

Requisite Skills and Knowledge for Entry-level IT Auditors

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ABSTRACT

Information technology auditing has become a career in high demand in recent years due to factors such as increasing compliance requirements with regards to information technology governance. Nonetheless, many information technology, management information systems, and accounting information systems educators may not have paid significant attention to this phenomenon and can benefit from an overview of the skills and knowledge requirements for a successful career in this lucrative field. Students seeking a career in information systems auditing also need to know more about the skills required for success, and the highest ranked categories may surprise management information systems students who tend to focus on technology skills (and often at the expense of other, "softer" skills). In this research, we analyze online advertisements for information technology audit jobs to compile a list of key career skills and knowledge for which educators, students and currently practicing audit professionals can focus attention to ensure success in this particularly strong employment market. This paper will also discuss specific ways that information systems educators can facilitate their students' development of these key skills.

Keywords: Information Technology Auditing, Careers, Online Employment Advertisements

1. INTRODUCTION

Information Technology (IT) and management information systems (MIS) educators are beginning to respond to the recent trend affecting student career options in the IT auditing employment marketplace: IT auditing is now a career in significant demand (Hoffman, 2004; Needleman, 2006), even for non-accounting majors (Merhout and Cothran, 2006). IT auditors, and those interested in IT audit as a career choice, should be aware of the skills and requirements currently desired by employers. Gallegos (2003b, p. 4, emphasis added) notes that the "opportunity for careers in this challenging and dynamic field have never been better ...[because] IT governance, new technology, e-business and legal issues have generated a 'new frontier' and the need for new skills and common sense in applying good business practices." The range of skills needed varies from technically specific concepts, such as knowledge of UNIX and Oracle, to general organization and leadership expertise.

The main purpose of this research is to distinguish which skills are most desired by employers, thus providing IT auditors with information about the skills they should possess (or develop) in order to progress during their careers

in this profession. The data for our study come from published literature (trade and academic), from a content analysis of IT Audit employment advertisements, and from interviews/discussions with professionals from firms and companies hiring IT auditors. This paper will also suggest how students from accounting and information systems (IS) backgrounds compare and contrast in terms of possessing the entry-level skills necessary to succeed as an IT auditor. Finally, we make recommendations for IT/MIS educators desiring to better meet the needs of their stakeholders; e.g., in their courses, educators may want to provide more opportunities for development in the key skill areas required for entry-level IT auditors to gain successful employment.

2. BACKGROUND

2.1 The Growing Need for IT Auditors

IT auditors focus on the computer-based aspects of an organization's information systems, including but not limited to, the assessment of the proper implementation, operation, and control of computer resources (Hall and Singleton, 2005). IT auditors must evaluate an organization's systems by reviewing documents, interviewing personnel, and

reviewing large data sets using computer programs (Hunton, Bryant and Bagranoff, 2004). These professionals are also enlisted to assist clients in performing control assessments mandated by Sarbanes-Oxley (SOX) Section 404 legislation (Hoffman, 2004).

The magnitude of work that must be done in an IT audit is too significant for external auditors to efficiently handle alone; thus most companies have added an IT audit component to their internal audit department (Merhout and Cothran, 2006; Needleman, 2006). Employment recruiters Kenneth Laury and John Cronin noted back in the year 2000 that "the need for information technology auditors far outstrips the supply of qualified candidates" (Cangemi, 2000, p. 44), an indication that this trend has been in effect for some time. And, with the growing dependence on IT in a company's operations and the changes in the regulatory environment, the demand and need for IT auditors continues to increase, both in the US and internationally (e.g., Dodds, 2005; Gallegos, 2003b; Needleman, 2006; Rosenthal-Sabroux, 2006). Moreover, the rapid changes in the IT environment require auditors to constantly update their skills and technical knowledge (Cangemi, 2000; Gallegos, 2003a; Oliphant, 1998).

