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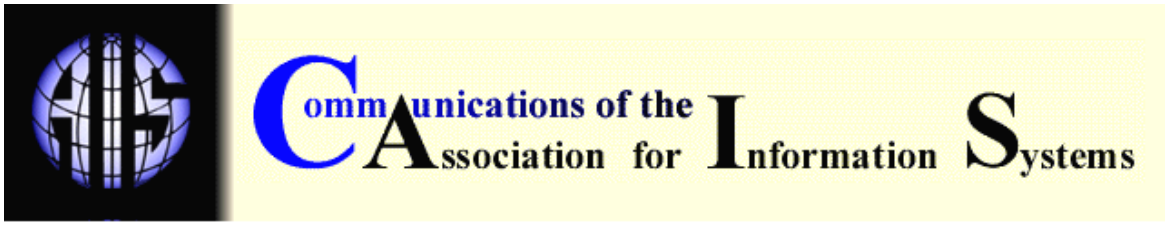

AN EAST-WEST COMPARISON OF IS PROFESSIONALS' PERFORMANCE AND KNOWLEDGE/SKILLS: AN EMPIRICAL STUDY OF USA VS. TAIWAN

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ABSTRACT

The outsourcing literature suggests that the capabilities of partners involved in outsourcing or off-shoring projects are a crucial factor for the success of the projects. This paper studies the capabilities of IS professionals from the USA and Taiwan on issues such as performance, time spent on IS related activities, and required skills vs. skills possessed. The goal is to determine the differences among these two groups in their core IT capabilities and to offer practitioners an empirical reference for carrying out their IS development decisions. Findings from the current study indicate that Taiwanese professionals tended to focus more on the technical issues and hardware/software details, while American professionals were proficient in business modeling, inter-personal communication, and end-user training. These findings present an opportunity for partnership between the two countries to develop low-cost but high quality IS projects. Other business implications are also discussed.

Keywords: information management, information technology, information systems, is management

I. INTRODUCTION

With rapid changes in information technology (IT), it becomes difficult to meet the requirements of modern information systems (IS). IS/IT professionals[1] find themselves challenged to meet dynamic business objectives and requirements [Barley and Orr, 1997; Mirvis and Hall, 1996]. Furthermore, the dynamics in the environment, business requirements, and IT advances intermingle with much complexity; causing difficulties in measuring the real demand of the required IS knowledge and/or skills [Howard, 1995; Weick, 1990]. Compounded with the complexity in the IS environment, some traditional tasks now require a significant amount of operational activities that are both contingent and hard to manage [Darrah, 1994]. Thus, a sustainable skill set that matches business needs is a must for IS professionals to excel in the job market.

Skill deficiencies of IS professionals are reported in various studies, such as [Nelson, 1991; Lee et al., 2002; Trauth et al., 1993]. The standards to assess employee performance are becoming more complex and demanding to improve productivity [Ilgen and Pulakos, 1997]. As a result, workers are continually adding, replacing, and rejuvenating their expertise to ensure an adequate stock of knowledge and work skills [Adler, 1992].

ORGANIZATION OF THIS PAPER

We begin with a discussion of outsourcing and skills compatibility (Section II). Then, after briefly discussing the skills literature, we outline the variables within the scope of the current study (Section IV). The next section (Section V) presents the hypotheses developed and the data collection procedures. Results are presented in Section VI and managerial implications are discussed in Section VII.

II. OUTSOURCING AND SKILL COMPATIBILITY

Global competition and movements toward online commercialization pressure businesses to operate on a lean but efficient information infrastructure. Outsourcing to offset ever-increasing IS/IT operating costs is now a popular business model. Many regions or countries, such as Taiwan, India, and South Korea, play a role equal to or surpassing their U.S. counterparts to win the outsourcing bids [Palvia, 2003]. For example, Taiwan became the world's largest producer of notebook computers and a range of PC components. The growing technological integrations and collaborations between several technology parks in Taiwan and the Silicon Valley benefited the economy on both sides and improved technology advancements [Saxenian, 2002].

