIM study is available at http://www.simnet.org/. This paper focuses on one research question: "Is there a future in pursuing a career in IT?" The answer we propose is that there is a future, but that, based on the interviews with IT management, the balance of technical and non-technical skills is changing.

The results should prove useful to academics and practitioners. The patterns of skills desired in-house will help academic programs to better prepare graduates for work in organizations. Practitioners will be able to better understand the movement of skills out of their organizations due to the impact of strategic sourcing decisions.

LITERATURE REVIEW

The literature on the IT workforce and on IT outsourcing is extensive. Due to space limitations an overview of the pertinent literature will be presented here. Other articles resulting from research on this database may be accessed for a more thorough sense of the literature.

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[1] The word "sourcing" in used throughout this document to prevent confusion about where the sourcing activity is taking place. Unfortunately in recent publications the word "outsourcing" has come to mean sourcing to a location outside the country of the client organization. While this is not strictly correct, it has become common and therefore has introduced confusion in the meaning of the word.

[2] Please see Acknowledgements for the names of the researchers.

Much of the literature on the IT workforce has focused on hiring patterns based on the changing needs for technical skills (Prabhakar, Litecky and Arnett, 2005; Litecky, Prabhakar and Arnett, 1996; Koong, Liu, Liu, 2002). The dynamics of the change are generally attributable to the "software du jour" influencing the needs of organizations. For example in recent years, demand for skills related to JAVA and Web-based tools has increased. This research area sheds light on the specifics of technical skills, but does not look at other non-technical skills in any depth.

Some studies have looked broadly at the importance of non-technical skills versus technical skills and have shown that managers rate non-technical skills higher than technical skills even for entry-level employees. In addition, managers' expectations with regard to the non-technical abilities of new hires are usually higher than the actual ability the new hires exhibit (Cappel, 2001; Van Slyke, Kittner and Cheney, 1998). An earlier paper looked at the "expectation gap" between what skills and experience industry expects from college graduates in IT versus what they find (Trauth, Farwell and Lee, 1993). A survey of ACM SIGCPR proceedings resulted in the same general conclusion that non-technical skills were equally or more important than technical skills for IT professionals (Nakayama and Sutcliffe, 2001). A literature review looking at IT workforce, skills, employment and outsourcing tends to uncover many articles which focus on the movement of "non-core" IT skills out of the corporate organization and into the realm of service providers, both foreign and domestic (Slaughter and Ang, 1996). The characterization of core vs. non-core has been drawn into question as most managers cannot clearly define what skills are core versus non-core. Lacity, Willcocks and Feeny (1995) explored whether managers can differentiate between IT systems that are strategic versus commodity and found that they could not. Furthermore, firms and their competitive environments change over time and skills considered core today may not be tomorrow's core skills. Therefore the value of these generalizations is suspect and they do not provide guidance for the student or manager on the differential value of IT skills.

An assessment of workforce globalization found that businesses want to retain certain kinds of IT services and software work in the United States (Anonymous, 2004). The report states that the characteristics of such IT work includes the following categories: products or processes in which there is uncertainty about customer needs or specifications, projects requiring highly iterative development processes, work that involves a high degree of personal interaction with end-users or clients, work that crosses many disciplines, applications with complex procedures, applications that involve a high degree of integration with other systems developed and maintained onshore, work involving nuances or deep cultural understanding, work in which much of the knowledge exists only in the minds of the onshore IT staff, analytical tasks, leading-edge research, non-rule-based decision-making, high levels of creativity, high management interaction requirements, process design, business analysis, technology and systems integration, and fusion of industry knowledge, high level IT skills, and business process expertise. Several articles have applied theories from diverse fields to study IT skills and the approach to outsourcing. Gomes and Joglekar (2005) have applied the theory of transaction cost economics to explore the nature of software development tasks that remain in-house. Their analyses show that process asset specificity indicated by task interdependence and task size predicts outsourcing the task. Understanding the factors that contribute to whether a skill remains in house or is sourced is an important aspect of our research.

