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Abstract:

A panel on workforce trends in the information technology industry was held at the AMCIS meeting in Toronto, Canada, in August 2008. Panelists discussed a continuing research project about the current state of the IT workforce and future trends, sponsored by the Society for Information Management (SIM). The initial phase was a study of workforce trends in IT client companies, completed in 2006. Results from phase one revealed a shift in the mission of the information system function from delivering technology-based solutions to *managing the process* of delivering solutions. Client-facing capabilities were found to be critical to this mission as well as business and project-management capabilities.

Phase two examined workforce trends in IT provider companies. Results indicate that provider firms are also seeking client-facing capabilities, project management and business domain knowledge over technical capabilities. Panelists compared the results of the two phases and the implications for curriculum design, hiring, and training practices.

The results of this research underline a looming crisis in several areas: 1) graduates who are not trained in areas that the marketplace is seeking; 2) thin pipeline for specific technical skills; 3) increasing pressure to source IT capability; and 4) lag in university responsiveness to the needs of the marketplace.

Keywords: IT capabilities, IT curriculum, outsourcing

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I. INTRODUCTION

This paper reports on a panel held at the Americas Conference on Information Systems (AMCIS), held in August 2008 in Toronto, Canada. The members of the panel reported on the current results of an ongoing research project, sponsored by the Society for Information Management (SIM) International Advocacy Program. The initial phase of the project was a study of workforce trends in information technology (IT) client companies and was completed in 2006. Results from phase one revealed a shift in the mission of the information system function from delivering technology-based solutions to *managing the process* of delivering solutions. Client-facing capabilities were found to be critical to this mission, as well as business and project-management capabilities.

The second phase examined workforce trends in IT provider companies. The results indicated that provider firms are also seeking client-facing capabilities, project management and business domain knowledge over technical capabilities.

The panel's presentation consisted of illustrating the trends, comparing the results from the two phases, and presenting the implications for curriculum design, hiring and training practices. An innovative aspect of this panel was to include the practice viewpoint along with the academic research. The practitioner participant, Phil Zwieg discussed the concerns that these trends pose for the marketplace. There was a lively question-and-answer period emphasizing some key concerns among the audience participants. These will be summarized as well.

II. SUMMARY OF PROJECT OBJECTIVES

Global IT sourcing, baby-boomer retirements, and low IT enrollments in universities are prompting changes in the IT capabilities available to and desired by IT departments. The resulting potential for a mismatch of supply and demand is a concern for business executives and academics alike.

Given the potential for a mismatch, key questions that were asked of top-level managers in both the client and provider phases of the research were: 1) What capabilities are important to maintain in house today? (2005 in phase one, 2006/7 in phase two); 2) What capabilities would become irrelevant or otherwise go away by 2008? (2009 in phase two); and 3) What capabilities would become more important by 2008 (2009 in phase two)? The IT capabilities were organized into five categories:

1. Technical
2. Project management
3. Business domain
4. Sourcing
5. IT administration

Results of this research have appeared in a number of publications, listed as follows, and these can serve to provide additional background and detail on the various research findings for those who seek more information:

- Zwieg, et.al. [2006] presents a practice-oriented summary of the first phase.
- Abraham, et.al. [2006] summarizes the phase one findings and discusses implications for IS programs.
- Bullen, et.al. [2007A] addresses the impact on sourcing strategies on organizational in-house resource requirements.
- Bullen, et.al. [2007B] reports on the panel presented at AMCIS 2007 (Keystone, Colorado), including preliminary phase 2 results and questions and discussion with the session participants.
- Gallagher, et.al. [forthcoming] presents a framework of requisite skills for IT workers.

III. SUMMARY OF PANEL

Critical Capabilities for Both Clients and Providers Now and Future

Phase one results were summarized and confirm a shift in the mission of the typical internal information system function from delivering technology-based solutions to managing the process of delivering solutions for their

organizations. Client-facing capabilities are critical to this mission, as are business and project management capabilities [Zweig et al. 2006; Abraham et al. 2006].