Offshore outsourcing does not necessarily imply that companies receive inferior products by paying lower wages. The goal of such an outsourcing scheme is to obtain better quality, in shorter time, and at lower cost [Palvia, 2003; Chen et al., 2002]. The underlying assumption is that the skill set in creating and using such technology is key to ensure appropriate technology transfer [Bunker, 2001]. Therefore, it is important to examine the skill set among IS/IT professionals across different cultures.

In this paper, we study the skill set and expertise level of IS/IT professionals in two regions: U.S. and Taiwan. We specifically looked into two types of skill sets: (1) required and (2) self-proclaimed, to assess the two groups of IS/IT professionals. Five categories

- management,
- technology and development,
- organizational and societal,
- interpersonal
- personal traits

[1] We use the term IS/IT Professionals to refer to people who are practitioners.

of skill sets are examined. This study aims to provide a fundamental understanding of IS/IT professionals from these two cultures. Because outsourcing and technology transfer are complex issues, our findings on the characteristics of intercultural vendors are expected to offer insights for outsourcing strategies.

III. INFORMATION SYSTEMS SKILLS – THE LITERATURE

The IS/IT professionals' skill set is an asset of the corporate IT function. Measuring IS/IT skills is a complex issue. The scope of IS/IT requires technical, business, managerial, and interpersonal skills. [Couger et al. 1995; Ross et al.,1996]. Byrd and Turner [2001] found that technology management skills of IS professionals were positively related to primary activity efficiency[2] and support activity efficiency[3], while business skills were also positively related to the primary activity efficiency, but negatively related to support activity efficiency.

Ashenhurst [1972] suggested thirty-seven types of skills and abilities in six categories: people, models, systems, computers, organizations, and society, that are crucial for IS graduates and professionals. Ashenhurst's work was revised, and extended by Byrd and Turner, [2001], Nelson [1991], Lee et al., [2002], Todd et al., [1995], and Young and Lee, [1996], resulting in a proliferation of classification schemes for IS skills. Despite the absence of a universally accepted classification, existing studies generally agree that people regard 'general' knowledge such as interpersonal skills and business knowledge more important than 'IS-related' skills [Ferguson and Morris, 1993; Nelson, 1991; Lee et al., 2002; Todd et al., 1995; Trauth el al., 1993; Yen et al., 2001].

Lee et al. [2002], using a modified systems development life cycle, identified 21 IS activities with 7 categories of plan/manage, analyses, develop, implement, support, integrate, and train/educate. Yen et al. [2001], and Koh et al. [2001] followed the same classification scheme to study IS professionals' competency, required skill set, and perceived skill difference among academicians and industry practices. Their results indicate that general business knowledge and technical skills should be balanced in IS education and curriculum development.

IV. VARIABLE OPERATIONALIZATION

IS-RELATED ACTIVITIES

Following Trauth et al. [1993], the current study expands Lee et al.'s [2002] original instrument by separating the analyze business problems and IS solutions variable into two: (1) analyze business problems and (2) design IS solutions for business problems. Two learning variables (i.e., (1) learn new IS technologies and (2)learn knowledge/skills other than new IS technologies) and one database activity (i.e., develop data warehouse) were added to supplement Lee et al.'s instrument. The resulting questionnaire, therefore, contains a list of 25 IS activities, which were used to assess IS professionals from two countries for their time and performance on IS activities.

KNOWLEDGE/SKILLS REQUIRED FOR IS PROFESSIONALS

The knowledge/skills (KS) required for IS professionals were classified into four broad categories,

- IS core knowledge (2 subcategories discussed below),
- knowledge about organizations and other societal entities,

[2] Primary activity efficiency is a measure of the effects of IS on the set of activities that are involved in the "physical creation of the product and its sale and transfer to the buyer as well as the after the sale service" [Porter, 1985, p. 18; Byrd and Turner, 2001, p.4].

