Future Educational Programs and Employment Prospects in Information Technology

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Abstract

Over the past several years, we have experienced a rather dramatic downward turn in demand for entry level information technology (IT) professionals. However, reports of trends at the end of 2004 indicated that job postings for IT workers reached their highest levels since 2001. This occurs at a time when the number of four year degree programs in IT has increased while the students interested in studying IT has decreased. The consensus among many recruiters is that there is a general lack of interest in pursuing an IT degree, and this will lead to shortages in qualified IT professionals.

This paper will examine the future of our technology-related educational programs as well as the projected employment prospects in the IT field. The paper will attempt to match competencies developed in our educational programs with projections for growth areas and shortages in the job market.

Introduction

The Information Technology (IT) workforce in the U.S. has been on a roller coaster of sorts over the past seven years. From a period of high demand, high salaries and worker shortages leading up to Y2K to the devastating dot-com bust in 2001 to the dramatic increase in offshore outsourcing and corporate downsizing in early 2004, employment prospects have been pessimistically unpredictable. Prospects for new positions and the lucrative salary offers of the late 1990's became a distant memory. The high tech boom and bust raised very serious concerns about the future of IT. The U.S. Bureau of Labor Statistics reports that in excess of 100,000 Americans left the IT labor force in late 2001 and 2002 and nearly 70% have not returned. There are expressed concerns that many people do not view IT as a long-term career path (Chabrow and McGee, 2005).

Following the boom period of Y2K and dot-com growth, enrollment in technology-related programs in colleges and universities has decreased substantially. The annual Computing Research Association's Taulbee Survey reported that undergraduate enrollment in programs for computer science and computer engineering dropped from 23,033 in 2002 to 17,706 in 2003 (Malykhina, 2005). Many students with aspirations for the technology arena decided to dedicate their talents to other more predictable fields of study. Students see employment reports that indicate that some companies are electing to forego full-time hires and use contract workers for projects and

support requirements to hold the line on expenses (Hoffman, 2004). Add to this the threat of layoffs and falling wages as a result of offshore outsourcing, and the decision to study an information systems related field is further compounded (Baker and Kripalani, 2004). Students are concerned that advanced technical degrees are expensive and may not provide the skills they need in the job market; therefore they are seeking business degrees as they feel safer from outsourcing threats if they have business qualifications (Verton, 2004).

To further confuse matters in a positive sense, however, Rich Stockfield of Atlanta-based Talenthire.com recently cited strong demand for IT auditors and IT security experts to respond to needs created by the Sarbanes-Oxley Act (Hoffman, 2004). Agents at the Recruiting 2004 Conference held in New York in November indicated that job postings for IT workers reached the highest levels since the 2001 dot-com bust (Hoffman, 2004).

Concerns for Higher Education

The convoluted scenario presented above creates a rather serious dilemma for the range of technology-focused programs found in colleges and universities. Many programs have experienced enrollment declines commensurate with the declining market place opportunities. The author has always been a firm believer in monitoring the marketplace that accepts its graduates, and adjusting content according to regional needs.

More importantly however, is the need to make our technology curricula "living documents." With the rapidly evolving pace of technological change and the dramatic changes in the needs of the technology marketplace, curricula for technology-oriented programs must be dynamic and flexible enough to react to the needs and demands of that changing marketplace. This is not to infer that our programs should become too vocational in nature, content or concept. Instead, the inference is that an information systems/computer science curriculum cannot be committed to paper and offered without change year after year. As educators, we must remain astutely aware so as to accurately assess the marketplace and maintain currency and relevance. To that end, we must also accurately define and communicate the objectives and expected learning outcomes of our programs. We must not mislead our students but instead clearly define the types of opportunities they will be prepared for upon completion of our programs. The ever-present threat of preparing a student for employment in an area that is a candidate for offshore outsourcing is another reason to closely monitor our marketplace.

All is not gloomy, however. Many analysts believe that the IT field will be facing worker shortages within the next several years. In an online article in TechRepublic, Joe Santana (2003) reports that there will be a huge shortage of IT workers due to the retirement of millions of baby boomers. Santana's projection is based on data provided by the Bureau of Labor Statistics. The Bureau of Labor Statistics also projects that eight of the ten fastest-growing occupations in the foreseeable future are technology-related. These job classifications include computer software engineers, applications; computer support specialists; computer software engineers systems software; network and computer systems administrators; network systems and data communications analysts; desktop publishers; database administrators; and computer systems analysts (Harper, 2003).

