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(2) the extent to which new graduates of Information Technology programs are
equipped with these skills. Includes four tables. (Contains 10 references.)
(Author)

AN EXPLORATORY INVESTIGATION OF REQUISITE SKILLS NEEDED BY DEVELOPERS OF E-COMMERCE SYSTEMS

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ABSTRACT

The aim of this exploratory study is to identify the skills needed by developers of Electronic Commerce (e-Commerce) systems. The paper proposes a framework pertaining to three categories of e-Commerce development knowledge: technical, human, and organizational. The initial findings reveal that there are some 16 possible e-Commerce skills tapping the three areas of e-Commerce knowledge. The results also reveal that there are similarities and differences among the perceptions of Information Technology managers and researchers with regard to (1) the relative usefulness of the 16 skills, and (2) the extent to which new graduates of Information Technology programs are equipped with these skills.

INTRODUCTION AND BACKGROUND

No academic institution would argue against the fact that there is a compelling need to produce graduates with sufficient Electronic Commerce (e-Commerce) skills and knowledge to meet today's market needs. The demand of public and private organizations worldwide for professionals with appropriate e-Commerce skills is currently in the increase. e-Commerce development expertise now ranks as the most sought-after skill in the Information Technology community, according to a recent Computerworld survey (Dash 2000).

Despite all of this, to date little research had been carried out to address the issue of e-Commerce skills. Most of available investigations have been carried out in a non e-Commerce context. Ang and Jiwahhasuchin (1998), for example, discussed traditional Information Technology education in Thailand. Tafti and Shirani (1997) examined a model of traditional hierarchy of needs in an end-user-computing environment consisting of users' information-, system-, and technical support-related needs. Gupta et al. (1994) developed two questionnaires to assess a set of specific Information Technology areas and skills, university-industry collaboration activities, and training requirements for

Information Technology graduates. Trauth et al. (1993) conducted a study to identify the key skills and knowledge areas that will be required of future Information Technology professionals. Nelson (1991) performed an assessment of educational needs that examined the deficiencies of both Information Technology and end-user personnel. All these studies were conducted in a non e-Commerce environment.

The objective of this study is to fill part of this gap in the Information Technology literature. To achieve this goal, our paper, based on the work of Nelson (1991), Lee et al. (1995), Trauth et al. (1993), and Rada (1999), proposes a three-dimensional proficiency space for identifying the requisite skills needed by developers of e-Commerce systems that covers three sets of knowledge areas: technical, human, and organizational.

INSTRUMENT DEVELOPMENT, DATA COLLECTION, AND RESULTS

To develop the research instrument, we first interviewed the Information Technology manager (or a representative) in 7 prominent private and public Kuwaiti organizations. During the interviews we asked them to

discuss the basic areas of knowledge needed by developers of e-Commerce systems and to highlight important skills within each area of knowledge. The interviews revealed several important high-level skills pertinent to the development of e-Commerce systems. Later, we organized these high-level skills in one list, deleted duplicate items from the list, and supplemented the list with certain of the high-level skills that we identified during our literature review. We pilot tested the instrument with two Information Technology managers and two Information Technology researchers. The managers and researchers provided minor albeit useful comments, which we incorporated in our final questionnaire. The final version of the questionnaire consists of two sections. The first section collects information on the respondents' background such as gender, age, education, etc. The second section requires the respondents to rate the usefulness of the 16 high-level skills, categorized into three knowledge areas. It also requires the respondents to indicate the extent to which newcomers who recently graduated from an academic institution are competent in these skills. All questions were anchored around a five-point scale, 1 = very low usefulness/competency, 2 = low usefulness/competency, 3 = medium usefulness/competency, 4 = high usefulness/competency, and 5 = very high usefulness/competency.

Rada (1999) maintains that the effectiveness of a worker can be characterized by how well he/she performs a list of individual tasks. Table 1 shows examples of high-level skills needed by developers of e-Commerce systems. The first set of skills relevant to technical knowledge and includes 6 high-level skills necessary for physical development of e-Commerce systems such as Web programming, Web internetworking, Web security, and the like. The second set of skills relevant to human knowledge and embodies 5 high-level skills such as interpersonal communication, problem solving, conflict resolution, and so on and so forth. The last set of skills relevant to organizational knowledge and covers 5 high-level skills such as the ability to facilitate the integration between the e-Commerce system with the organization and existing information technologies.

