



Towards Defining IT Skills Portfolio for E-Business

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ABSTRACT

When companies move from an e-commerce to an e-business enterprise, the technology-driven transformation generates new demand of IT workers. This paper examines several factors pertinent to e-business transformation, in terms of changes in architecture, enterprise applications, application development environment, organization change process, and tools and techniques. A framework is proposed to guide the identification of specific IT skill sets essential to e-business transformation. Further research will be conducted to evaluate the applicability of the framework for identifying IT skills.

INTRODUCTION

This paper proposes a framework for identifying optimal IT skill sets necessary for supporting the organizational transformation into an e-business enterprise. E-business emphasizes the integration of internal business process and those affecting customers and business partners. Information technology plays a pivotal role in delivering integrated services and relationships. New approaches for enterprise application architecture and the increasing pressure for industry-wide collaboration require enterprises to acquire and develop new IT talents. Our current research examines the changing IT skill requirements in the context of e-business transformation and the gaps between workforce development and industry need. This research has four objectives:

1. To identify key factors shaping the IT skill requirements for e-business transformation;
2. To propose a conceptual framework for defining the IT skills portfolio for e-business transformation;
3. To evaluate the extent to which established e-business enterprises implement such a framework and their specific implementation strategies;
4. To examine the gaps between the industry needs and the direction of Information Systems (IS) and Electronic Commerce (EC) curricula in developing the IT workforce.

In this paper, we focus on the first two objectives. We first review past research and identify trends that pertain to the changing IT skill portfolio. Based on the review, we propose a framework to guide our next stage of work on case studies and reviews of curricular needs.

E-BUSINESS TRANSFORMATION

E-business refers to the "complex fusion of business processes, enterprise applications, and organizational structure necessary to create a high-performance business model" (Kalakota and Robinson, 2001). When moving from e-commerce to e-business, companies have to undergo a structural transformation in many fronts. Essential to this transformation is the desegregation and re-aggregation of a company's value chain that is evolving in an increasingly dynamic and collaborative environment. Information technology plays a pivotal role in delivering a company's end-to-end services through seamless integration of sales and marketing, customer services, and its value chain with business partners.

Michael Porter (2001) stresses the importance of organizational strategy when it comes to transforming a traditional enterprise into an e-business enterprise. He blames the lack of clear, well-defined, strategies for the failure of many dot-com companies and other traditional organizations that rushed onto the e-business scene. He also criticizes companies for adopting similar types of Internet applications offered by third party developers. These generic packages diminish a company's ability to differentiate itself from its competitors. He emphasizes that a company should develop its own enterprise systems. Don Tapscott (2001) argues that the Internet enables "a new business architecture that challenges the industrial-age corporate structure as the basis for competitive strategy." This new architecture involves all the players of the value chain, including suppliers, distributors, service providers, infrastructure providers, and the end customers. Therefore, Internet based technologies and solutions are essential to e-business.

In addition to technologies, organizational strategy for the transformation into an e-business must include a human resource strategy and organization change strategies. Proper project team development is considered one of the critical factors towards the success of e-business ventures (Lientz and Rea, 2001; Turban, 2000).

IS THE DEMAND STILL THERE?

Despite the fallout of dot-coms and the economic downturn since 2000, digital economy continues to develop strong roots. Industry forecast proceeds to project a slower but consistent growth in e-commerce during 2002-2007. Forrester Research projects online retailing will grow at a cumulative annual growth rate of 25% to reach a sale volume of \$217.8 billion by 2007 (Hirsh, 2002). Long-term impacts of Internet technology on global e-business are prominent in all industries. American and European companies have adopted a wide range of Internet-based business solutions at a steady pace (Varian, Litan, Elder, and Shutter, 2002). Among the US companies, 70% of the enterprises in the wholesale/retail sector and the financial service sector, as well as 88% of the telecommunication sector, have adopted e-business solutions, such as e-supply chain management (SCM), customer relationship management (CRM), and e-procurement. Most commonly adopted solutions are those supporting customers, and for financial and HR functions. The benefits are to increase the efficiency of workforce, improve inventory management and customer relationship, and reduce costs. These trends indicate a continued need for IT talents with a solid foundation in Internet-based technologies and business strategies.

