Critical topics in e-commerce knowledge for college students who majored in IT

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ABSTRACT: With the fast-paced advancements in information and communication technologies, IT managers must cope with dramatic challenges in today's business enterprises. Facing more severe pressure in allocating firms' e-resources, IT professionals should possess proficient skills/knowledge to align, synchronise and merge their technology and business resources, to operate simultaneously both strategic and tactical Electronic Commerce (EC) initiatives. The study carried out empirically investigated IT-majored college students' practical education needs for critical EC knowledge topics in Taiwan. More than 300 IT managers participated in this study to provide what they thought about 28 EC knowledge topics. The research findings can provide instrumental and useful suggestions to help IT managers select suitable learning courses, as well as to provide practical guidelines for EC curriculum planning and development.

INTRODUCTION

In today's Internet-based economy, information and communication technologies (ICTs) are ubiquitous and prevalent across a variety of functions and processes of contemporary business enterprises. The integration of information technology (IT) and information systems (IS) with business operations has been widely recognised to create value in business, seed new market opportunities, facilitate process innovation and help shape business vision and strategy to gain competitive advantages for organisations [1]. Facing these emerging IT/IS applications, IT managers ought to make difficult choices and then implement, deliver and support these choices throughout their organisations [2-4]. This should force IS educators, instructional technologists and practitioners to re-evaluate and acquire compulsory knowledge, skills and abilities on a regular basis [5][6].

The fast-paced developments in Electronic Commerce (EC) technologies have largely changed the landscape of both the established and emerging commercial world. Information Technology professionals must cope with dramatic challenges in today's business environment. Based on the Internet, EC applications have been widely applied to all sorts of business processes to ensure rapidity in trading among enterprises or between enterprises and consumers. Some emerging professional legal issues are involved, such as protection of intellectual property rights and the right to privacy and taxation. However, electronic-commerce training is a matter of great urgency and a top priority solution, given the ubiquitous nature of EC. As a result, institutes for teaching EC were set up rapidly and in great numbers, particularly in colleges and universities.

Consequently, providing university/college students with information regarding EC education and providing them with EC courses to supply the needs of organisations is a great challenge to the relevant stakeholders, such as IS educators, departments' administrators and curriculum designers [7][8]. To address these challenges, the aim of this study was to investigate which topics are important to IT/IS practitioners in business enterprises in Taiwan. A survey instrument was developed to answer the questions: how much IS practitioners had learned about the topic in their formal educations; how much they know now about the topic and how important the topic has been to their career.

LITERATURE REVIEW

Evolution of EC Technology and EC Education in Taiwan

In the information era, the recognised shifts in information and communication technologies have taken place: from Web-based computing, mobile computing, to ubiquitous (nomadic) computing [9]. These principal ICTs directly enabled modern E-commerce, including Web-based computing, mobile computing and ubiquitous computing [10-13].

Web-based computing was implemented based on wired networks using the Internet until the ability to connect approached physical limits leading to mobility. Mobile computing based on wireless infrastructure gave rise to a new S curve, with the new physical limits bringing a greater level of ubiquity and embeddedness [14]. Over the past decade, we have witnessed rapid developments in ICTs that have substantially changed the landscape of E-commerce. The Internet has introduced a significant wave of change. Our communication patterns have changed. Electronic commerce (E-commerce, EC) is based not only on developments pertaining to the Internet, but also on prior technological and organisational innovation arising from the combination of telecommunications and network computing [15]. We have become dependent on the Internet. We interact with firms via Web sites. The proliferation of the Internet has stimulated the development of on-line commercial applications and business innovations, commonly referred to Internet-enabled commerce.

The next wave, introduced through mobile technology, is about to change our lives and the business world even more. The increase in transmission capacity of wireless devices lays the foundation for transactions unrestricted by physical location. We can do transactions any time, blurring the borderline between business and private. The enabling EC is called mobile commerce [13][16]. Recently, many experts have proposed another wave of change: a world that provides the ultimate form of ubiquitous networks and universal devices; a world that presents an alternative view of space and time [17][18]. Likewise, we will enter into a new EC - an EC that goes over, above and beyond traditional commerce. The emerging frontier for EC is ubiquitous commerce [19]. New ICT applications often are developed in conjunction with organisational changes [20]. Indeed, the rapid evolution of EC, from I-commerce, M-commerce to U-commerce poses considerable challenges for many firms and results in many new change management issues. For incumbent firms, the main challenge is change [21]. However, innovative EC applications have the potential for significant changes in ICT applications and in a firm's business model and performance, as well as the potential for disruption for the EC stakeholders. To cope with the changes, a number of researchers have suggested it is vitally important for firms to understand the dynamics and nature of change and how to manage it well [22]. Therefore, a systematic study of EC education is needed in Taiwan.