2.2 IT Auditing – A Blend of Two Disciplines

The IT Audit function is unique because it blends the skills of an auditor, whose primary focus is to ensure that the financial statements are presented fairly, and the skills of an IS professional, who is educated and skilled in the implementation, operation, and maintenance of IT systems in an organization. The IT auditor is the technical expert providing guidance to the audit staff (Gallegos *et al.*, 2004). In addition to unique technical abilities, IT auditors must also possess the general business and operational acumen often associated with internal and external auditors (Cangemi, 2000).

2.2.1 External and internal audit skills: External auditors have experienced continual changes in their sector of the auditing profession in this post-Enron era. The public accounting profession has evolved in response to financial scandals such as Enron and WorldCom (and others like it) and the subsequent regulations created in attempt to regain the public's trust in the auditing profession and in financial reporting by companies (Holtzman, 2004). The Certified Public Accountant (CPA) has moved from the "back office to the front office," and the roles of accountants/auditors have often been redefined "from information processors to strategic business advisors" (Holtzman, 2004, p. 949). According to one "Big 4" CPA firm partner speaking at our university, the expectations for an entry-level external auditor include: integrity, a positive attitude, independent and critical thinking, teamwork, continuous improvement and learning, written and oral communication skills, professionalism, and ownership and accountability.

Internal auditors have also seen changes in their professional duties "as [they] shed some of their operations focus [on efficiency]" and evolved into having more of a financial controls perspective because of SOX requirements (Harrington, 2004); moreover, they have taken on a more strategic role in corporate risk management (Pickett, 2004).

Harrington argues that communication skills (both oral and written) have become increasingly important for internal auditors because of their new responsibilities and the need to build relationships with the audit committee of the Board of Directors. Companies are also looking for a broader range of skills for internal auditors. The internal audit professional must now understand financial controls, while continuing their responsibilities to truly comprehend the general business structure of their organization and the processes they audit. At the same time, internal auditors must also continue to develop and expand their interpersonal skills (because of their increased exposure to management and Directors).

Other qualifications for internal auditors may include "Big 4" audit experience (an average of five to fifteen years experience is preferred); an educational background in finance, accounting or related degree; a professional certification, such as Certified Internal Auditor (CIA), Certified Fraud Examiner (CFE), Certified Management Accountant (CMA), Certified Financial Manager (CFM), or the Certified Information Systems Auditor (CISA) designation; experience with internal controls and Sarbanes-Oxley; a high degree of personal and professional ethics; the ability to manage and motivate staff; highly-developed analytical and problem-solving skills; and strong IT skills, such as in database design (Harrington, 2004). Pickett (2004) adds that the new internal auditor should be able to assess the "big picture" (especially in cases of missing or distorted information), but yet still understand details and comprehend how the pieces fit together.

2.2.2 Information systems skills: To succeed in today's business environment, information systems employees can no longer use their technical job as an excuse to neglect necessary interpersonal skills (Young, 1996). Specifically, written and oral communications skills are important for IS personnel in order to work in business units, create usable documentation, and interact with financial management (Young and Lee, 1997). Outsourcing of IT jobs and changes in the US economy have led to changes in the preferences for knowledge and skills by recruiters (Fang, Lee and Koh, 2005). Their study determined that key factors for hiring decisions for entry-level IT positions include communication skills, internship work experience, technical skills, grade point average, and management skills. Somewhat surprisingly, interpersonal and personal skills (e.g., teamwork, critical thinking) are viewed as the most important attributes, and are rated higher than specific IS core knowledge and technical skills (e.g., operating systems, database design, networking). However, when specific software skills are required, the ones most often desired include web related tools (e.g., ASP, VB.net), e-mail tools, database query languages, and PC operating systems (Fang, Lee and Koh, 2005). When specific technical skills are not specifically required, it is most likely because of the rapidly changing technology environment; instead, IS personnel are expected to be effective learners and to continue their technical training throughout their careers (Young, 1996; Young and Lee, 1997).

These skills expectations for external and internal auditors and for IS personnel have been previewed because it

is helpful to keep them mind as the skills and knowledge for IT auditors are analyzed throughout this paper. The necessary blending of audit abilities plus technology proficiencies gives the IT auditor a unique combination of both the general business and systems knowledge to properly carry out their responsibilities (Cangemi, 2000).