Although offshore outsourcing remains a threat to entry level employment opportunities, some analysts believe that the outsourcing movement is healthy because it may create more sophisticated jobs and eliminate less productive ones. These same analysts admit that many jobs remaining in the U.S. could be prone to lower wages (Paramasan, 2003). Add to this the risks involved in outsourcing because of language difficulties between customers and service representatives and the skill sets of some foreign workers. In a November 2003 announcement (Gonsalves, 2003), Dell indicated that it had withdrawn technical support for two corporate computer lines from India back to the U.S. following complaints from commercial customers. Although the going rate for a recent college IT graduate in Shanghai is 10-15% of that required in a major American city, there are also pitfalls to overcome. Training is expensive and time consuming, language is a major obstacle, and to function smoothly much support for quality assurance, documentation, and technical support is required (Evans, 2004). The salary costs are far from the total costs.

In the meantime, there are some executives such as Jamie Dimon, CEO of J. P. Morgan Chase and formerly CEO of Bank One Corporation who simply believes that technology is better done in-house. He cancelled a $2 billion IT outsourcing deal with IBM while at Bank One, and he has now cancelled a $5 billion 10 year deal with Chase and IBM. The Chase statement accompanying the cancellation stated "We believe that managing our own technology is best for the long term growth and success of our company" (McDougall, 2004).

Concurrently, another form of "homegrown IT outsourcing" is emerging as competition for those jobs going offshore. These options are sprouting up across rural America and are being referred to as "rural IT sourcing." Lower cost and underemployed workforces in rural areas have appeal to large and small companies alike. The CIO of McKesson Corporation estimates a $10 million annual savings in salary costs after relocating its primary data center and about 75 IT jobs from San Francisco to Dubuque, Iowa. Similarly, the Mattel Inc. CIO estimates a savings of 33% by outsourcing a portion of web-based software development to Jonesboro, Arkansas (King, 2005). Although the current capacity of rural sources is inadequate to compete with Wipro of India, this innovative movement may gain momentum and allow IT professionals in these areas to be paid well by local standards, and keep employment opportunities in the U.S.

Finally, there are analysts who believe that we should stop worrying about IT positions going offshore and concentrate on generating new jobs in new industries in the U.S. Investing in education and innovation and a willingness to take risks will lead to success in America. We must revive the interest in Ph.D. programs in science and engineering as the number of doctorates awarded to Americans in these critical fields has dropped by 16% since 1997 including a 25% decline in mathematics and computer science (Mandel, 2003). A Purdue University study reported to Congress that of 5,500 doctorates in computer science and engineering awarded by North American universities between 1992 and 1997, only eight were awarded to U.S. citizens. These are distressing indicators that we may face future shortages in these critical areas (Verton, 2004).

The Present and the Future

In December of 2004, the American Institute of Certified Public Accountants (AICPA) released a Top 10 Technologies list that included an unprecedented seven first-time entries. The AICPA Top 10 list along with a brief description for as follows (AICPA. Org, 2004):

1. **Information Security.** The hardware, software processes, and procedures in place to protect organizations' systems. It includes firewalls, anti-virus, password management, patches, facilities, etc.

2. **Spam Technology (new).** The use of technology to reduce or eliminate unwanted e-mail. Technologies range from confirmation of the sender via ISP lookup to methods where the recipient accepts e-mail only from specific senders.

3. **Digital Optimization (new).** Also known as The Paperless Office. The process of capturing and managing documents electronically in PDF and other formats.

4. **Database and Application Integration (new).** The ability to update one field and have it automatically synchronize between multiple databases.

5. **Wireless Technologies.** The transfer of voice or data from one machine to another via the airwaves without physical connectivity.

6. **Disaster Recovery.** The development, monitoring, and updating of the process by which organizations plan for continuity of their business in the event of a loss of business information resources due to theft, weather damage, accidents, or malicious destruction.

7. **Data Mining (new).** The methods by which a user can sift through volumes of data to find specific answers.

8. **Virtual Office (new).** The technologies, processes, and procedures that allow personnel to work effectively, either individually or with others, regardless of physical location.
9. **Business Exchange Technology (new).** The natural evolution from EDI to greater business transaction and data exchange via the Internet using datasets that are transported easily between programs and databases.