Development of College-Level EC Education in Taiwan

From 1998 on, business automation research and development centres were set up by the Ministry of Education in the National Taipei University, Dayeh University, National Yunlin University of Science and Technology; and the National Sun Yat-Sen University, respectively in the north, midland and south of Taiwan. By integrating intramural, cross-campus and industrial academic resources, as well as research and educational achievements, commerce automation was promoted. In Taiwan, undergraduate and graduate schools of commerce automation were instituted in a few colleges, and most colleges have commerce automation programmes. Statistical data for 1998 from the Ministry of Education has shown that there were 110 faculty instructors, including 6 professors, 76 associate professors, 6 assistant professors and 22 lecturers from departments of information and business management.

With the completion of a phased mission of a 10-year production automation project in 2000, the Ministry of Education planned educational developments for e-manufacturing and EC to co-ordinate with plans for production automation and e-business. This would be carried out by The Executive Yuan to educate in logistics, cash flow, business flow, service flow and information flow. Further, there were three EC-related graduate institutes and three undergraduate EC programmes in colleges and universities in 2007 in Taiwan. Later, 103 colleges and universities had departments of information management and there were EC-related programmes in 75 schools. By 2008, 10 colleges and universities had set up EC-related programmes such as electronic commerce (management), information commerce and information management at the National Chung-Hsing University, Tatung University, Nan-Hua University, Aletheia University, Wu-Feng Institute of Technology, etc.

Critical EC Knowledge Topics for IT- Majored College Students

Many colleges in Taiwan have focused on the establishment of electronic-commerce teaching. A report regarding improvement of commercial automation instruction by Taiwan's Ministry of Education indicated that most colleges have started to plan and establish EC educational courses. In addition, they pondered on how to fit the Internet into management courses. For example, Dayeh University and the National Yunlin University of Science and Technology have set up electronic stores; National Taiwan University of Science and Technology has built a Web site for EC instruction; Feng-Chia University has built a professional commercial Web site to supply information on insurance and finance. Of account in this study are the characteristics of EC related courses in Taiwan, as well as the gathering of information on EC curriculum planning in well-known universities in Taiwan (e.g. National Taiwan University). Reviewed in this study are related EC research literature and Association for Computing Machinery (ACM) curriculum documents, such as IS 2002, *model curriculum and guidelines for undergraduate degree programs in information systems*; CC2005, *the overview report including the guide to undergraduate degree programs in computing*; and MSIS 2000, *model curriculum and guidelines for graduate degree programs in information systems* to find out EC topics

critical for university-level EC education in Taiwan. Based on the intensive literature review and in-depth interviews with domain experts, 28 EC knowledge topics were identified, as shown in Table1.

Table 1: The classification of EC knowledge topics in this study.

Category	Business management	Technology management	IT-specific
EC related knowledge topics	BM1.Knowledge management BM2.Project management BM3.Marketing management BM4.Production & operation management BM5.Information ethics BM6.Human resource management BM7.Strategic management BM8.Financial management BM9.Innovation management	TM1.Introduction to MIS TM2.Systems analysis & design TM3.Information security TM4.Electronic commerce (EC) TM5.Information systems planning TM6.Enterprise resource planning TM7.Decision support systems TM8.Supply chain management TM9.Production information systems TM10.Strategic information systems TM11.Accounting information systems	IT1.Introduction to computer science IT2.Programming languages IT3.Database management systems IT4.Operating systems IT5.Data Communication & network IT6.Data mining IT7.Multimedia systems IT8.Wireless communication network

RESEARCH DESIGN

Methods and Instruments Implemented

A survey instrument of EC knowledge topics was developed and used to collect the data in this study. Using a questionnaire, data were gathered by researchers in personal interviews with IS/IT practitioners and academic experts. From this, the researchers were able to gauge the clarity of the questions, whether the instrument correctly gathered the data required by the researchers and verify if important EC topics were omitted. This process was continued until no further modifications to the questionnaire were necessary. Feedback from this pilot study served as the basis for refining the experimental scale of the course items. The finalised formal questionnaire contained two major parts, including respondent's basic data and the responses to EC topics. The basic data portion requested IS/IT practitioners to name their organisations, their main tasks, demographic characteristics and their current management position. The second part contained 28 course topics and each topic was associated with four of the following questions adopted from Lethbridge [23] to capture the subject's perception of each course topic as shown in Figure 1. The six-point measure for the four questions was applied as shown in Figure 2 and Figure 3.