3. RESEARCH

3.1 Research Questions

The ever changing IT environment and the increasing need for IT auditors with an adequate blend of skills create the need for a study to determine:

- (1) the skills and knowledge that employers most often desire for IT auditors, and
- (2) the skills IT auditors need to develop in order to advance in the profession.

The data to address these two questions generally comes from Web job advertisements which are summarized and then analyzed from the perspective of the literature. In response to the analysis of these two research questions, we also indicate how different degrees (i.e., accounting and IS) tend to prepare IT auditors for entry-level jobs. This current paper is part of an ongoing overall study to understand the phenomenon of the recent dramatic increase in demand for IT audit human resources and to determine ways IT/MIS educators might refine their curricula to provide better service to their stakeholders by helping to meet this demand. This research will provide useful information for current IT auditors and those interested in entering the IT audit profession, with an emphasis on entry-level positions expected to be filled by recent college graduates.

3.2 Research Methodology

We have found no existing studies that empirically investigate the skills and knowledge required for IT auditors. Similar to other research using employment advertisements (e.g., Koong, Liu and Liu, 2002; Lee and Lee, 2006; Prabhakar, Litecky and Arnett, 2005; Wade and Parent,

2002), we initiated our study by identifying IT Audit positions posted on one well-known job search website, monster.com. Specific job advertisements were located by inputting "IT audit" as a keyword in monster.com's home page search option. The job postings selected for the current study (based on containing the required amount of detail in the advertisement) were located throughout the United States. All efforts were made to reduce duplicates in this study, and unique job advertisements were analyzed to determine the key (i.e., the most prevalent) skills and knowledge required of IT auditors by employers. While we are cognizant that at least 95% of these advertised positions require experience, we nonetheless argue that most of these skills are essential for IT auditors at any level and can be used as a gauge for what entry-level auditors will need to possess (or develop) to be successful in this career over the long term.

New jobs were listed almost daily and were captured in a spreadsheet over the period beginning October 18, 2005 and ending April 12, 2006. For each job advertisement, the date of the posting, the name of the company, the job title, and the location were recorded. The degree, experience, and certification requirements were also noted. The skills and knowledge desired by the company were noted as well, and grouped into the following categories (listed in Table 1) based on an analysis of sample data (with an effort to mirror similar studies done by Lee and Lee, 2006; Prabhakar, Litecky and Arnett, 2005; Todd, McKeen and Gallupe, 1995; and Wade and Parent, 2002). Specifically, we used the skills classification schemes proposed by Todd, McKeen and Gallupe (1995) and further developed by Wade and Parent (2002); we also added some additional categories to cover the unique IT audit skills identified. These additional categories are generally based on the Information Systems Audit and Control Association (ISACA) *Model Curriculum*(2004); e.g., "Audit Process" is one of ISACA's seven curriculum domains. See Table 1 for a listing of the skills categories we used for classification purposes.

Technical Skills/Abilities	Organizational Skills/Business Knowledge	Audit & Technical Knowledge
<ul style="list-style-type: none"> • Hardware/Telecommunications <ul style="list-style-type: none"> - Networking - Internet - Security • Software <ul style="list-style-type: none"> - Operating Systems - Database <ul style="list-style-type: none"> ▪ CAATs*/ACL** ▪ SQL*** - Windows/Office Applications - Programming - ERP**** 	<ul style="list-style-type: none"> • Work Experience • General Management <ul style="list-style-type: none"> - Degree - MBA Preferred • Communications • Problem Solving • Social <ul style="list-style-type: none"> - General - Willingness to Travel - Willingness to Work Long Hours - Foreign Language 	<ul style="list-style-type: none"> • Systems Knowledge <ul style="list-style-type: none"> - Development Methodology - Computer Operations - Experience with IT Controls • Audit Knowledge/ Experience <ul style="list-style-type: none"> - Audit Framework <ul style="list-style-type: none"> ▪ COBIT ▪ COSO - Audit Process - General Audit Knowledge - Sarbanes-Oxley Section 404 Experience - Risk Experience - Big 4 Experience • Certification

Table 1. Organization of Skills

3.3 Research Results

Table 2 illustrates the number of times a particular category was mentioned in the ads and the percentage of jobs listing the category (out of 595 ads).