IT WORKFORCE ISSUES

During the past three years, the IT workforce has experienced volatile changes as a result of economic slowdown. The latest study by the Information Technology Association of America (ITAA) indicates that IT workers lost five percent of employment during this period. ITAA projects a lower demand for skilled IT workers during the next twelve months (2002). Nevertheless, the "gap" in IT workers, the positions unfilled due to a lack of qualified workers, remains consis-

tently around 50% of total demand (ITAA, 2000, 2001, 2002). This gap implies that employers have more difficulty getting the right mix of IT talents and hiring IT workers. Firms have to take an approach of skills portfolio management to address issues concerning skills acquisition, skills development, and skills maintenance (Nakayama and Sutcliffe, 2001).

Outsourcing is a common tactic for meeting the e-business development need. A major problem with many e-business development teams is that members of the team often come from different organizations, including outsourced service provider organizations and independent contractors. A Gartner (2001) article claims that "in the typical IS organization, about half of the e-business expertise will come from outside resources." With the current state of the economy, however, many organizations have been forced to cut their outsourcing relationship and seek alternative means of developing e-business, mainly through the use of their own internal workforce (Paulson, 2001).

Higher education institutions play a critical role in producing talented IT workers who can meet the demands of the e-business market. IS and EC curricula must closely follow the application of technology in business and industry (Augustine, Surynt, and Jeancola, 2002). This demand heightens the pressure on universities and colleges to undertake continuous curricular innovation in order to meet the demand of changing e-business needs (Chan, 2001). The challenge in this fast paced environment is to determine which newly introduced technology is a trend and which is a fad. Many academic programs have focused on Web development, but the gap for Web developers is closing (ITAA, 2002). As companies need support for complex Internet-based e-business solutions, skills in new technology, such as .NET, JSP, SOAP (Simple Object Access protocol), UDDI (Universal Description, Discovery, and Integration), WSDL (Web Services Description Language), Web mining, systems integration, and Linux will be critical. A recent employer survey conducted by our own institution confirms that analytical tools, such as data mining, and technologies to support collaboration, such as XML, e-business XML (ebXML), will become even more important three years from now.¹ While technical skills are important, researchers have found that IT professionals rated "soft" skills such as team work, work under pressure, and meets deadlines, higher than "hard" skills, such as database design, client/server applications, and operating systems (Turner and Lowry, 2002). This implies that IS and EC programs should address both technology and skills for change management.

NEW REQUIREMENTS FOR IT SKILLS

The challenge for companies embracing e-business is likely to be more acute because the new technology and the process involved in e-business transformation are more complex. We identify five sets of issues that have implications on IT skills acquisition and development.

1. Architectural Issues

E-Business is built on the Internet-centric technology architecture. Enterprise applications will go beyond the enterprise resource planning (ERP) packages to integrate back-end internal processes with those affecting customers and business partners. The application architecture will likely include CRM, SCM, business intelligence (BI), selling chain management, data warehousing, and data mining functions (Kalakota and Robinson, 2001). The architecture for applications and infrastructure will emphasize collaboration and external needs (Genovese, Bond, Zrimsek, and Frey, 2001). Component-based application architecture will allow deeper functionalities and unique features for vertical markets, which are absent in many enterprise application packages. These changes will satisfy a company's desire for differentiation as well as its need to participate in industry-wide collaboration. These trends place a greater premium on IT knowledge and skills in technology and application architecture, component-based technologies, and Internet-based enterprise applications than programming and Web development skills. Additionally, from the perspective of knowledge management, e-business transformation enables an enterprise to evolve into a knowledge-based organization. In such environment, the skill mix will involve information management and knowledge management (Abell and Oxbrow, 2001).

2. Implementation Issues

Implementing an effective e-business applications framework is a complex endeavor that integrates enterprise systems, such as ERP, along with typically multi-vendor Web application systems, such as CRM and SCM. Such implementations affect existing organizational interfaces with customers, employees, stakeholders, business partners, and suppliers. According to Krasner (2000), a successful e-business implementation must carefully deal with issues of e-business strategy, project management approaches, complex technology and systems, and end-use resistance. The high failure rate of CRM projects seems to repeat the early experience of ERP implementation. The demand for integrated enterprise applications and collaboration systems implies that companies will need more IT talents with solid foundation in project management, systems integration, and change management.