Q1. Amount learned in education (i.e., How much did you learn about this in your formal education?) 0 = Learned nothing at all 1 = Became vaguely familiar 2 = Learned the basics 3 = Become functional (moderate knowledge) 4 = Learned a lot 5 = learned in depth; become expert	Q2. Amount learned on the job: What is your current knowledge about this, considering what you have learned on the job as well as forgotten? 0 = know nothing 1 = Am vaguely familiar 2 = Know the basics 3 = Am functional (moderate knowledge) 4 = Know a lot 5 = Know in depth; become expert
Q3. Practical level: How useful have the details of this specific material been to you in your career as a professional IS staff or manager? Please leave blank if you know little about the material. 0 = Completely useless 1 = Almost never useful 2 = Occasionally useful 3 = Moderately useful (in certain activities) 4 = Very useful 5 = Essential	• Q4. Influence level: How much influence has learning the material had on your thinking, whether or not you have used the details of the material? Please consider influence on both your career and other aspects of your life. Please leave blank if you know little about the material. 0 = No influence at all 1 = Almost no influence 2 = Occasional influence 3 = Moderate influence in some activities 4 = Significant influence n many activities 5 = Profound influence on everything I do

Figure 1: Four questions in response to the 28 EC knowledge topics.

Participants

The IT professionals who participated in this study were from various industries. The study was in Taiwan and used a questionnaire. Enterprises from the top-1,000 firms ranked by Taiwan's Bureau of Business were included. Only those

firms with a formal MIS department were qualified to be selected. Through a random sampling procedure, 500 companies from the top-1<000 firms were selected at random to constitute a representative sample. Each company received an initial phone call to explain the purpose of the research project and to inquire as to the firm's willingness to participate in the study. Participation in this study was voluntary and respondents were assured that their individual responses would be treated as confidential.

One thousand questionnaires were sent out to the IT professionals and 329 were returned. Sixty-one invalid responses were discarded. The 268 valid responses were coded for statistical analysis. Among these, most respondents work in IS-related jobs in a diversity of industries. Analysis of the results show that only 14 per cent of the respondents do not work in IS related departments; 70.6 per cent had received a bachelor's degree and 22.5 per cent had postgraduate degrees. More than 70 per cent of the respondents had their final degrees in computer science, software engineering or information systems; while 24 per cent had degrees in other areas of science or an engineering discipline.

DATA ANALYSIS AND RESULTS

For each EC-related course topic, the amount learned in education was calculated from the average of the responses to Question1. As the results show in Figure 2, the top five most extensively taught topics are *introduction to computer science*, *programming languages* and *database management systems* in the IT specific category, as well as *introduction to information management* and *systems analysis & design* in the technology management category. There was one IT specific course *wireless communication networks*, one technology management course *accounting information systems* and three business-management related courses, *innovation management*, *financial management* and *strategic management* that the IT practitioners took in their formal education. As a whole, the data imply the extent to which each course had been taught in educational institutions.

The responses to Question 2 indicate what IT professionals currently know. The analysis shows that the top five areas of current knowledge are almost the same as the top five topics being taught except for *data communication & network* in the IT-specific category. Conversely, while the order is slightly different, the least five important topics of the areas of current knowledge level are almost the same as the least five important learned topics in education. The current areas of knowledge data indicate the EC knowledge topics in which IT professionals are now proficient and deficient. The five courses of *strategic information systems*, *accounting information systems*, *strategic management*, *financial management* and *innovation management* seem to be ignored by the majority of IT professionals in Taiwan. The practicability and popularity of the courses perceived as less important might be task-orientated and industry-specific.