Technical Skills/Abilities		
Hardware/Telecommunications		
Networking	112	19%
Internet	49	8%
Security	106	18%
Software		
Operating Systems	139	23%
Database	141	24%
CAATs/ACL	89	15%
SQL	22	4%
Windows/Office Apps	107	18%
Programming	19	3%
ERP	204	34%
Organizational Skills/Business Knowledge		
Work Experience	565	95%
General Management	315	53%
Degree	524	88%
MBA Preferred	173	29%
Communications	356	60%
Problem Solving	112	19%
Social		
General	191	32%
Willingness to Travel	275	46%
Willingness to Work Long Hours	25	4%
Foreign Language	15	3%
Technical Knowledge		
Systems Knowledge		
Development Methodology	64	11%
Computer Operations	29	5%
Experience with IT Controls	184	31%
Audit Knowledge/Experience		
Audit Framework		
COBIT®	90	15%
COSO	105	18%
Audit Process	163	27%
General Audit Knowledge	27	5%
SOX Experience	180	30%
Risk Experience	122	21%
Big 4 Experience	248	42%
Certification	503	85%

Table 2. Results of Coding 595 IT Audit Job Advertisements

3.3.1 Education, certification, and experience: Almost all of the jobs analyzed were targeted for experienced IT audit positions; thus the number of postings requesting work experience was 95%. This experience ranged from two to three years for an IT Audit Senior to twelve years for an IT Audit Director.

While the requirements for IT auditing skills are changing and emerging every day, all IT auditors are

expected to possess a minimum level of general skills and qualifications. According to Hunton, Bryant and Bagranoff (2004), IT audit professionals are very likely to hold a bachelor's degree. Our research shows that 88% of the jobs posted require a candidate to hold a bachelor's degree. The degrees most often noted were accounting, finance, information systems, computer science or other related degrees. While these are the most noted degrees, a study by Merhout and Cothran notes that one "IT audit hiring manager [they interviewed] was looking for any business major with an aptitude for technology" and a high GPA (2005, p. 400). A graduate level degree, most often a Masters of Business Administration or other related degree, was either preferred or required in 29% of the jobs posted. In addition, many IT audit recruiters prefer candidates who hold a professional designation, such as a CISA, CIA, or CPA (Cangemi, 2000). Gallegos *et al.* state that, "certification is important and a measure of skill attainment" (2004, p. 611). Not surprisingly, our research discovered that 85% of jobs posted preferred (or required) certification or a candidate working toward certification.

3.3.2 Technical skills/abilities: The IT auditor needs to be able "to work in many different environments: from organizations totally dependent on mainframes, [to] those who have ... a network of client/server applications, to those who [use] standalone mini and micro computers" (Oliphant, 1998). From our research and analysis, network, Internet, and security knowledge were desired by only 19%, 8%, and 18% (respectively) of companies with job postings. According to IT audit employment recruiters Gerry Meyers (a past president of ISACA) and Madeline Meyers, "proficiency in UNIX is still a must [and] those competent in PeopleSoft, Oracle, and Windows NT are also in high demand" (Cangemi, 2000, p. 43). The operating systems category in our study includes UNIX, Windows NT, and other environments, and 23% of job postings we analyzed desired skills in these areas. Moreover, 24% of the jobs preferred database skills, including Oracle, PeopleSoft, JD Edwards, and others.

Companies posting advertisements desired ACL/CAATs and SQL abilities in 15% and 4% of their ads, respectively. Since ACL and CAATs are used to extract and manipulate data (at the population, rather than sample, level) while SQL is used mainly to define and access relational databases, it is no surprise that ACL and CAATs have a higher percentage (Hunton, Bryant and Bagranoff, 2004; Gallegos *et al.*, 2004). In addition, 34% of jobs we analyzed desired experience with ERP systems - most likely because many organizations now see enterprise systems as the answer to their overall business information needs, and because IT auditors must assess the significant risks associated with ERP software and ensure controls are working properly (Gallegos *et al.*, 2004). 18% of companies desire IT auditors to possess experience with Windows applications, and the Windows abilities and skills most often referred to include proficiency with Microsoft Office applications and personal computing.