3. Organization Change Issues

The greatest challenge here is the need for enterprise-wide process change. IT management and workforce must play a major role in training and facilitating the process change in order for those affected to be more willing to go along. Collaboration across industry and global supply chain demands more profound changes in business process than what enterprises have experienced to date. While ERP projects focus on internal operational efficiency, process innovations for enhancing collaboration with partners and for strengthening relationship with customers are driven and defined by external factors. Such process changes rely more on information technology and will have to be implemented at a faster pace than past changes. There are many implications for IT. IT professionals will need to acquire a broad knowledge about the complex structure of a company's value chain, CRM, change management, and human factors.

4. Application Development Issues

Dynamic e-business strategies will be built on analytical information and business intelligence. Therefore, e-business application development will go beyond Web development, which has been a key focus on skills development in academic programs and industry training. Enter-

Table 1. A Proposed Framework for E-Business IT Skills Portfolio.

Factors	Issues	IT Skills Requirements
Architecture	Application architecture Infrastructure architecture Collaboration Information structuring & architecture	Internet/Web architecture Network administration Database management, Middleware Security, document management Information management Knowledge management Technology planning e-business strategy
Implementation	ERP and Web systems integration Effective Project management Process change management	Systems integration SCM, CRM, IM Data warehousing, Data mining Project management, Interpersonal skills Process re-engineering
Organization Change	Process change driven by external demand	CRM, SCM, Value chain Change management Human factors
Application Development	A shift of development efforts from simple Web development to analytic capability and system/application integration.	Project management System analysis and design Structured programming methods Web development Object-Oriented development Data mining Human computer interaction
Tools and Techniques	Wide-range of tools and techniques New tools and techniques Lack of standardization Proper education and training	Unix, Linux, Windows .Net technologies CGI, Perl, C++, C#, ASP PHP, SQL, MySQL, XML, Java, SOAP, UDDI, WSDL, ebXML

prise portals drawing data from integrated applications, industry e-marketplaces, and decision support tools, will provide employees and industry partners the gateway to analytical and transactional information. Companies will need a strong competency in systems integration and analysis using data mining and BI tools. Capability for object oriented database and knowledge management tools will be in demand.

5. Tools and Techniques Issues

Tools and techniques for developing e-business applications are many. These tools and techniques span various platforms and application types. Certain tools only work with Windows-based machines, while others work only with Unix-based machines. Add to the complexity the lack of standards on many of the available development tools. Another noticeable issue with Web development tools is their "rate of birth," many new tools are developed before one even begins to master older ones. This continuous growth in Web tools and techniques makes it the more difficult to produce a highly experienced IT workforce.

A Proposed Framework for E-Business IT Skills Portfolio

Based on the above analysis, we propose the following framework to determine skills required to support e-business transformation.

CONCLUSION AND FUTURE RESEARCH

We have proposed in this paper a framework for an e-business IT skills portfolio and examined the challenges in developing such a portfolio. Literature review was conducted and presented to show the necessity for conducting such a research. Future plans of action will include the study of e-business enterprises and determining how they meet and handle the IT skills issues discussed here. Additionally, we plan on studying the gap between industry IT skills needs and the IS and EC curricula in developing the IT workforce.

Some specific research questions to be addressed include the following:

- Percentage of outsourced workforce in the development of the e-business applications?
- Are the organizations moving more towards internal sufficiency?
- What were the factors of success in the transformation process, as they relate to the IT workforce?
- What skills sets were utilized and what training was conducted?
- What tools and techniques are more important to the organizations?
- Is there an organizational strategic plan for teams and skills development?
- Is there a difference between B2B and B2C skill requirements?
- How can current educational curricula be modified to better serve e-business?

ENDNOTES

1. Findings were drawn from a 2002 survey of employers of students graduated from the School of Computer Science, Telecommunications, and Information Systems at DePaul University.

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