This can be seen in the following table (Table 1), where the top 10 capabilities that client companies indicated were critical are shown (total exceeds 10 due to tied positions). The color coding used here is consistent throughout the illustrations:

- Orange = Technical skills and capabilities
- Green = Project management skills and capabilities
- Blue = Business domain skills and capabilities
- Purple = Sourcing skills and capabilities (seen in later figures)

Table 1. Client Critical Capabilities 05-06

Capability	Ranking
Functional Process Knowledge	1
Project Planning/Scheduling/Budgeting	2
Business Process Redesign/reengineering	3
Industry Knowledge	3
Company Knowledge	3
Project Leadership	4
Systems Analysis	5
Managing Stakeholder Expectations	6
User Relationship Management	7
Project Risk Management	7
Systems Design	8
Change Management	9
Project Integration	10

In the next table (Table 2), the client companies indicated the capabilities that they will source. As demonstrated by the color coding, these are all in the technical category.

Table 2. Capabilities Clients Source

Capability	Ranking
Programming	1
System Testing	2
Desktop Support/Helpdesk	3
Systems Design	4
Systems Analysis	5
Telecommunications	6
Database Design	7
Server Hosting	8
Operations	9
Continuity/Disaster Recovery	9
IT Architecture and Standards	10
Operating Systems	10

In the second phase, the respondents were limited to service provider firms only. There were a total of 126 providers in the phase two data. The focus was on what capabilities the providers seek—not internally—but to serve their clients. In other words, the research was looking at the "other side" of the question. The providers taking part in the survey represented a broad geographic pattern around the world, and a diversity of sizes as seen in Table 3.

Table 3. Demographics of Phase Two Providers	
Geographical Distribution	
North & South America	66%
W. Europe, E. Europe & CIS	17%
Australia & India	16%
Revenue	
Fortune 500 (>$3 billion)	14%
Large ($500 million to $3 billion)	15%
SME (<$500 million)	71%

In both phases of the research, the respondents were asked to indicate which skills and capabilities would emerge in three years hence as important for them to maintain as in-house capabilities. Table 4 shows the top 10 responses from the provider population:

Table 4. Provider Emerging Skills in 2009	
Capability	**Ranking**
Working Globally	1
Virtual Teams	2
Industry Knowledge	3
IT/Architecture Standards	4
BPR/Reengineering	5
Communication	6
Change Management	7
Managing Third-Party Providers	8
Project Risk Management	9
Security	10

A comparison between phase one clients and phase two providers shows seven overlapping capabilities (Table 5).

Table 5. Overlapping Emerging Capabilities
Business Domain
Industry Knowledge
BPR/Reengineering
Change Management
Communication
Technical
IT Architecture and Standards
Security
Sourcing
Managing Third Party Providers

In another question, both clients and providers were asked to indicate which capabilities would decline in the three years hence, and these were primarily technical skills. For clients, the top 10 were all technical skills, with programming at the top of the list. For the providers, eight of the skills were technical, with mainframe/legacy at the top of the list. Finally, in both phases the question was posed as to what were going to be the critical skills to maintain in house in three years. Both groups indicated a mixture of skills from the four major categories with many overlapping choices (Table 6).

Table 6. Critical Skills for Both Clients (in 08) and Providers (in 09)

Client Critical Skills 2008	Provider Critical Skills 2009
Project Planning	Industry Knowledge
Functional Knowledge	Project Leadership
Company Knowledge	Project Risk Management
BPR/Reengineering	Project Planning/Budget/Scheduling
Systems Analysis	Customer Relationship Management
Industry Knowledge	Functional Knowledge
Project Leadership	IT Architecture and Standards
Project Risk Management	User Relationship Management
Systems Design	Systems Analysis
Change Management	Working Globally
Managing Third Party Providers	

Hiring Practices

In another set of questions, both clients and providers were asked to respond to questions related to their hiring practices. The team was interested in determining what the marketplace is demanding of the graduates in IT-related programs. Data was sought at both the entry-level—newly minted undergraduates—and the mid-level—those with at least five years of experience. These responses led to conclusions about what we call "requisite skills."

Clients rank technical skills highest in entry-level positions, indicating a desire for entry-level hires to have a basic foundation in the technical area. Desired technical skills include programming, systems analysis and systems design. However, there is also a desire to have "softer skills," such as communications, which along with industry knowledge and functional process knowledge were identified as skills most often missing. These results indicate an interest in entry-level candidates who possess a blend of technical and business domain capabilities.

Providers also seek a blend of technical and softer skills; however, they include project management skills in their mix. Therefore, along with the skills listed for clients in the technical and business domain areas, providers also listed project planning and budgeting, working with virtual teams, and user relationship management. These three are all categorized as project management capabilities in our research.