Programming skills requirements were negligible (i.e., 3%), as IT Auditors typically have little to no programming responsibilities during their audits. Each client requires different technical knowledge; accordingly the more broadly

diversified an IT auditor's background, the more marketable he or she is (Cangemi, 2000) (rather than in-depth knowledge of specific technologies which can be brought into the engagement on an as-needed basis). In summary, while experience in all the technology areas previously mentioned are certainly desirable, "it's probably more important that an individual...just genuinely 'like' computers and technology" (Hunton Bryant and Bagranoff, 2004, p. 8) and have a strong aptitude for IT.

3.3.3 Business knowledge—management, communications, problem solving, and social skills: Hunton, Bryant and Bagranoff (2004, p. 8) argue, "[w]hile technical skills are important [for] an IT auditor, general business skills probably matter even more," and our research determined that 53% of the jobs posted preferred general management skills, such as leadership, project management and planning, and training. 32% of the jobs desired strong general social skills including interpersonal skills, personal motivation, the ability to work independently, and teamwork skills. While being able to work independently when required is vital for audit productivity and flexibility, auditors especially need teamwork and interpersonal skills since they usually work as part of an engagement team; moreover, they need exceptional interpersonal skills to overcome many organizations' negative attitude toward auditors (Hunton, Bryant and Bagranoff, 2004). Oral and written communication skills were classified separately because of their importance in IT auditing. Hunton, Bryant and Bagranoff, (2004) notes that, "IT auditors, like all auditors, write up their work [and] frequently make presentations to clients. As a result, written and oral skills are keys to success in the profession" (p. 8). This assertion is strongly supported in our research because 60% of the jobs posted expressed a desire for oral and written communication abilities. Interestingly, problem solving skills, such as analytical modeling, finding creative solutions, and critical thinking skills, were specifically mentioned by only 19% of the companies.

3.3.4 Audit and systems technical knowledge: According to our research results, 11% and 5% of companies expressed preferred knowledge of systems development methodologies and computer operations, respectively. Additionally, 31% of the classifieds desired experience with IT controls. The *Control Objectives for Information and related Technology* (more commonly referred to as COBIT®) is a popular IT controls framework sponsored by ISACA – it "may be used by auditors in assessing and advising management about internal controls" (Hunton, Bryant and Bagranoff, 2004, p. 13). Our research determined that experience with the COBIT® controls and auditing framework is explicitly desired in 15% of the jobs posted. The more generic COSO framework, developed by the Committee of Sponsoring Organizations of the Treadway Commission, may also be used by IT auditors in assessing controls and is preferred by 18% of companies. Thus a full third of the classifieds specifically mentioned an audit framework. Furthermore, 27% of the posted jobs preferred knowledge of the audit process, most likely because of the interaction with financial auditors and the need to apply a formal audit process in IT audits.

Because of the recent heightened compliance requirements and the specific internal control mandates of Sarbanes-Oxley Section 404, experience with SOX is desired by 30% of companies. Sarbanes-Oxley requires that each publicly traded corporation adopt and implement an appropriate internal control framework. Accordingly, IT auditors need an understanding of the risks facing an organization because of the necessity to identify controls to mitigate these risks. In addition, Enterprise Risk Management (ERM) has achieved a greater presence in organizations, and COSO was created to help manage risks. Not surprisingly, therefore, experience with evaluating and mitigating risks in an organization is preferred in 21% of the jobs posted.

As mentioned, most of these advertisements were seeking to hire experienced professionals, and 42% of the companies prefer to hire IT auditors with previous "Big 4" auditing experience. (While this category encompasses consulting, and internal, and external auditing, "Big 4" or "Big 5" had to be mentioned to be included.) According to Jon Molkentine, president of a professional search firm, "companies throughout the US are looking for candidates who have come up the ranks in public accounting or within internal audit groups of major corporations" (Cangemi, 2000, p. 44). The desire for "Big 4" and public accounting experience is most likely due to the wide range of experiences auditors receive while employed at these firms, including having publicly traded companies as clients.