[3] Support activity efficiency measures the impact of IS on such support services as human resource management, hiring, legal, and governmental affairs, and general management [Byrd and Turner, 2001, p. 4].

- interpersonal skills, and
- personal traits (Table 1).

IS core knowledge is a major attribute to differentiate IS professionals from others.

Table 1. Variable Groups

ACTIVITY VARIABLES: TIME SPENT AND PERFORMANCE
Twenty-five IS-related activities were identified. Each activity was measured in two aspects: the time spent on the activities and the perceived performance.
KNOWLEDGE/SKILLS VARIABLES: REQUIRED AND POSSESSED
Twenty-one IS knowledge/skills items were identified. Each item was measured in two aspects: the level of proficiency required for and the level of proficiency possessed by each IS professional. These knowledge/skills items may be organized as follows: **IS core knowledge**: 1. IS management: Visions about IS/IT competitive advantage and knowledge of IS technological trends 2. IS technology & development: Knowledge/skills in hardware, packaged products, operating systems, networking/communications software/languages, programming languages, systems development methodologies, and implementation/operation/maintenance (IOM) issues. **Organizational and Societal knowledge** Knowledge/skills in specific business functional areas, specific organizations, specific industries, and the company's general operating environment. **Interpersonal skills** Interpersonal behavior skills, interpersonal communication capability, international communication ability, and teaching/training skills. **Personal trait** Personal motivation/ability to work independently, think creatively, and think critically.
SOFTWARE/TOOLS EXPERTISE VARIABLES: REQUIRED AND POSSESSED
Twenty-nine items for IS software/tools expertise were identified. Each item was measured in two aspects: the level of proficiency required for and the level of proficiency possessed by each IS professional.

This category is further divided into two subcategories: (1) IS management and (2) IS technology and development. The IS management subcategory includes two items and corresponds roughly to the technology management knowledge category discussed in Lee et al. [1995] or general IS knowledge in Nelson [1991]. The IS technology and development subcategory corresponds to the technical specialties knowledge in Lee et al.'s study [2002].

Functional areas in an organization work together as a team to achieve maximal business performance. Therefore, IS professionals can hardly isolate themselves from their environment to simply mind their own business. It is apparent that they need to excel in organizational, societal and interpersonal skills. The organizational and societal skills category consists of four skill variables:

- specific functional areas,
- specific organizations,
- specific industries, and
- general environment.

Following Nelson [1991], this study includes interpersonal communication and interpersonal behavior into the interpersonal skills category. Two additional variables: international

communication ability, and teaching and training skill were added to the interpersonal skills category to assess the impact of globalization and mutual learning abilities of IS professionals.

For personal traits, Todd et al. [1995] suggested the inclusion of personal motivation and ability to work independently. We also included creative thinking and critical thinking in the list.

SELECTION OF VARIABLES

The balance between the number of variables of the IS core knowledge category and that of other KS categories was investigated to ensure a valid study. The focus of the current study is on the relative importance of the IS core knowledge and the knowledge of other categories. As a result, general knowledge of systems thinking or model building, for example, was excluded from the list because it is closely related to and overlaps with critical thinking and/or creative thinking. Some attributes cited in business behavior and economic theories were included in the appropriate organizational and societal variables because of their relevance. The variables included in this paper were designed to be sufficiently comprehensive yet mutually exclusive. Most of the items associated with the ability to perform over-specialized tasks were excluded from the list.

A number of IS technologies were included in the software/tools category to examine the required and possessed IS skills. The authors started with a list of software/tools widely used in most IS areas, and then consolidated the list into 11 categories, and finally identified 29 variables (listed in Table 8 in Section VI).

V. RESEARCH HYPOTHESES AND DATA COLLECTION

HYPOTHESES

Many previous studies identified critical IS/IT skills, but an empirical assessment of culturally distinct groups of IS/IT professionals will offer insights of their preparedness for technology advancements. Null hypotheses regarding the differences between American IS professionals and Taiwanese professionals are conjectured below:

Hypothesis 1: The two groups are identical with respect to the time spent on IS activities.