RESEARCH METHOD AND DATA ANALYSIS

The data collection was carried out from May to October 2005 using a standardized interview outline (that had been pre-tested on a small sample) and both face-to-face and telephone interviews. All researchers used the same outline and spent approximately one-hour with each respondent. The resulting data was integrated into one database for all researchers to use in conducting their analyses. Of the over 104 interviews that were conducted, 96 (87 distinct organizations) resulted in sufficient data for analysis. Organizations were categorized into three groups by revenue size, SMEs (less than $500million), Large ($500million to $3billion) and Fortune 500 (over $3billion). They were also assigned NAICS codes for industry classifications.

Questions on the outline consisted of statistical data and multiple choice answers. This facilitated the analysis process. In addition there were textual answers that were developed into short cases and were used to clarify the multiple-choice answers when the database was integrated from the individual responses.

Questions covered the following topics:

- What skills and capabilities do IT managers consider critical to maintain in house in 2005?

- What skills and capabilities will be leaving in house by 2008?

- What skills and capabilities will be becoming critical in 2008?

- What are the skills that are desired at both entry and mid-level hiring?

- What skills are moved to service providers (SPs)?

- What are the reasons for moving skills to SPs?

- How many full-time equivalent (FTE) employees are maintained in house as opposed to with independent

  contractors (ICs) and SPs, both in 2005 and in 2008?

A list of skills and capabilities was created categorized into five areas of related skills: Technical, Business Domain, Project Management, Sourcing and IT Administration.

RESULTS

Overall Organizational Profile

Interviewees had extensive experience within IT in their organizations, with 82% of those interviewed representing IT senior management. The following table shows the industry and revenue breakdowns.

Industry	Percentage
Professional Services	21
Financial Services	21
Heavy Industry	26
Other Services	33
Revenue	
Fortune 500+	41
Large	22
SME	37

Table 1. Demographics of Organizations

The organizations in this analysis are characterized as either clients at 88% or service providers (SPs) at 11%. Since the workforce trends differ within these two groupings, the analysis reported here looks only at the client grouping.

Changes In IT Staffing

From 2005 to 2008 there is minimal change in the number of full-time equivalent employees (FTEs) in the IT workforce. FTEs represent all employees, both internal and external to the organization. What does change is the mix of in-house employees and employees obtained through the use of outside service providers. The outside FTEs shown in figure 1 represent independent contractors and third party providers who are both domestic and foreign.
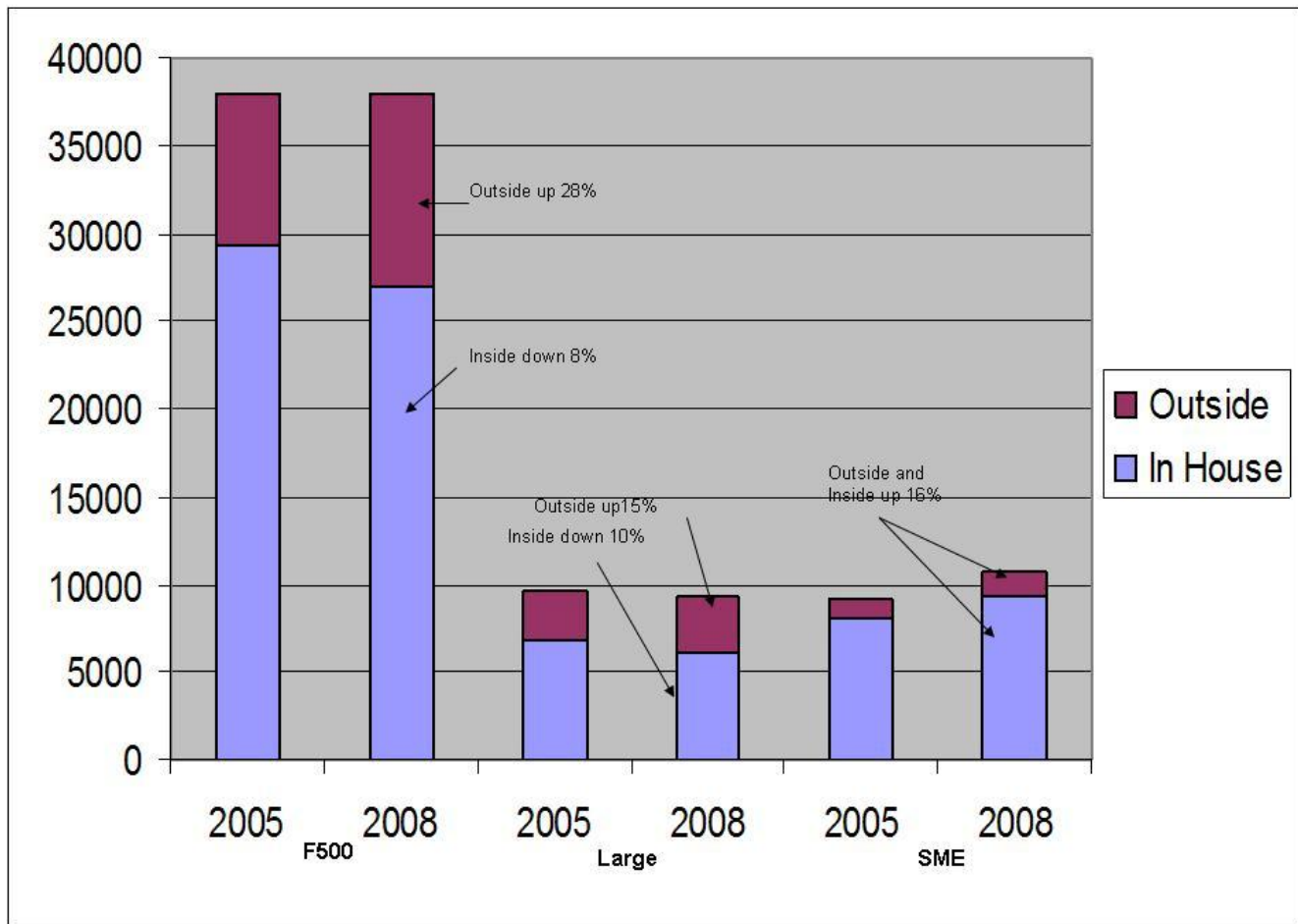
Figure 1. Change in FTEs from 2005 to 2008 by Organizational Groupings