Therefore, at entry-level hiring, the data indicates similar capabilities sought by both clients and providers, with the providers citing even more non-technical skills as a requirement in the candidates they are hiring.

When we look at the mid-level hiring (at least five years of experience), there is remarkable similarity in the capabilities that both clients and providers seek. Both are looking for a mix of project management, business domain, and client-facing technical skills. The clients indicated a preponderance of project management skills with eight of the top ten in this category. The next category down is business domain with four skills, and finally technical with two (total is greater than 10 due to tied rankings).

Providers' top category is business domain with six skills, followed by project management with five skills and technical with three. There is strong agreement on the individual skills between clients and providers (Table 7).

Mid-level results are very different from those of entry-level but more closely aligned with the firm or business unit critical skills discussed earlier. The results raise an important question regarding how the entry-level employees will gain the capabilities required at the mid-level if they do not already have them upon entering the IT workforce.

Table 7. Mid-Level Hiring Capabilities	
Client Mid-Level Hiring 2005	**Provider Mid-Level Hiring 2006**
Project Planning/Budget/Scheduling	Project Planning/Budget/Scheduling
Project Leadership	Project Leadership
Project Risk Management	Functional Process Knowledge
User Relationship Management	User Relationship Management
Systems Analysis	Project Risk Management
Systems Design	Industry Knowledge
Industry Knowledge	Communication
Negotiations	Systems Analysis
Functional Process Knowledge	Systems Design
Project Integration	IT Architecture and Standards
Working with Virtual Teams	Negotiations
Communication	Business Process Reengineering
Working Globally	

Development of Requisite Skill Categories

Developing requisite skill categories is another phase in our analysis of data results. The requisite skill categories are derived from the client data. This analysis is ongoing with the provider data, but preliminary results support the six skill categories presented following.

Table 8 summarizes the Non-Technical Skills by showing that they were categorized by respondents as both critical to maintain in house and sought in new hires (both entry and mid level), but not sourced to providers. However, the three categories differ in their historical grounding in academia and practice.

Table 8. Non-Technical Skills Summary			
Non-Technical Skills	**Critical In House**	**Sought in New Hires**	**Sourced**
Project Management Skills			
Project Leadership	✓	✓	
Project Planning/Budgeting/Scheduling	✓	✓	
Project Integration/Program Management	✓	✓	
Project Risk Management	✓	✓	
Problem/Opportunity Skills			
Company Specific Knowledge	✓	✓	
Functional Area Process Knowledge	✓	✓	
Industry Knowledge	✓	✓	
Business Process Reengineering	✓	✓	
Change Management Organizational Readiness	✓	✓	
Relationships Skills			
User Relationship Management	✓	✓	
Communications	✓	✓	
Negotiation	✓	✓	
Managing Stakeholder Expectations	✓	✓	

In contrast to Table 8, where no skills were sourced, in Table 9, the Technical Skills are sourced to providers. A few are critical to maintain in house, and some are sought only at entry-level hiring.

Table 9. Technical Skills Summary			
Technical Skills	**Critical In House**	**Sought in New Hires**	**Sourced**
Foundational Skills			
Programming		**Entry Level**	✓
System Testing		**Entry Level**	✓
Desktop Support/Help Desk		**Entry Level**	✓
Database Design/Management		**Entry Level**	✓
Operating Systems		**Entry Level**	✓
Voice/Data Telecommunications		**Entry Level**	✓
Operational Skills			
Operations			✓
Service Hosting			✓
Continuity/Disaster Recovery			✓
Mainframe/Legacy			✓
Essential Skills			
Systems Analysis	✓	✓	✓
Systems Design	✓	✓	✓
IT Architecture/Standards	✓	✓	✓

Finally, in Table 10, all the Non-Technical and Technical Skills are shown together for summary purposes. Table 10 indicates the top skills in all categories and therefore comprises the requisite skills that anyone seeking a career in IT will require to respond to the needs of the marketplace. A reminder: these six categories of skills were derived from the client data only. Additional analysis is being done to determine if these categories fit the provider data.