Hypothesis 2: The two groups are identical with respect to performing IS activities.

Hypothesis 3: The two groups are identical with respect to the required proficiency level of knowledge/skills.

Hypothesis 4: The two groups are identical with respect to the possessed proficiency level of knowledge/skills.

Hypothesis 5: The two groups are identical with respect to the required proficiency level of software/tools.

Hypothesis 6: The two groups are identical with respect to the possessed proficiency level of software/tools.

DATA COLLECTION

The questionnaire[4] contains two parts:

(1) a section for demographic data, and

[4] The English version of the questionnaire is shown in Appendix I.

(2) a section to measure the software skill levels of IS professionals.

The mailing list included a variety of industries in which IS professionals work (Table 2). Respondents were assured that all collected data were confidential and that only aggregate results were to be reported.

Table 2. Demographics of IS Professionals

Demographic variables	USA	Taiwan
Years of experience		
Less than 5 years	21%	45%
5 – 10 years	29%	47%
More than 10 years	47%	7%
Gender		
Male	72%	89%
Female	**28%**	**11%**
Age		
Under 20	1.2%	0%
20-24	10.7%	9.8%
25-29	23.8%	42.5%
30-39	35.7%	31.6%
40-49	22.6%	12.8%
50-59	6.0%	3.3%
60 & Over	0%	0%

A follow-up mailing was made to non-respondents. A total of 92 questionnaires were returned from a group of 470 survey questionnaires mailed to the USA IT professionals. The response rate was 19.57%. Excluding seven invalid questionnaires, a total of 85 records were used for the analysis. A total of 500 questionnaires were mailed to Taiwanese professionals and 84 valid responses were received after the follow-up mailing. The response rate for the Taiwanese sample was 16.8%.

Table 2 shows that the two groups of IT professionals differ in their IT experience and other demographic variables. For the population of respondents, US IT professionals tend to be more experienced in the IT area than the Taiwanese professionals. In the US group, 28% of the respondents are female, which is much higher than the 11% in their Taiwan counterpart. In general, the gender information does show that the majority surveyed in both USA and Taiwan are male, Reflecting the IT experience data, the USA workforce sampled is older than their Taiwan counterpart.

The diversity in cultural, economic, and other factors makes it difficult to balance the need for samples that are both representative of the workforce in their respective countries and yet comparatively similar in their demographics. Even within the same geographical region, countries differ in their IT workforce characteristics. These observed differences are perhaps one reason why existing comparative studies (such as [Peterson and Kim, 2003; Tan, et al. 1998]) opted for a direct comparison with little or unclear documentation to ensure homogeneity of the demographic variables across the samples. That said, we tried to screen respondents from the two countries.

A series of job skill analyses follows the demographic outline in Table 2. In brief, our analyses showed:

1. all IS professionals possessed the proper level of software skills to do their jobs successfully,
2. the overall proficiency level possessed was about the same as or higher than the proficiency level required in the most areas,
3. IS professionals felt virtually no deficiency in IS software skills required to perform their jobs.

Details of the analyses are presented in Sections VI and VII.

VI. FINDINGS

RESEARCH FINDINGS

Because of the missing values in the data, it was inappropriate to test the hypotheses related to the technical expertise at the individual variable level. Instead, the MANOVA procedure in SAS V. 6.12 was applied against a set of technical variables to test the hypotheses. The procedure uses only the records with no missing values for analysis.

The results of MANOVA in Table 3 show that, at the 5% significance level, all six hypotheses were rejected. This indicates that American and Taiwanese IS professionals differ in the required and possessed proficiency level of knowledge/skills, software/tools expertise, the time spent on IS activities, and the performance on IS activities. Tables 4 through 9 show the details of this difference for each variable group. The means and the ranks of mean values of variables for the two countries are also presented in these tables. Furthermore, these variables in each table are sorted in ascending order based on the difference between ranks of the two countries (i.e., the value of Taiwanese rank subtract from the value of American rank). For each variable group, the mean values from the two countries and the results of t-test values (paired comparison) to test the difference of the overall mean values, and correlation coefficients between the two countries or between various variable groups are presented in Table 3(a) and (b).