The questionnaire was sent to the Information Technology manager (or a representative) in 15 private and public organizations operating in Kuwait and to 15 Information Technology academicians/consultants. All questionnaires that were sent were completed and returned to the author. Table 2 summarizes usefulness rankings of high-level skills needed by developers of e-

TABLE 1
HIGH-LEVEL SKILLS NEEDED BY DEVELOPERS OF E-COMMERCE SYSTEMS

Knowledge Area	High-level Skill
Technical	Web programming
	Web networking
	Web databases
	Web security
	Web management
	Web site design
Human	Interpersonal communication
	Problem solving
	Conflict resolution
	Collaboration
	Dealing with change
Organizational	Organizational goals and objectives
	Organizational policies and procedures
	Organizational functions and processes
	Organizational culture
	Organizational constraints

Commerce systems as seen by Information Technology managers and academicians. It is evident from the table that there are some agreements and disagreements among Information Technology managers and academicians with regard to usefulness of the different skills needed for developers of e-Commerce systems. For example, both groups of Information Technology managers and academicians agree that web security, networking and programming skills are important for e-Commerce professionals. However, the same two groups disagree with regard to the importance of organizational goals and procedures. While Information Technology managers perceive organizational goals as less useful a skill to the work of e-Commerce developers, Information Technology academicians see the opposite. Information Technology academicians rank understanding the goals of the organization as the third most useful/important skill for work in an e-Commerce context. In the same vein, while Information Technology managers rank organizational procedures high in the usefulness scale, Information Technology academicians put the same skill last in the usefulness list. An interesting finding that comes out of our study is that Information Technology managers believe that skills relevant to the technical knowledge area (web security, web networking, web programming, web databases, web management, and web site design) are

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the most useful skills needed by developers of e-Commerce systems. In addition, Information Technology academicians to some extent share this view except the fact that they believe problem solving and understanding organizational goals and objectives are more useful than some technical skills such as web management.

Table 3 shows Information Technology managers and academicians' ratings of the extent to which recently graduated Information Technology professionals are competent in e-Commerce skills. The table reveals that once again there are some similarities and differences among Information Technology managers and academicians perceptions with regard to perceived e-Commerce skills and knowledge of recently graduated Information Technology professionals. For instance, both groups of Information Technology managers and academicians agree that newly graduated Information Technology professionals are well trained in interpersonal communication, problem solving, collaboration, and dealing with change. Nonetheless, the perceptions of Information Technology managers and academicians differ with regard to the level of training that newly graduated Information Technology professionals receive on several skills, most notably the preparation they receive on web security, conflict resolution, web programming, web site design, understanding organizational goals, and following organizational procedures. Although Information Technology managers perceive newly graduated Information Technology professionals as inadequately trained on

web security, web programming, web site design and understanding organizational goals, Information Technology academicians believe their students are getting adequate training on these subjects. Moreover, whereas Information Technology managers perceive newly graduated Information Technology professionals as adequately trained on conflict resolution and organizational policies and procedures, Information Technology academicians believe their students are getting inadequate training on the same two skills. Another interesting finding that comes out of this study is that Information Technology managers believe that students usually come to the market prepared to exploit web databases.

Table 4 summarizes the usefulness-competency gap as perceived by Information Technology managers. Overall, the results reported in Table 4 reveals that Information Technology managers believe that the competency level of new Information Technology graduates in all skills, but conflict resolution, is below what they believe could be useful for their current work. Web security, web programming, web management, web site design, and web networking come at the top of the discrepancy list as perceived by Information Technology managers. Besides that, these skills come at the top of the mismatch between the usefulness-competency gap as perceived by Information Technology managers and the same gap as perceived by Information Technology academicians.