3.3.5 Supplemental data - requirements for IT auditors by one international risk consulting firm: A desire for a more specific look into the skills and knowledge of IT auditors suggested an interview with the human resources department of a large international risk consulting firm that regularly hires IT auditors (the second author of this study previously interned at this firm). This firm specializes in independent risk consulting and has a large technology risk service sector that hires IT auditors. Questions were asked about the skills and knowledge required at the different IT auditor levels (consultant, senior, manager and director) within the firm. The responses of the head of human resources in one of firm's offices are discussed and may be insightful for IT auditors interested in the skills needed to advance to higher positions.

A bachelor's degree in computer information systems (CIS), MIS, finance or accounting is required, and a combination of CIS or MIS with finance or accounting is most highly desired at all levels. A master's degree is not required at any level, but is considered when hiring decisions are made. Entry-level employees must have a minimum grade point average of 3.0 on a 4.0 scale. In addition, candidates need to be open to traveling, and expectations are set at 50% annually. (This approximates the total for Travel requirements in Table 2.) Business related jobs or internships and prior exposure to auditing is also preferred when hiring entry-level consultants. Two to three years experience is required for a senior hire. In addition, "Big 4" experience is preferred, and IT auditors hired out of industry may be started at a lower level because their exposure to certain audit methodologies is usually limited. For a manager hire, at least five years experience is required, with audit, consulting,

and "Big 4" experience preferred. Eleven plus years experience in a closely related field is required for directors to be hired.

Certification is not required for a consultant or senior hire, but it is encouraged and expected in order to move into management. At the manager and director level, certification is "VERY strongly desired" (i.e., required). The certifications acceptable include a CPA, CIA, CISA, Certified Information Systems Security Professional (CISSP), Project Management Professional (PMP), CFE, and Certified in Production and Inventory Management (CPIM). Communication skills for entry-level consultants are desired and include the ability to be professional (e.g., "could we put them in front of a client?"), articulate, quick-thinking, and good at conversation. The same communication skills are desired for seniors with the addition of the ability to "effectively communicate" with people who work "for" them. At the manager and director levels, communication skills need to be developed and "exceptional." When hiring consultants, leadership skills in team projects or groups are also assessed. At the senior level the abilities to delegate responsibility and plan engagements are required. Managers and directors are additionally expected to have experience managing projects.

Technical skills requirements, as defined in our study, are rather insignificant for this firm at the consultant level - basic knowledge of system types and general IT language is all that is required. Technical knowledge requirements, as defined in this study, are also minimal and are not necessary for consultant hires. For senior, manager and director level hires, a diverse skill base in IT auditing and information systems is desired, and proficiency in Microsoft Office suite applications is required. Industry knowledge becomes increasingly important at the manager and director levels. Knowledge of the Sarbanes-Oxley Act provisions and methodologies for achieving compliance is also desired at the senior, manager and director levels.

4. SUGGESTIONS FOR IT/MIS/AIS EDUCATORS

4.1 Degrees Required for IT Auditors

Our research shows that 88% of the jobs posted specifically require a candidate to hold a bachelor's degree (indeed, it is difficult to believe anyone would be an entry-level hire into this profession without a four year degree of some sort). Most public accounting firms tend to desire that an IT auditor have an accounting degree with a management information systems or CIS co-major or minor (Hunton, Bryant and Baganoff, 2004; Merhout and Cothran, 2006). The dual accounting/MIS degree allows IT auditors to obtain the CPA designation and have detailed understanding of auditing and regulatory requirements.

However, Merhout and Cothran (2006) note that non-public accounting firms (e.g., internal audit departments of corporations) are often willing to hire MIS majors without any additional coursework in accounting (other than the foundation accounting classes required of all business majors). These findings highlight the varying requirements for different entry-level career opportunities in IT audit, and also represent an opportunity for MIS/IT educators to help develop students for a non-traditional career path for MIS

majors. MIS educators could note the requirements for audit and systems technical knowledge from this study (Sec. 3.3.4) and incorporate audit control frameworks and risk management into their courses, for example.