10. **Messaging Applications (new).** Applications that permit users to communicate electronically, including e-mail, voicemail and instant messaging.

The AICPA initiative also identified five emerging technologies. The expectation is that these technologies will affect businesses and individuals over the next several years. The technologies identified include the following (AICPA, Org 2004):

1. **ID/Authentication.** Verifying either the identity of a user who is logging onto a computer or the integrity of a transmitted message.

2. **Radio Frequency Identification (RFID).** RFID tags, which consist of silicone chips and an antenna that can transmit data to a wireless receiver, could one day be used to track everything from soda cans to cereal boxes. Unlike bar codes, radio tags do not require line-of sight for reading.

3. **3G wireless.** Designed for high-speed multimedia data and voice.

4. **Simple Object Access Protocol (SOAP).** A message-based protocol based on XML for accessing services on the Internet.

5. **Autonomic Computers.** Tools and strategies to manage and maintain all systems across the enterprise, including system maintenance, upgrades, automatic patching, and self-healing. This is an approach toward self-managed computing systems with a minimum of human interface.

The preceding lists may prove helpful as we proceed with efforts to update our curricula. Awareness of the technologies and emphasis on related course content in our curricula can pay handsome dividends for our students. It is healthy to have a sense of current and future market needs as we strive to retain relevance in our programs. It is also helpful to be aware of current Bureau of Labor Statistics. For example, in the eight IT job categories tracked by the Bureau of Labor Statistics, unemployment has been lowest among database administrators (1.8%) and network and system administrators (2.9%) over the last four quarters. Worst on the list were network and data communication analysts (5.2%) followed closely by support specialists (4.5%) and programmers (4.1%). At the end of the 12 months ending March 31, 2005, there were a reported 131,000 unemployed IT professionals, the lowest level since the 112,500 reported in the third quarter of 2001 (Chabrow and McGee, 2005). Recruiters have tracked the beginning of the upturn back to the summer of 2004. Lest we become too optimistic; however, many feel that a number of companies have simply decided to invest and increase beyond skeleton staffs that had been in place for the past several years.

Recommendations

As one can readily determine, we, as educators, are faced with a very complex set of circumstances. We must be prognosticators of sorts to ensure that what we teach is relevant and forward looking. We can examine the earlier stated recommendations of the AICPA, and decide whether our graduates are qualified to address some of the identified needs.

The research, however, does identify some rather specific areas of need now and for the near term future. What skills do the practitioners claim are desirable for entry level employment? Based on current research, the author of this paper will recommend those areas or practices that appear to be most promising for the immediate future.

1. At the very top of our list, our curricula should have a formidable communications requirement. A 2004 report by the National Commission on Writing reported that 33% of employees at blue chip companies can't write well. Communication skills, more so than technical skills can eventually catapult people to top management positions (Morsch, 2005). Leslie Bonner of business consulting firm Solutions 21 opines "My experience is that it's (communication skills) the number one aspect employers look for. It's just like your appearance. It's the most noticeable thing about you. If you are a poor communicator, more than likely you're not going to make it through the interview process" (McKay, 2005).

2. Emphasize project management in your program. Though project management skills have been in high demand for the past several years, the demand continues to increase. Companies realize the importance project management plays in successfully deploying technology solutions. In addition to addressing the basics of planning, organizing, staffing, and managing a series of technical tools, it's also important to address the business aspects such as business process flows, requirements gathering, user acceptance testing, and most importantly business change management (Eckle, 2005).

3. Marry IT studies with other disciplines, especially business. The goal is to develop professionals who can take a multi-disciplinary approach to solving complex problems. Tracy Nakahura, senior manager of IT at the Gap, Inc. stated "People that can bridge the communication gap between IT people and business partners-they're valuable but rare to find" (Malykhina, 2005). The marriage of technical, business, and communication skills makes for a bright future (Malykhina). This marriage of technology to other disciplines in not limited to business however, as there are equal advantages to be realized in the liberal arts, music, biology, etc.

4. Provide coverage of the security aspects of technology. Pastore (2005) reports that a potential long-term cure for the recent insecurity in the IT job market might be a job in security. In addition to being in demand, organizations are very reluctant to offshore outsource security jobs or to use temporary employees to fill these increasingly important positions (Pastore).

   Related to the demand for employees in the area of security, many organizations are taking trusted in-house people and getting them certified for security positions. There was a 185% increase in jobs that required a security clearance in 2004 (Pastore). Somewhat related is the increased demand for positions that require secure networking and Linux developers and administrators (Pastore).