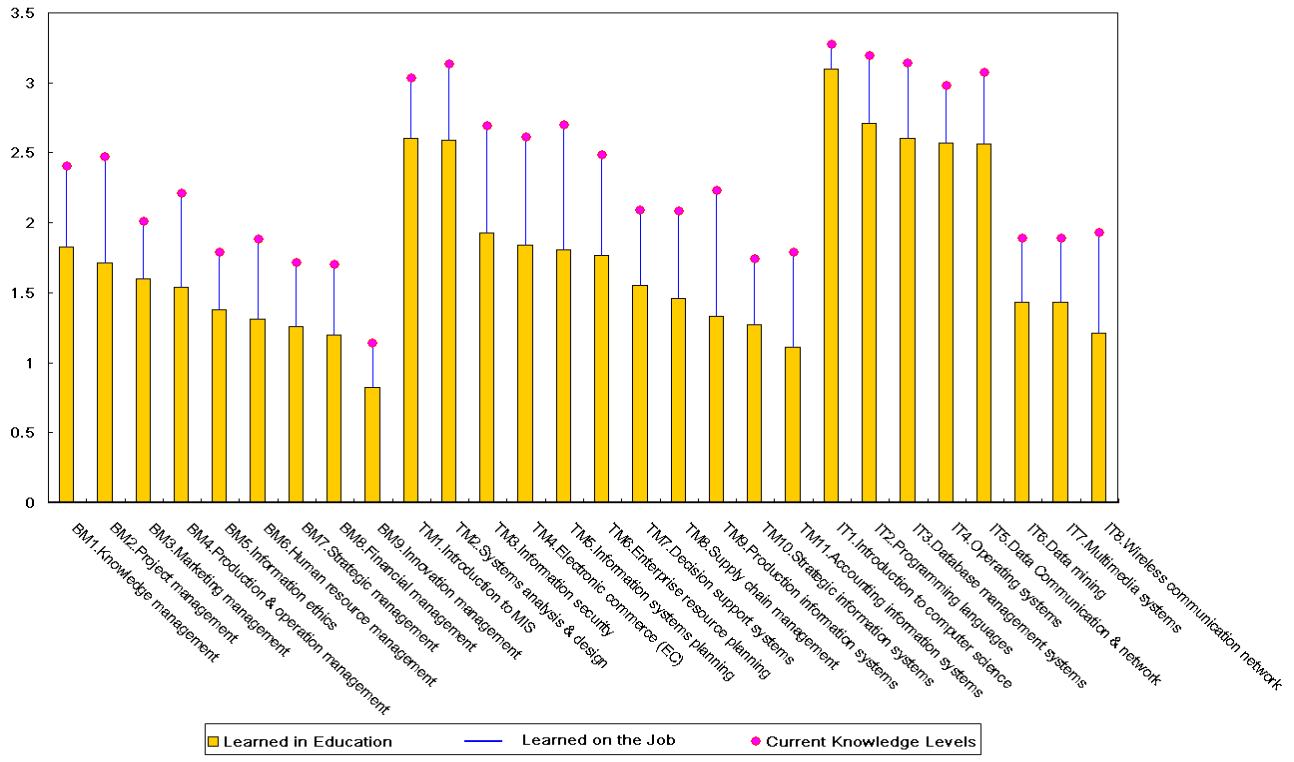

Figure 2: IT professionals' knowledge levels on 28 EC knowledge topics.

The amount learned on the job (or forgotten since education) is the difference between the current knowledge level and the amount learned in education. The analysis results indicated that the top five most learned topics from IT professionals' job experience are *production information systems*, *information systems planning*, *information security* and *electronic commerce* in the technology management category, and *project management* in the business management

category. This is quite reasonable since IT professionals can acquire experience and learn much more by doing their jobs rather than by taking these courses in school. Regarding the five IT-specific courses, including *artificial neural networks*, *artificial intelligence*, *fuzzy theory*, *computer visualisation* and *introduction to computer science*, the participants deemed they have learned the least from their job experiences. This bolsters the argument by the authors of this article for re-examination of coverage and teaching methods for these topics to improve the return on investment in education.

The responses for each EC-related knowledge topic to Questions 3 and 4 provide the perceived importance. The importance of each topic was computed by averaging the responses to Questions 3 and 4. As shown in Figure 3, the analysis shows *system analysis & design* to be the most important topic, with *database management systems* close behind, followed by *programming languages*, *data communication & network* and *introduction on MIS*. The majority of the top five most important topics are all fundamental compulsory courses for IS departments in the universities and colleges in Taiwan. The descriptive results also show that the least five important topics are *innovation management*, followed by *multimedia systems*, *financial management*, *strategic management* and *information ethics*. All of the five least important topics are interest-orientated elective courses in the universities and colleges in Taiwan.