OVERALL ASSESSMENT

Table 3(a) shows that the overall proficiency levels of required and possessed knowledge/skills are quite similar for the American and Taiwanese IS professionals. It is noticeable in Table 3(a) that Taiwanese professionals were required to possess and did possess higher level of software/tools expertise than Americans. In addition, American and Taiwanese IS professionals possessed, on average, the required level of proficiency for both knowledge/skills and

Table 3. Overall Comparison

(a) Pair-comparisons of variables

	MANOVA	T-Test					Spearman Rank	
	p-value	USA		Taiwan		p-value	Correlation	
		mean	S.D.	mean	S.D.		γ_s	p-value
Activity:								
Time Spent	.000	2.41	.64	3.12	.47	.000	.68	.000
Performance	.032	3.38	.42	3.19	.37	.003	.67	.000
Knowledge/Skills								
Required	.000	3.49	.70	3.41	.46	.515	.65	.002
Possessed	.000	3.56	.58	3.43	.40	.160	.69	.000
Software/Tools Expertise								
Required	.000	2.47	.66	2.91	.53	.000	.78	.000
Possessed	.000	2.65	.72	2.88	.52	.001	.88	.000

(b) Correlation of Mean Values Between Variables

Variable Group	Country	Pearson Cross-Product		Spearman Rank	
		ρ	p-value	γ_s	p-value
Activity	USA	.93	.000	.99	.000
Time Spent vs. Performance	Taiwan	.74	.000	.44	.026
Knowledge/Skills	USA	.98	.000	.99	.000
Required vs. Possessed	Taiwan	.51	.018	.39	.078
Software/Tools Expertise	USA	.98	.000	.99	.000
Required vs. Possessed	Taiwan	.76	.000	.73	.000

software/tools expertise. Table 3(a) also shows that American professionals spent less time on the tasks assigned but did a better job. Table 3(b) explains in part this seemingly contradicting finding. For the American IS professionals, the Pearson cross-product correlation coefficients are .93, .98, and .98 for the 3 pairs of variables, and the Spearman rank correlation coefficients are as high as .99 for all 3 pairs. In addition, the Pearson correlation coefficients for Taiwanese IS professionals are .74, .51, and .76 and the Spearman rank correlation coefficients are only .44, .39 (not statistically significant at α=.05), and .73 for the 3 pairs, respectively. These findings indicate that American professionals performed well for the job assigned, while Taiwanese professionals did not perform quite as well. Furthermore, American professionals seemed to perform better but were less skillful in the surveyed software/tools.

The large difference between the two groups for the time spent on IS activities suggests that the data may likely be contaminated by the leniency error. The leniency error occurs when a respondent is either an easy rater or a hard rater [Cooper and Schindler, 1998, p.190]. To ensure more accurate interpretation of the data, this study relies mainly on the rank-order data in the following discussions.

TIME SPENT ON IS ACTIVITIES

Table 4 shows the time the American and Taiwanese IS professionals spent on various IS activities. The most obtrusive phenomenon in the table is that the mean values of Taiwanese professionals are larger than those of Americans for 24 out of 25 activities ($p < .1$). Analyze