4.2 ISACA Model Curriculum

Universities and colleges are encouraged to use the ISACA *Model Curriculum* (2004) when creating IT audit programs or offering IT audit courses (Merhout and Cothran, 2006). ISACA is the 65,000 member international organization dedicated to serving IT governance, control, security and audit professionals. The *Model Curriculum* was developed by ISACA as a guide for educators wanting a framework of the educational topics required for students to develop the skills needed to be employable in the profession, and can be downloaded for no charge at www.isaca.org. The seven curriculum domains include: 1) Audit Process; 2) Management, Planning and Organization of IS; 3) Technical Infrastructure and Operational Practices; 4) Protection of Information Assets; 5) Disaster Recovery and Business Continuity; 6) Business Application System Development, Acquisition, Implementation and Maintenance; 7) Business Process Evaluation and Risk Management. Note that these domains map to the CISA certification examination content areas, which would give students an advantage when pursuing this key professional designation. (This certification is particularly important for those non-accounting majors who cannot pursue the CPA designation.)

In addition to the suggested curriculum model, the *Curriculum* document also provides implementation guidance, such as an appendix entitled "Relevance of ISACA Model Curriculum to COBIT Conceptual Framework and CISA Content Areas." Another appendix provides examples of mapping existing university programs to the ISACA Model Curriculum Compliance Grid. This provides both MIS and accounting information systems (AIS) programs a means to compare their existing curricula to the ISACA model to be able to identify gaps in course content.

4.3 Importance of COBIT® to the IT Audit Profession

In addition to the *Model Curriculum*, ISACA also provides a means to effectively integrate COBIT® into MIS and AIS information technology audit curricula. COBIT® was developed as a framework for the development and management of internal controls and appropriate levels of security in IT (ITGI, 2004). Thus, it is not only important for IT auditors to be familiar with the framework, as discussed in Section 3.3.4, but it is also important for the competency, knowledge and skills of the IT auditor to be considered when an organization hires an IT auditor as an important part of its IT human resources. As outlined in the COBIT® "Cube" (ITGI, 2004, p. 11), "people" are one of the five IT resources needed to help organizations meet business information requirements (the others are application systems, technology, facilities, and data). People are defined as the "staff skills, awareness and productivity to plan, organise, acquire, deliver, support, monitor, and evaluate information systems and services" (ITGI, 2004, p. 11). People include: management; employees; internal, external, and IT auditors; and all users of IT in the organization.

IT audit expertise can be integrated into various domains and processes of the COBIT® framework, and IT auditors can serve as consultants or as part of the internal or external audit team. For example, the IT auditor can be involved in the Plan and Organize (PO), Acquire and Implement (AI), and Deliver and Support (DS) domains (ITGI, 2004). As consultants, IT auditors can help organizations with numerous processes in the PO domain including, defining information architecture (PO Objective #2), communicating management aims and directives (PO Objective #6), and/or ensuring compliance with external requirements (PO Objective #8), just to name a few.

MIS educators can thus utilize COBIT® in the classroom in many effective ways. For example, the *COBIT in Academia* materials, available from ISACA (www.isaca.org) is a comprehensive set of instruction materials, including a COBIT Presentation Package (slides), COBIT Student Book, COBIT Caselets, and a COBIT Case Study: TIBO. They can be integrated in different types of assignments, such as having students prepare a research paper and presentation on some course topic (e.g., identity theft) and to apply the COBIT framework as appropriate to that content.