Table 10. Six Categories of Requisite Skills	
Non-Technical Skills	**Technical Skills**
Project Management Skills	***Foundational Skills***
Project Leadership	**Programming**
Project Planning/Budgeting/Scheduling	**System Testing**
Project Integration/Program Management	**Desktop Support/Help Desk**
Project Risk Management	**Database Design/Management**
Problem/Opportunity Skills	**Operating Systems**
Company Specific Knowledge	**Voice/Data Telecommunications**
Functional Area Process Knowledge	***Operational Skills***
Industry Knowledge	**Operations**
Business Process Reengineering	**Service Hosting**

Change Management Organizational Readiness	**Continuity/Disaster Recovery**
Relationships Skills	**Mainframe/Legacy**
User Relationship Management	***Essential Skills***
Communications	**Systems Analysis**
Negotiation	**Systems Design**
Managing Stakeholder Expectations	**IT Architecture/Standards**

IV. IMPLICATIONS FOR CURRICULUM AND HIRING

The IS curriculum will need to train students in both technical and non-technical skills. IBM and Gartner have begun promoting the form of the T-shaped person as a person with broad general skills and deep technical skills. The concept of the T-shaped person has been in the literature for at least 17 years as the quote following shows.

> This type of rounded personality is also sought in other branches of the same theory, which prizes individuals known as **T-shaped** people. These are a variation on Renaissance Man, equally comfortable with information systems, modern management techniques, and the 12-tone scale.
>
> —David Guest, "The Hunt is on for the Renaissance Man of Computing," *The Independent* (London), September 17, 1991 [1]

Our conclusions regarding the requisite skills are the following:

- All six categories are important to an IT professional's success.
- IT professionals may choose to focus on a particular category or categories.
- IT professionals need some competency in all six if they are to grow and advance in their careers.
- The six categories are interdependent.
- The six categories are not mutually exclusive or exhaustive.

Our data indicates that another highly valued version would be a person with broad technical skills and deep business skills. In particular, the data on mid-level positions shows a real need for project management and business skills. Our provider data also shows that respondents listed several business and project management skills as missing in entry level hires. The top three missing skills were managing stakeholder expectations, process knowledge, and business process reengineering.

Currently, most computer science programs provide deep technical skills. They need to incorporate business applications of those skills and to foster such general skills as team work and communication. Information systems (IS) or Information Technology (IT) programs, on the other hand, are often housed in business schools. Core requirements include accounting, finance, marketing and operations courses that build deep business skills and capabilities. They also provide a broad technical education that includes programming, systems analysis and telecommunications courses. These programs could be strengthened by exposing students to cross functional courses and projects that emphasize supporting business processes. These curriculum prescriptions are reflected in the ACM draft IT curriculum[2] and the ACM/AIS task force on curriculum.[3] The draft IT curriculum addresses the need for social and professional development, experiential learning and working in teams. The task force emphasizes enterprise systems, business process management, project management, collaboration, communication, and functional specialization. We suggest from our research results that security and IT service management are also emerging as key areas where business and technology intersect. In addition, we are seeing the topic of how to implement "green IT" gaining in importance as a new business/IT area. Organizations are looking to IT to implement environmental measures that have an impact on the entire organization, e.g., new electronics that

[1] http://www.wordspy.com/words/T-shaped.asp accessed 9/28/2008

[2] Draft Computing Curricula, Information Technology Volume, Revised April 22, 2008, Joint Task Force on Computing Curricula, Special Interest Group on Information Technology Education (SIGITE) of ACM and IEEE Computer Society, http://campus.acm.org/public/comments/it-curriculum-draft-may-2008.pdf

[3] IS Curriculum Wiki, Joint ACM/AIS Undergraduate Curriculum Revision Task Force, http://blogsandwikis.bentley.edu/iscurriculum

conserve power and are recyclable, using new technologies such as ground water cooling systems in place of traditional air conditioning in data centers, and so on.

Many programs are adding courses or modules that discuss the Information Technology Infrastructure Library (ITIL) prescriptions for standardizing IT operations [AMCIS 2007 panel].

A paradox in the data has to do with careers and career paths. Respondents cited missing business and project management skills. Yet they still mostly hire programmers into entry level positions, usually from computer science programs. While programming is still the most common mid-level position, our provider data shows that there are differences across high- and low-wage regions, as shown in Figure 1.