Within the Fortune 500 grouping, there is an increase in the use of outside FTEs of 28%, accompanied by a small decrease in in-house staff of 8%. The organizations in the large group show an increase in outside FTEs of 15%, with a corresponding decrease of in-house FTEs of 10%. The SMEs show an increase in both outside FTEs and in-house FTEs of 18%. While the Fortune 500 organizations receive more attention because of their size, it is interesting to note that the population of SMEs in the IT field may be more important given the large numbers of organizations in this size category.3 The interesting question is to determine what skills and capabilities are being sourced outside the organization, and whether there are any specific patterns in the sourcing activities.

INVESTIGATING SKILLS

The skills that are being sourced are primarily technical skills. The top skills sourced to any outside SP are:

- Programming

- Systems Testing

- Desktop Support/Helpdesk

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[3] The United States Small Business Administration states that over 99% of U.S. businesses have less than 500 employees. http://www.sba.gov/advo/research/data.html. Worldwide, the definition of "small business" varies, based on revenue and number of employees; however the percentage of the economy that small organization's represent is a large majority of business in most countries.

- Systems Design

- Systems Analysis

- Database Design/Management

The specific order changes depending on whether the SP is an independent contractor or a third party provider, however in all cases programming is the top sourced skill.

The skills most critical to keep in house are business domain skills and capabilities, representing five of the top ten skills in house, while project management skills represent three of the top eight. The remaining two skills are the client facing technical skills - systems analysis and systems design - which we found are also in the top five skills that are sourced. Rather than being contradictory, what we found is that these client-facing technical skills are sourced when organizations need to augment their existing staff because of time or funding constraints.

These top skills remaining in house represent skills that require knowledge of the business and require interaction with clients and team members. These skills are generally found in individuals who have had time to gain the practical experience on the job. The pattern indicates that IT top management is concerned about maintaining a strong body of IT professionals who know the industry, know the company and its processes and can work well with clients and colleagues.

Hiring Practices

We asked our respondents to describe the skills sought and hiring practices they used for entry-level positions, along with what critical skills were most often missing from this group. We also looked at the requirements for mid-level hiring. The differences in skills sought reflect the impact that sourcing strategies have had on the IT workforce.