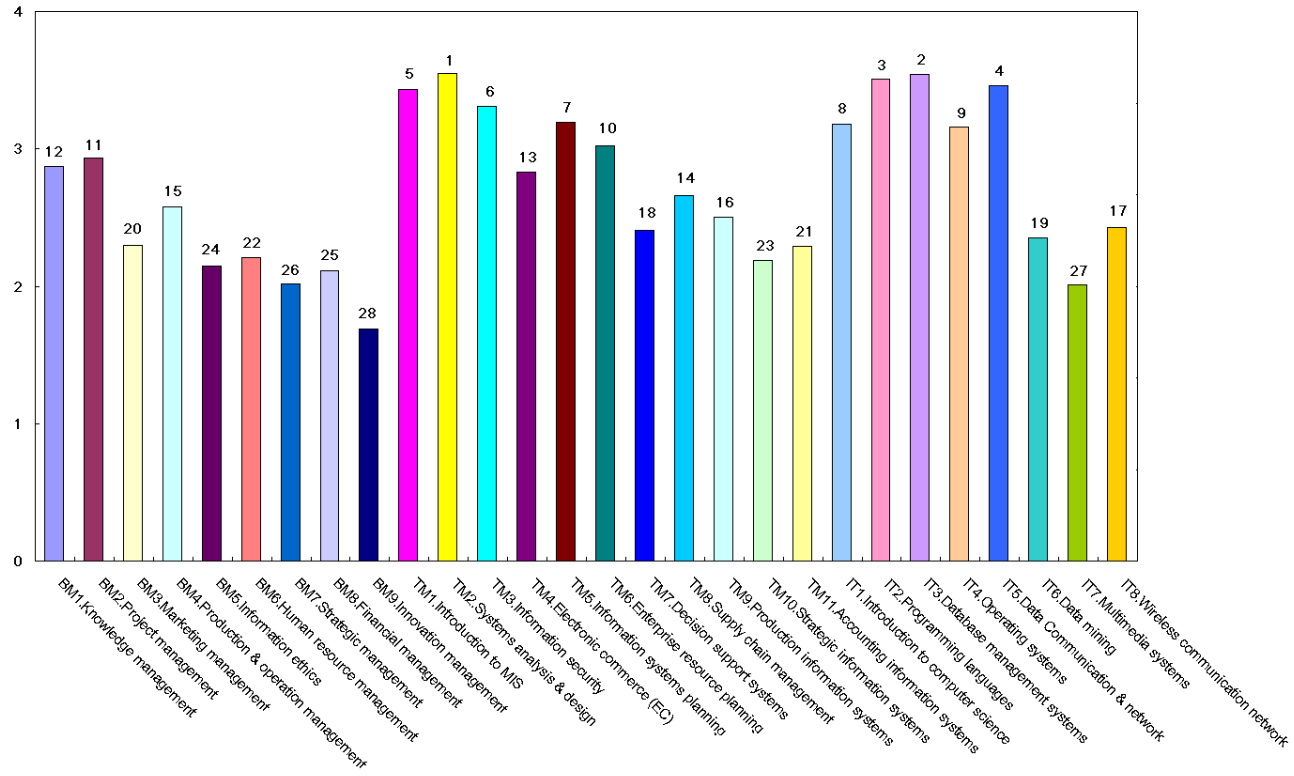

Figure 3: Overall importance and ranks of the 28 EC knowledge topics.

DISCUSSION AND CONCLUSIONS

The aim of this study was to investigate the EC knowledge and topics critical for IT-majored college students in Taiwan from an industry perspective. To make the study more complete, a series of follow-up interviews were conducted with IT professionals who had *learned in education* and *learned on the job*. Also, the curriculum of an IT department of a well-known technology university in the southern part of Taiwan was analysed rigorously, to justify the research results. All of the interviewees in the follow-up survey asserted that the findings in this study, regarding the content of each course, accurately reflect the knowledge content in the industry.

All indicated that the educational knowledge gaps between university-level EC education and industry expectation might still exist. They worry about the impact of these gaps and they provide invaluable suggestions without reservation. Twelve of the group members, with the most knowledge that was *learned in education*, emphasised that the education sectors should offer more intern opportunities on courses. There were ten interviewees at managerial levels and they suggested that educational institutions should place more emphasis on fundamental courses to equip students with essential skills/knowledge and capabilities to enable them to cope independently with the highly changeable business environment.