Table 4. Time Spent on IS Activities

VARIABLES	Rank Difference	USA		Taiwan		P-value
		mean	rank	mean	rank	
Analyze business problems	17	3.45	1	2.95	18	0.01
Learn knowledge other than new IS technologies	7	3.24	3	3.32	10	--
Analyze software packages: evaluation and selection	7	2.28	14	2.77	21	0.01
Train and educate end-users	5	2.59	12	2.99	17	0.05
Train and educate IS professionals	4	2.63	11	3.10	15	0.02
Support end-user computing	3	2.15	17	2.81	20	0.00
Implement new or changed computer-supported business process	2	3.12	6	3.46	8	0.07
Support existing portfolio of applications	2	2.65	10	3.19	12	0.02
Support user-developed systems	2	1.78	21	2.26	23	0.02
Develop data warehouse	1	1.34	24	2.08	25	0.00
Support hardware	0	1.66	22	2.77	22	0.00
Integrate existing and new business applications	0	2.82	7	3.50	7	0.00
Develop application software: purchase and tailor	-1	2.19	15	3.17	14	0.00
Integrate data types	-1	1.26	25	2.14	24	0.00
Develop DB	-1	2.03	20	2.85	19	0.00
Manage/plan systems development/implementation	-1	3.35	2	3.90	1	0.00
Learn new IS technologies	-1	3.12	5	3.58	4	0.01
Design IS solutions to business problems	-1	3.20	4	3.60	3	0.02
Implement system evaluation processes	-2	2.13	18	2.99	16	0.00
Manage/plan corporate IS strategies, strategic applications, technology architecture	-2	2.77	8	3.53	6	0.00
Support information access and security	-5	2.16	16	3.21	11	0.00
Implement data management procedures	-6	2.04	19	3.18	13	0.00
Manage/plan feasibility/approval process for new systems and technology	-7	2.66	9	3.62	2	0.00
Develop in-house application programs	-8	2.28	13	3.54	5	0.00
Integrate networks	-14	1.40	23	3.42	9	0.00

business problems was the only activity that American professionals were involved more than Taiwanese professionals. As the ranked data show, American professionals spent more time on the users, managerial, and business related activities, while Taiwanese professionals were more involved in the technical and development activities. American IS professionals seemed to spend more time on the following activities than Taiwanese professionals: analyze business problems, train/educate end-users, analyze software packages, train/educate IS professionals, and support end-user computing. Taiwanese professionals were more involved in integrate networks, develop in-house application programs, manage/plan feasibility/ approval process for new systems/technology, implement data management procedures, and support information access/security.

American IS professionals seemed to focus more on modeling business problems and solutions in their information systems, and on providing training to users of various types. They spent less time on technical issues such as software/hardware development, maintenance, testing, and integration than did Taiwanese professionals

The following variables were considered important by professionals in both countries: Manage/plan systems development/implementation, design IS solutions to business problems, learn new IS technologies, implement new/changed computer-supported business process, integrate existing/new business applications and manage/plan corporate IS strategies/strategic applications/technical architecture These results show that professionals in both countries were equally aware of the importance of mapping IS solutions to business problems.

PERFORMANCE ON IS ACTIVITIES

Table 5 shows the performance of IS professionals from both countries. In contrast to Table 4, Taiwanese professionals perform better only in 2 out of 14 ($p < .1$) activities. Taiwanese professionals performed well on hardware support and configuration, while Americans did better not only on user and business related activities, but also on software development activities.

Further, a significant difference appears in ranks for analyzing business problems between the two countries. In addition, American professionals performed user and business related activities (e.g., train/educate end-users, analyze software packages evaluation/selection, and implementing new or changed computer-supported business process) better than their Taiwanese counterpart.

Taiwanese professionals, on the other hand, performed well on activities such as integrate networks, support hardware, support information access/security, support existing portfolio of applications, and support end-user computing.

Both groups, however, did well in activities such as design IS solutions to business problems, manage/plan systems development/implementation, learn new IS technologies, and learn knowledge other than new IS technologies. In addition, both sets of professionals did not do well in these activities: develop databases, support user-developed systems, develop data warehouse, implement data management procedures, and integrate data types. As these activities are highly related to the database market where few giant players are available (e.g., Oracle, IBM, and Informix), it is likely that development of databases, data warehouses, and data management procedures are specialized tasks only accessible to a few trained professionals. Thus, other IS professionals are left little room to assimilate, learn and practice such activities in both countries.