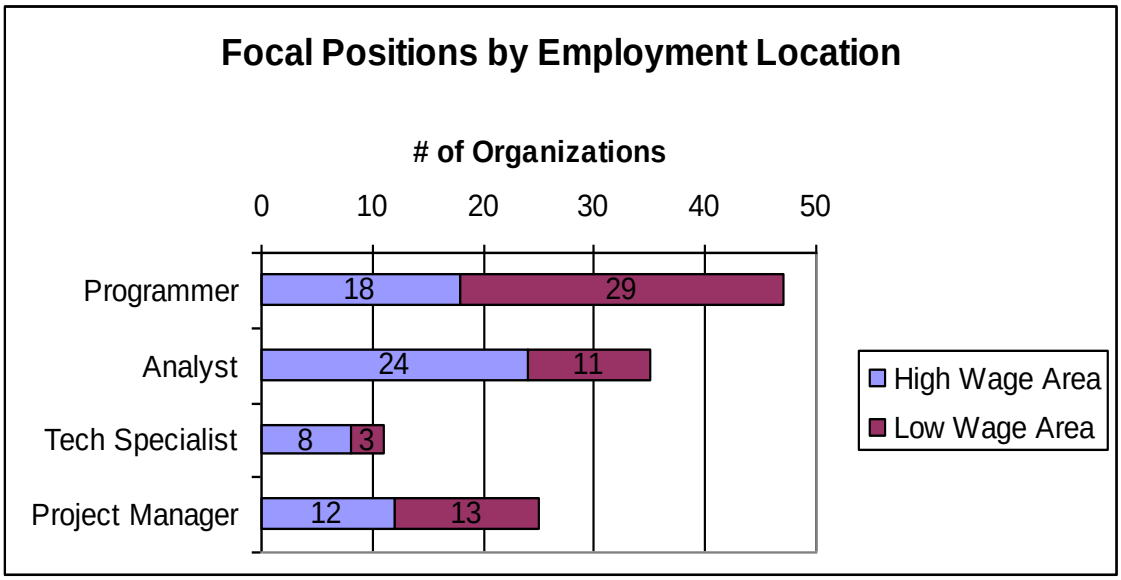

Figure 1. Employment Location Differences

Analysts, technical specialists and project managers are hired in high-wage countries as compared to programmers who dominate in low-wage locations.. The AIS curriculum indicates four broad categories of job titles that mesh well with four categories that we see in mid-level positions: developer, analyst, technical specialist, and project manager. As a result of our data analysis, we recommend that alternate career paths should be created for these positions rather than forcing all new hires to start as programmers. We also suggest that IT programs may better prepare students for some of these new paths. Some companies are already doing this. At Chubb Insurance, new hires may start in quality assurance to learn business rules and get on a path to business analyst positions.[4] Other new hires start at the service desk on a career path to IT operations manager. At L'Oreal, new recruits are rotated through several departments to understand the business and develop contacts.[5] These companies also recruit from a variety of programs including computer science, information systems and business.

Our conclusions can be summarized in the simple statement that anyone choosing a career as an IT professional in most client and provider organizations will need a balance of technical and managerial skills to meet the demands of the marketplace. The technical skills will vary widely depending on the company and industry needs; however, in light of increasing sourcing of IT services, the managerial skills in the categories of project management and business domain knowledge are becoming increasingly critical in practice.

V. VIEW FROM PRACTICE

The practitioner view was represented on the panel and supported the research results based on recent experience and work with a wide variety of organizations and industries. Specifically, sets of skills which we are proposing as key in an IT professional's career match what is seen in business. An important concern was raised here that curricula changes in academic programs are not happening at a fast enough rate. The marketplace is moving forward and academia is lagging. This may be the driver for "special training" companies expanding their presence in the market.

[4] Private interview with one author, 2008
[5] Private interview with one author, 2008

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A significant aspect of preparing the undergraduate for the requirements of the market is to focus on internship programs. Creating quality internships is critical. The student must be introduced to the true business application of IT and not isolated in either clerical or technical-only tasks.

From an historical perspective, it is interesting to note that when there was a glut of talent in the market; companies celebrated this largesse by reducing salaries in the information technology field. This had the subsequent effect of driving people away from the career area and lowering enrollments in IT-related academic programs. Today, these lower enrollments have created a thin pipeline and organizations are experiencing the pain of not being able to find the talent they require.