The comparison between the IT curriculum and the survey results show that many of the important topics were not extensively taught. Universities/colleges might consider increasing their coverage of such topics, and the education or training departments in firms might provide relevant material. In summary, this study has several implications for the formulation of EC educational training programmes or EC curricula for universities/colleges in Taiwan. The findings of

this study might be relevant for EC training institutes, licensing bodies, departments and curriculum designers in universities or colleges. The college students, graduates and IT professionals who majored in IT in EC-related fields, and are seeking continuing education and on-the-job training, can use the results of this study to help them select suitable EC course topics in their future career planning.

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REFERENCES

1. Wheeler, C., NEBIC: a dynamic capabilities theory for assessing net-enablement. *Information Systems Research*, 13, **2**, 125-146 (2002).
2. Benamati, J. and Lederer A.L., Coping with rapid changes in IT. *Communications of the ACM*, 44, **8**, 83-88 (2001).
3. Tennyson, R.D., Defining core competencies of an instructional technologist. *Computers in Human Behavior*, 17, **3**, 355-361 (2001).
4. Wu, J.H., Chen, Y.C. and Lin, H.H., Developing a set of management needs for its managers: a study of necessary management activities and skills. *Information & Management*, 41, **4**, 413-429 (2004).
5. King, K.P., Educational technology professional development as transformative learning opportunities. *Computers & Educ.*, 39, **1**, 283-297 (2002).
6. Wu, J.H., Chen, Y.C. and Chang J., Critical IS professional activities and skills/knowledge: a perspective of IS managers. *Computer Human Behavior*, 23, **6**, 2945-2965 (2007).
7. Lee, S., Koh S., Yen, D. and Tang, H.L., Perception gaps between IS academics and IS practitioners: an exploratory study. *Information & Management*, 40, **1**, 51-61 (2002).
8. Milliken, J. and Barnes, L.P., Teaching and technology in higher education: student perceptions and personal reflections. *Computers & Educ.*, 39, **3**, 223-235 (2002).
9. Wu, J.H. and Hsia, T.L., Analysis of e-commerce innovation and impact: a hypercube model. *Electronic Commerce Research and Applications*, 3, **4**, 389-404 (2004).
10. Banavar, G. and Bernstein, A., Software infrastructure and design challenges for ubiquitous computing applications. *Communications of the ACM*, 45, **12**, 92-96 (2002).
11. Kannan, P.K., Chang, A.M. and Whinston, A.B., Wireless commerce: marketing issues and possibilities. *Proc. 34th Hawaii Inter. Conf. on System Sciences* (2001).
12. Germanakos, P., Tsianos, N., Lekkas, Z., Mourlas, C. and Samaras, G., Capturing essential intrinsic user behaviour values for the design of comprehensive web-based personalized environments. *Computers in Human Behavior*, 24, **4**, 1434-1451 (2008).
13. Varshney, U., Vetter, R.J. and Kalakota, R., Mobile commerce: a new frontier. *IEEE Transactions on Computer*, 35, **1**, 32-38 (2000).
14. Lyytinen, K. and Yoo, Y., Issues and challenges in ubiquitous computing. *Communications of the ACM*, 45, **12**, 63-65 (2002).
15. Zwass, V., Electronic commerce and organizational innovation: aspects and opportunities. *Inter. J. of Electronic Commerce*, 7, **3**, 7-37 (2003).
16. Balasubramanian, S., Peterson, R.A. and Jarvenpaa, S.L., Exploring the implications of m-commerce for markets and marketing. *J. of the Academy of Marketing Science*, 30, **4**, 348-361 (2002).
17. Fano, A. and Gershman, A., The future of business services in the age of ubiquitous computing. *Communications of the ACM*, 45, **12**, 63-87 (2002).
18. Islam, N. and Fayad, M., Toward ubiquitous acceptance of ubiquitous computing. *Communications of the ACM*, 46, **12**, 89-92 (2003).
19. Watson, R.T., Pitt L.F., Berthon, P. and Zinkhan, G.M., U-commerce: extending the universe of marketing. *J. of the Academy of Marketing Science*, 30, **4**, 329-343 (2002).
20. Markus, M.L. and Robey, D., Information technology and organizational change. *Management Science*, 34, **5**, 583-598 (1988).
21. Daniel, E.M. and Wilson, H.N., The role of dynamic capabilities in e-business transformation. *European J. of Information Systems*, 12, **3**, 282-296 (2003).
22. Straub, D.W., Research commentary: transformational issues in researching IS and net-enabled organizations. *Information Systems Research*, 12, **4**, 337-345 (2001).
23. Lethbridge, T.C., What knowledge is important to a software professional? *IEEE Transaction on Computer*, 33, **5**, 44-50 (1998).