   There is a direct connection between data security and availability. An increasing number of organizations are emphasizing business continuity planning and are devoting budget and human resources to enhance disaster planning and recovery initiatives (Mearian, 2005). This is another area that we may want to introduce in our programs.

5. Include coverage of IT system auditing and the Sarbanes-Oxley Act in your curriculum. Rick Stockfield, managing partner at Atlanta-based Talenthire.com indicated there is a particularly high demand for IT auditors to comply with Sarbanes-Oxley Act guidelines and also IT security experts (Hoffman). A CIO Magazine poll reported that nearly half of the large companies surveyed will divert more than 15% of their budgets to Sarbanes-Oxley compliance in 2005 (Beach, 2005). Knowledge of Sarbanes-Oxley guidelines can serve to differentiate applicants for a position.

6. Where possible, orient your curriculum toward professional certifications. Somewhat alarming to colleges and universities, some organizations are only hiring people with four year degrees and additional formal training such as certifications and credentials (Chabrow and McGee). Others suggest that job opportunities for those with training and experience in project management and business analysis techniques are very good. PMP certification awarded by the Project Management Institute would provide a significant advantage (Eckle, 2005). Dan Garrow, CIO of Mohegan Sun Casino in Uncasville, Connecticut stated "Knowing someone has at least studied the concepts and has taken the steps to obtain certifications gives that person a step over someone who hasn't" (Hoffman, 2005).

   In a survey conducted by Foote Partners LLC., with Human Resources and IT executives, it was reported that a three year downward trend in IT salaries was reversed. The overall median average pay increased 1% for 62 non-certified skills and 4% for 62 certified skills. This followed three years which saw median pay for certified skills shrinking 6% annually while non-certified declined 8% annually (McGee, 2005).

7. Use corporate advisory boards to counsel faculty about current IT needs and trends (Verton). To ensure the success of our graduates, we must eliminate the disconnect between what most universities teach and what is needed in the job market (Verton). Many regional universities are committed to keeping graduates in their geographic area by insuring entry level job opportunities. An advocate of this thinking is North Dakota's Valley City State University president Ellen Chaffee. "We talk to corporations and ask them what their entry level skills and experience requirements are so we can tailor our curriculum for our graduates to have those skills" (King, 2005). Of course, this thinking raises the age old question of whether it is our responsibility to provide a solid education for the sake of education or provide an education for the sake of securing an entry level position. This paper will not pursue this discussion.

8. Include training on change management in your program. The IT-related professions are in a constant state of change, and we as educators must be aware of those changes and react to them with appropriate curriculum revisions. More importantly, our students must be prepared to manage the change process, as technology frequently changes the way work is performed. Pearlson and Saunders (2004) stress that managers must actively manage the change process and gain acceptance for proposed changes. They present Davis' Technology Acceptance Model that advocates man-

aged involvement of employees in the development process to ensure that proposed changes will gain acceptance. Also, see number two in this list.

Conclusion

Much has been presented for your consideration in this paper. Perhaps the most significant conclusion that can be drawn is that we in the higher education community must constantly evolve our curriculum content. SAS Institute CEO Jim Goodnight advocated keeping a rather short horizon for IT. He stated: "Our horizon is about two years…if you have a big five year plan, you're going to get about halfway through and the world is going to change" (Whiting, 2004). Also, we do not want to prepare our students for jobs such as the basic programming jobs that have already been outsourced according to Patrick Hynds, CTO of Critical Sites Inc. (Whiting).

We have many areas to consider as we prepare the IT leaders of tomorrow. As the IT industry continues to mature, many jobs as we know them will go away or become commodities while new, more advanced jobs are created (Evans, 2004). Analysts are predicting that high level design and development positions will become available as low-level jobs disappear or go offshore (Verton, 2004). The need for skilled developers, researchers and project managers is not going away (Evans, 2004). To ensure success, we must continue to develop skills in problem solving, innovation, communication, and team work. Blending technology, liberal arts, and business is a very healthy approach for universities (Malykhina, 2005).

As we accept the challenge of deciding how to prepare our students to be the future leaders of the IT world, it would be helpful if we had the answer to the following two questions:

- What jobs exist today that will not exist in five years?
- What jobs do not exist today, but will exist in five years?

The technology world is certainly full of uncertainties!

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