Following is a summary of the skills and experience desired for an IT professional who aspires a systems analyst position:

- Minimum of one programming course in college
- Dual major programs, e.g., IT and Financial Services
- Work experience rotating between IT and business areas or the equivalent internship experience

As we move to an ever more disperse IT environment that includes software services, cloud computing, social networking and Web 2.0, a broad range of capabilities in both technical and managerial areas becomes increasingly critical.

Another key issue from the practice point of view includes the impact of blogging, which can significantly affect opinions about careers in IT. Blogs can be used to present the real concerns of experienced IT professionals who are finding themselves displaced in the market because they no longer have marketable skills. In some cases, they may feel the impact of changes in the global economy and the growth of off-shore sourcing of IT services. These are legitimate concerns. However, in the end, the unemployment rate for IT professionals remains one of the lowest in our economy when compared to other professions. What one must consider carefully is the facts versus emotional rhetoric.

VI. QUESTIONS AND COMMENTS FROM THE AUDIENCE

The attendees for this session contributed some interesting comments and raised some important questions about the results. Their questions are summarized following.

How do you explain the mixed message in the data that the marketplace is hiring for technical skills but then says they are not critical to maintain in house?

As part of the interviews associated with phase one the research team probed this question and determined that the senior level executives being interviewed had the strong belief that learning programming as part of the undergraduate program provided a fundamental grounding in analysis and problem solving that they viewed as valuable. Second, the logical career path for entry-level hires is toward project management, where they would be managing programming and thus they should have a basic understanding of the task in order to do that well. Finally, because most of the respondents studied programming in their undergraduate programs, they may feel comfortable requiring this and/or evaluating programming capabilities in an entry-level candidate.

How important is the issue of security? The keynote speakers at the conference indicated this was paramount but it is less important in your data?

Security is shown as emerging by 2008 for clients and 2009 for providers as a critical capability. It is now 2008, so this may be coming true! However, security is also sometimes buried in other capabilities associated with technical specialties and may be even more prominent that we recognize in the data.

How do you justify the business case for rotating IT professionals through business areas in the organization?

There are risks and rewards for rotation schemes, The greatest risk is that a valuable IT professional may be lost to a business area, which will be good for the individual's career but bad for IT management. However, the risk is overshadowed by the creation of a more valuable IT staff member who has also built strong relationships with the user community.

Should we develop a standard career path in IT as we have seen developed in other areas, e.g., accounting?

This is a very important question as many feel that our students do not understand possible career paths since there is a wide variation among organizations. There are many career paths and perhaps too many. The average accounting graduate does not have this confusion! Most undergraduates seem to believe that the entry step is programming but do not know what comes next. We need data to make the case for which technical skills should be the strongest for which areas and career paths. How long does it take to become a CIO? Opinions were offered that it takes 20 years! Project manager has been an "accidental career" with no clear path or training required. ERP specialists are hybrids from business and technical super users.

What should programs in business schools be doing?

An interesting step would be for business schools to require IT as a minor for all students. An alternative is to move a component of IT into all majors. Program data should be collected on percentages of majors in business programs.

Do companies hire new employees or decide to source their IT services?

We have some data on this, however, it is now out of date. The research team plans to continue collecting data on a regular basis in order to update the information and be able to readily respond to this kind of question. In the earlier data, from 2005-06, companies were both increasing hiring and increasing sourcing. Differences were related to the size of the companies, where the largest were growing more through sourcing and the smallest were growing evenly through hiring and sourcing [Kaiser 2006].

How can universities be persuaded to change programs when hiring is good based on the IT professional shortage?

This question raises another interesting paradox. The low enrollments in IT-related programs have now created a shortage of graduates. It is difficult to motivate change when academic programs see their graduates successfully hired. However, it is important for the results of this research to be used to help universities understand that this is the pendulum swinging the other way based on the previous glut of graduates. If university programs improve communication with the marketplace to better anticipate the requirements for IT skills and capabilities, we may be able to steady the swings and provide a more reliable career path for our graduates. University programs should not mistake the current successful hiring of their graduates to mean that their programs are "perfect" and do not need reviewing.

VII. CONCLUSION

The high level of attendance at the panel and the lively discussion that ensued underscored the interest in this research and the importance of the study. Academia and industry together as partners need to rethink the curriculum for IT-related programs and the hiring requirements for IT professionals—at all stages of their careers. Our panel shed some light on the capabilities industry is seeking, proposed some requisite skill categories, and some strategies for how academia can deliver them.

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