TABLE 2
USEFULNESS RANKINGS OF E-COMMERCE SKILLS—IT MANGERS VS. IT ACADEMICIANS

High-level Skill	Usefulness Rank	
	IT Managers	IT Academicians
Web programming	3	4
Web networking	2	2
Web databases	4	7
Web security	1	1
Web management	6	9
Web site design	5	6
Interpersonal communication	9	8
Problem solving	7	5
Conflict resolution	16	15
Collaboration	13	13
Dealing with change	11	11
Organizational goals and objectives	12	3
Organizational policies and procedures	8	16
Organizational functions and processes	14	10
Organizational culture	15	12
Organizational constraints	10	14

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TABLE 3
THE COMPETENCY OF NEW IT GRADUATES—IT MANGERS VS. IT ACADEMICIANS

High-level Skill	Competency Rank	
	IT Managers	IT Academicians
Web programming	14	6
Web networking	6	2
Web databases	1	7
Web security	16	4
Web management	15	11
Web site design	13	5
Interpersonal communication	8	9
Problem solving	3	3
Conflict resolution	4	14
Collaboration	11	10
Dealing with change	9	12
Organizational goals and objectives	12	1
Organizational policies and procedures	2	15
Organizational functions and processes	5	8
Organizational culture	10	16
Organizational constraints	7	13

TABLE 4
THE E-COMMERCE USEFULNESS-COMPETENCY GAP—IT MANGERS VS. IT ACADEMICIANS

High-level Skill	Usefulness-Competency Gap	
	IT Managers	IT Academicians
Web programming	1.93	0.20
Web networking	1.53	0.20
Web databases	0.67	0.13
Web security	2.67	0.33
Web management	1.60	0.00
Web site design	1.53	0.00
Interpersonal communication	0.60	0.00
Problem solving	0.60	0.00
Conflict resolution	-0.07	-0.40
Collaboration	0.40	-0.53
Dealing with change	0.47	-0.20
Organizational goals and objectives	0.60	0.00
Organizational policies and procedures	0.33	-0.40
Organizational functions and processes	0.07	-0.40
Organizational culture	0.20	0.00
Organizational constraints	0.47	-0.33

Additionally, the table reveals an interesting finding. In spite of the fact that Information Technology academicians believe that newly graduated Information Technology students possess higher competency than required in skills such as collaboration and understanding organizational constraints, Information Technology managers believe that the students should get more training on the same skills. Tables 3 and 4 together reveal another quite an interesting finding. Although they concur that newly graduated Information Technology students have reasonable training on web databases, Information Technology managers believe that the students should get more training on the same to be more useful for the work of the organization.

CONCLUSIONS

According to Rada (1999), many Information Technology jobs go unfilled due to a lack of adequately skilled people to fill them. The goal of this paper was to address this concern by exploring the skills needed by developers of e-Commerce systems. The study proposed a framework pertaining to three categories of e-Commerce development knowledge—technical, human, and organizational—and found some 16 possible high-level e-Commerce skills tapping the three knowledge areas. The preliminary results reveal that there are some agreements and disagreements among Information Technology managers and academicians with regard to usefulness/importance of the different skills needed for developers of e-Commerce systems. The results also reveal that there are some similarities and differences among Information Technology managers and academicians perceptions with regard to perceived e-Commerce skills and knowledge of recently graduated Information Technology professionals. Furthermore, most technical e-Commerce skills come at the top of the mismatch between the usefulness-competency gap as perceived by Information Technology managers and the same gap as perceived by Information Technology academicians.

Given the rapid change in nature of e-Commerce development and consequently the skills needed by developers of e-Commerce systems, managers and academicians worldwide will value the implications of the present empirical investigation. This change is projected to have significant impacts on various elements of the e-Commerce training/preparation system (Heckman 1998). One of the critical challenges facing managers and academicians in this regard, hence warrant further research, is to understand low-level (as opposed to high-level) skills needed by developers of e-Commerce systems.

The practical implications of the present study could be many. However, we limit ourselves to two suggestions that we offer to academic institutions offering programs in Information Technology at this point. The first recommendation is that the Information Technology curriculum should give more emphasis on technical web courses to ensure that graduates have a strong web security, web programming, web networking, web management, and web site design foundation in order to meet the current and future demands of the e-Commerce environment. The greatest transition in job requirements

in the Information Technology market has usually occurred for technical knowledge and skills (Todd et al. 1995). The second suggestion is that Information Technology graduates should be equipped with the ability to collaborate with work partners and to cope with the changing e-Commerce environment and demands. Students must be made to realize that the academic education is only to prepare them with a foundation in Information Technology and that the best training it can provide for them is the ability to cooperate with others and to learn in whatever area necessary.

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