4.4 Impact of Advanced Degrees and Certifications

A study by Wier, Hunton and Beeler (2000) determined the impact of advanced degrees and certifications on promotions in IT auditing versus non-IT auditing. This may be insightful for individuals considering entering the IT auditing profession or continuing their education during their careers (and for educators advising them). The study found no significant differences in the promotion time between the senior and manager level for IT auditors with or without a master's degree. Accordingly, Wier, Hunton and Beeler state that, "the beneficial effects of a Master's degree is not realized for [IT] auditors until the highest level of promotion [i.e., manager to partner] is obtained" (2000, p. 39). At the executive level, those with an advanced degree become partner at a much faster rate. Hence, "there are significant long-term benefits for [IT] auditors attaining a Master's degree, more specifically, an MBA" (Wier, Hunton and Beeler, 2000, p. 41, emphasis added).

Based on Wier, Hunton and Beeler's research, IT auditors are promoted more quickly when they have the CPA designation than when they do not (giving an advantage to the professional with an accounting degree who can pursue this certification). Moreover, faster promotions also are seen by IT auditors with a CISA designation than those without: "[IT] auditors with either the CPA or CISA professional certification gain a relatively remarkable significant promotion advantage over their careers, when compared to IS auditors without the certifications" (Wier, Hunton and Beeler, 2000, p. 41). The study thus concludes that short-term sacrifices are worth it over the long-run career of an IT auditor and that "life-long learning initiatives...suggest a win-win situation for [IT] auditors and their profession" (2000, p. 41). Ryan and Schou (2004) add that security professionals are seeking academic credentials and/or certifications (such as the CISA) in dramatic numbers – another argument for the increasing importance of certifications, training and education for IT auditors' continued career success.

5. LIMITATIONS, FUTURE RESEARCH & CONCLUSIONS

5.1 Possible Limitations and Future Research

In this study we have attempted to triangulate our evidence from four sources: 1) review of the external audit, internal audit and IT audit literature, 2) an extensive content analysis of 595 employment advertisements directed at IT auditors, 3) a formal interview with the human resources manager of a large, international information risk management consulting firm, and 4) numerous informal conversations with campus recruiters hiring entry-level IT auditors. We argue these diverse sources of evidence, which cumulatively provide very consistent themes about the key skills and abilities for success in an IT audit career, are a major strength of our study.

Of course, no research is without some potential limitations; for example, one might wonder if an advertisement not mentioning a particular skill implies that the skill is not desired. However, word space is usually limited in advertisements because of various factors (cost; job seeker attention span, etc.); thus it is not unreasonable to infer that the ones that are specifically mentioned are the key skills sought. This assumption is consistent with prior studies. Moreover, we recognize that our main source of evidence, the 595 job advertisements, are almost entirely directed towards experienced IT auditors and conceivably may not represent the most important key skills and abilities required of truly entry-level employees. However, we contend that these skills required of upper-level IT auditors are the ones that are required for long-term success in this career.

In the future we would like to accumulate enough entry-level job postings (from campus recruiter contacts) to do a content analysis of their job descriptions. In addition, we hope to formally interview and/or survey campus recruiters about their perceptions of key skills and abilities of our candidate pool (and perhaps expand this to other campuses they recruit as well). And finally, we may attempt to formally interview and/or survey recent IT audit hires (e.g., within year one) to see if their perceptions of what skills they need and have agree to our research findings. We have done this informally in the past and received insightful feedback, such as how surprised staff-level auditors were about the quantity of writing required in their audit engagements.

5.2 Conclusion

IT auditing is a fast paced and challenging career. The blending of auditing knowledge with IT skills is unique and necessary for the IT auditor. "[IT auditors] must have interpersonal skills to interact with multiple levels of personnel and technical skills to understand the variety of technology used in [organizations]" (Gallegos *et al.* 2004, p. 605). IT auditors can take many paths in their careers, including public accounting, private industry, consulting, and government (Gallegos *et al.* 2004). And, regardless of the path they choose, continuing education in specific skills and knowledge is most important. On the other hand, one suggestion IT auditors might want to heed as they advance through their career is that, while the skills and knowledge mentioned throughout this paper are essential to acquire and

develop, "the glue that holds it all together...is [a 'can do'] attitude" (Cangemi 2000, p. 44). Moreover, IT/MIS/AIS educators should strive to cultivate such a positive attitude in their students, and they should also make students aware of the potential opportunities in the challenging (and lucrative) IT audit career path.

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