Entry-Level Hiring

At the entry level, the top skills sought, in order are:

- Programming

- Systems analysis

- Systems testing

- Systems design

- Communication

- Voice/Data Telecommunications

- Desktop Support/Help Desk

Along with these skills, the managers interviewed are looking for undergraduate degrees in business, computer science/EE and MIS/IT. They generally recruit on university campuses and through internet job postings. However another popular method is by hiring from their internship programs.

We also asked what skills are most often missing from the entry-level candidate. The top answers are communication, business domain knowledge and systems analysis and design.

These answers pose some conflicting requirements. Most undergraduates from computer science programs who have studied programming have not had the opportunity to develop business domain knowledge and communication skills. These results indicate a need for universities to rethink the preparation that they are providing to undergraduates in order to better match the needs of the marketplace.

Mid-Level Hiring

The top skills sought at the mid level are, in order:

- Project management skills

- Systems analysis and design

- Business domain knowledge

Along with these skills our respondents are also looking for undergraduate degrees in business, computer science/EE, MIS/IT or any other degree. There is a minimum of five years of experience and recruiting is done through internet job postings, headhunters and informal channels/employee referrals.

When asked why managers preferred hiring these skills into the organization (as opposed to obtaining them through sourcing) the top three answers were:

- Critical skill for the future

- Critical position to keep in house

- Less expensive to have in house

It is interesting to note that while IT top management is seeking strong client-facing skills, they are still looking for technical skills in the background of their mid-level hires, e.g. systems analysis and design and the desire to find those with undergraduate computer science/EE degrees. We interpret this to mean that they value the fundamental technical training and want their mid-level hires to have that in addition to the softer skills. In other words, they are looking for a good balance of technical and general managerial skills.

Education and Training

We asked our respondents what types of education and training they use at each level of hiring. For the entry-level hires the most frequent form of training involved using customized training materials, followed, in order, by self-tutorials, mentoring and generic training material from third parties.

At the mid-level, they used the same kinds of education and training, but in a slightly different order. Customized training maintained the first position, followed by mentoring, generic training material and self-tutorials.

While there is a general sense based on reduced IT budgets and popular news reports that organizations are not investing in training in house, this is not what we found. Our respondents indicated a strong commitment to using education and training to build their workforces.

INTERPRETATION OF RESULTS

Implications for Career Paths

How do these results shed light on the question of IT career paths? Since one clear conclusion is that the skills most often sourced are also the skills that are generally looked for in entry level hires, one might conclude that there is no career in IT: fewer entry-level people would be hired since the skills are sourced and there is a decrease in the pipeline of in-house FTEs to be promoted.

However, there is another interpretation: There is an excellent opportunity for a career in IT if the individual has the right combination of skills:

- Entry-level hires need fundamental technical skills along with client-facing and business domain skills

- This rich combination implies a fast-track career to project management and other managerial positions

- IT management is investing in education and training to create the management workforce they need for the future.

Litecky, Arnett and Prabhakar (2004) propose a model for IS recruiting called Image Theory. This research posits a two-stage hiring process that is used at all levels: Selection/Filtration Stage and Choice/Hiring Stage. The Selection/Filtration Stage is what is represented in job postings. It is the necessary technical background required for a position. The Choice/Hiring Stage is where additional skills and experience on the softer side come into play in the hiring decision. This article states that a study by SRI and the Carnegie Foundation in 2003 found 75% of long-term job success depends on soft skills and only 25% on technical knowledge.

Curriculum Issues

The fundamental question that universities must address is: "Are students being properly prepared for what the marketplace is seeking?" George,Valacich and Valor (2005) examine the recent and rapid rise and fall of university student enrollments in information systems programs and describe how these enrollment fluctuations are tied to the job opportunities of graduates. Drawing on the work of Ives, Valacich, Watson, and Zmud, R (2002), they recommend that programs can influence the number of majors they attract by focusing more on why information technology is valuable to an organization rather than on

what the technology is or how it works. Foote reported a 10.3% decline in computer science undergraduate enrollment from 2000 to 2004 and noted that UCLA had calculated a 60% decline in undergraduate declaring computer science as their major from 2000 to 2004 (Foote, 2005). Other universities have indicated similar drops during that time period (Trewyn, 2005). Cappel also addresses the issue of how students can better prepare for the marketplace requirements (Cappel 2001).