Table 5. Performance on IS activities

VARIABLES	Rank Difference	USA		Taiwan		P-value
		rank	mean	rank	mean	
Analyze business problems	19	3	3.77	22	2.92	0.00
Train and educate end-users	7	9	3.61	16	3.26	0.04
Analyze software packages: evaluation and selection	5	13	3.53	18	3.17	0.02
Implement new or changed computer-supported business	4	7	3.68	11	3.31	0.02

process						
Implement system evaluation processes	4	16	3.38	20	3.06	0.09
Integrate existing and new business applications	3	6	3.69	9	3.36	0.03
Develop DB	3	18	3.35	21	2.99	0.09
Design IS solutions to business problems	2	1	3.83	3	3.53	0.04
Develop in-house application programs	2	8	3.62	10	3.32	--
Support user-developed systems	2	21	2.98	23	2.56	0.07
Learn knowledge other than new IS technologies	1	4	3.76	5	3.45	0.04
Train and educate IS professionals	1	14	3.49	15	3.26	--
Develop data warehouse	1	24	2.50	25	2.12	0.07
Manage/plan systems development/Implementation	0	2	3.81	2	3.60	0.08
Implement data management procedures	-1	20	3.17	19	3.17	--
Integrate data types	-1	25	2.38	24	2.35	--
Manage/plan feasibility/approval process for new systems and technology	-3	10	3.60	7	3.41	--
Manage/plan corporate IS strategies, strategic applications, technology architecture	-3	15	3.45	12	3.31	--
Learn new IS technologies	-4	5	3.73	1	3.60	--
Develop application software: purchase and tailor	-5	11	3.56	6	3.42	--
Support end-user computing	-5	19	3.34	14	3.26	--
Integrate networks	-6	23	2.60	17	3.24	0.00
Support existing portfolio of applications	-8	12	3.53	4	3.50	--
Support information access and security	-9	17	3.36	8	3.41	--
Support hardware	-9	22	2.78	13	3.26	0.02

PROFICIENCY LEVEL OF REQUIRED KNOWLEDGE / SKILLS

Table 6 shows that American professionals considered themselves most proficient in interpersonal communication and interpersonal behavior, followed by moderately proficient activities such as specific organizations, IOM issues, and development methodologies. Taiwanese professionals gave themselves high ratings on IS technological trends, IS/IT competitive vision, and specific business functional area. In addition, they both were moderately proficient in networking/communication, operating systems, and programming languages. This finding shows the difference about how IS professionals achieved the goals set forth by their job requirements. Americans achieved their goals with their communication skills, while Taiwanese strove for their technical soundness.

The professionals from both countries considered themselves highly proficient in all three personal traits—work independently, critical thinking, and creative thinking. Teaching/training was considered moderately important by American professionals, but relatively unimportant for Taiwanese professionals. On the other hand, Taiwanese considered application programs important, Americans rated it only moderately important. Professionals from both countries were least concerned with the outside environment in specific industries, general environment, hardware, and international communication.

Table 6. Proficiency Level of Required Knowledge/Skills

VARIABLES	**RANK DIFFERENCE**	USA		Taiwan		p-value
		mean	rank	mean	rank	
Specific organizations	9	3.74	7	3.14	16	0.00
IOM issues	8	3.8	6	3.15	14	0.00
Interpersonal communication	7	4.58	1	3.62	8	0.00
Interpersonal behavior	7	4.51	2	3.62	9	0.00
Development methodologies	6	3.34	13	2.95	19	0.04
Teaching and training	3	3.27	14	3.13	17	--