There is no question that students in computer science/EE programs are receiving solid technical foundations for careers in IT. The top IT managers that we interviewed confirmed this. What these entry-level hires are missing however are some of the important soft skills, e.g., communication skills, project management skills and business domain knowledge.

Some of the approaches that could be used in undergraduate programs for computer science/EE and which would also enrich MIS/IT programs include:

- Creation of Interdisciplinary studies among computer science, IT and business

- Introduction of new subjects, e.g. project management and outsourcing

- Use of real world cases in the classroom

- Incorporation of real-world projects where students work in organizations

- Increased use of internships and work/study programs

There are both benefits and constraints to making the kinds of changes listed. On the negative side, organizations cannot always work within the course/semester time frame. The faculty reward systems in most universities do not support any of these innovative approaches to education. Existing bureaucratic boundaries within universities present hurdles to interdisciplinary programs. It is difficult to get organizations to become engaged on an on-going basis with student projects.

On the positive side, there are many benefits to students, faculty and organizations in working together. The students are given the opportunity to develop real-world professionalism through their exposure to working in organizations as part of their education. They are also provided with networking opportunities that may lead to future employment. Organizations have an opportunity to preview top regional talent and make hiring decisions. As some of our interviewees said, they only hire from their own internships programs. This allows them to really get to know someone before committing to an employment offer. And in the best of circumstances, organizations may be able to get quality work done on their in-house projects using the students to supplement their staff.

University instructors and organizational managers have challenges to face in creating the working partnerships necessary to implement what we are suggesting. However, the benefits to the student experience and ultimately to the IT workforce are significant and should drive curriculum in this innovative direction.

CONCLUSION

The answer to the question: "What is the impact of sourcing on the IT workforce pipeline?" is manifold. First, it re-emphasizes the necessity for an individual to possess business skills, particularly client-facing and project management skills, for a successful future in firms whose primary business is producing goods or services other than IT hardware, software, or services. Second, it suggests that the IT career path may be evolving from "one size fits all" to a dual track, in which one branch is oriented more towards business and management (the client side) and the other branch is oriented more towards technology (the service provider side). It should be noted that even on the business branch an individual needs a base level of technical skills, but they must be complimented with a wide-ranging set of business and managerial skills. Conversely, individuals on the technology branch will require a minimum level of business and managerial skills, but a more comprehensive set of technical skills. Other research has supported this conclusion (ITAA, 2004; Litecky, *et. al.*, 2004). We conclude that the impact of sourcing on the IT workforce pipeline leads to a change in the mix of business and technical skills, depending on which branch of the IT career path an individual chooses. It is very clear from this research that IT management sees the undergraduates entering the work force today as lacking key managerial skills and experience.

Therefore the answer to the question: "Is there a future in pursuing a career in IT?" is yes, but the individual must have the right balance of technical and managerial skills. The impact of sourcing strategies on how the mix of FTEs is changing between in-house and outside has intensified the need for a good balance of skills.

Another impact of sourcing on the IT workforce pipeline is the avalanche of advice to future college students from media commentators, parents, and high school guidance counselors that there is no longer a promising IT career path in client organizations (as opposed to IT organizations like Microsoft, or service providers like IBM). The dramatic dot.com bust, following so closely on the heels of the Y2K peak, has heightened perceptions that jobs are being lost to sourcing, and the

future of IT is offshore. While this may make for dramatic headlines, this research we report on here indicates that there is a stable demand for IT workers in the short-term. Furthermore, the demand will become more intense as baby boomer retirements begin to have an impact on the existing workforce. Universities and organizations need to take steps to broadcast this message. Young people must be made aware of the critical role that IT plays in the competitive success of organizations, and the ongoing demand for IT workers. Otherwise, we run the risk of a self-fulfilling prophecy.

It is becoming increasingly important for organizations, universities and governments to work together to present a unified and accurate message – that there is no shortage of IT jobs, but rather that the short-term demand is solid and stable, and long-term demand will be greater. The downturn in enrollments in MIS programs is beginning to ease, and young people should be counseled to pursue IT careers in order to ensure an adequate presence of IT workers in the pipeline to supply the increasing needs of both client and service provider organizations for the future.

ACKNOWLEDGMENTS

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