Specific industries	3	2.89	17	2.71	20	--
General environment	3	2.80	18	2.46	21	0.06
Packaged products	1	3.62	10	3.32	11	0.09
Work independently	0	4.49	3	4.04	3	0.00
International communication	-3	2.07	21	3.01	18	0.00
Critical thinking	-3	4.47	4	4.13	1	0.01
Creative thinking	-3	4.12	5	4.05	2	--
Application programs	-3	3.67	9	3.67	6	--
Hardware	-4	2.62	19	3.15	15	0.00
Programming languages	-4	2.94	16	3.31	12	0.09
Specific business functional areas	-4	3.68	8	3.97	4	0.10
IS/IT competitive vision	-4	3.58	11	3.63	7	--
Operating systems	-5	2.99	15	3.47	10	0.01
Networking/communication	-7	2.53	20	3.21	13	0.00
IS technological trends	-7	3.57	12	3.97	5	0.02

LEVEL OF POSSESSED KNOWLEDGE/SKILLS

Table 7 shows that the level of possessed knowledge/skills between the two groups is quite similar to that of required proficiency level discussed in the previous section. Americans were highly skilled in interpersonal communication, interpersonal behavior, specific organizations, and IOM issues, while Taiwanese were more into IS technological trends, IS/IT competitive vision, and specific business functional area. Work independently, critical thinking, and creative thinking received high ranks from both countries.

Table 7. Level of Possessed Knowledge/Skills

VARIABLES	Rank Difference	USA		Taiwan		p-value
		mean	rank	mean	rank	
Interpersonal communication	7	4.42	2	3.54	9	0.00
Specific organizations	7	3.72	9	3.21	16	0.00
Packaged products	6	4.06	5	3.49	11	0.00
IOM issues	5	3.72	8	3.37	13	0.05
Interpersonal behavior	4	4.26	4	3.59	8	0.00
Development methodologies	4	3.51	13	3.15	17	0.05
General environment	3	3.00	18	2.54	21	0.01
Specific industries	3	3.04	17	2.83	20	--
Teaching and training	2	3.53	12	3.24	14	0.10
Work independently	0	4.42	1	4.13	1	0.02
Critical thinking	-1	4.27	3	3.97	2	0.02
Networking/communication	-1	2.67	20	2.99	19	0.06
Application programs	-1	3.80	7	3.69	6	--
Programming languages	-1	3.55	11	3.53	10	--
International communication	-3	2.21	21	3.03	18	0.00
Creative thinking	-3	3.98	6	3.91	3	--
Hardware	-4	2.94	19	3.24	15	0.06
Operating systems	-4	3.31	16	3.46	12	--
Specific business functional areas	-6	3.56	10	3.82	4	0.10
IS/IT competitive vision	-8	3.43	15	3.59	7	--
IS technological trends	-9	3.43	14	3.78	5	0.025

PROFICIENCY LEVEL OF REQUIRED SOFTWARE/TOOLS

American professionals considered project management tools, spreadsheet tools, object-oriented languages, word processing tools, and PC-based DB tools more important, while Taiwanese professionals evaluated mini/mainframe OS, telecommunication tools, PC OS, high-level procedural languages, fourth generation languages, and LAN tools important. E-mail tools, internet/navigation browser, and query languages were highly ranked by both countries.

Table 8. Proficiency Level of Required Software/Tools

VARIABLES	Rank Difference	USA		Taiwan		P-value
		Rank	mean	Rank	mean	
Project management tools	16	4	3.20	20	2.74	0.02
Spreadsheet tools	11	6	3.14	17	2.87	--
Object-oriented language	6	12	2.63	18	2.86	--
Word processing tools	5	2	3.47	7	3.26	--
PC-based DB tools	5	11	2.68	16	2.94	--
Presentation graphic tools	3	7	3.13	10	3.04	--
Query language	1	5	3.16	6	3.36	--
Enterprise resource planning tools	1	22	2.21	23	2.55	--
Tele/video-conference tools	1	24	1.81	25	2.36	0.00
Expert systems/shells	0	26	1.54	26	2.28	0.00
Multimedia production tools	0	27	1.54	27	2.21	0.00
Simulation/optimization tools	0	28	1.48	28	2.18	0.00
Assembly language	0	29	1.14	29	1.55	0.00
Decision support systems	0	19	2.26	19	2.82	0.01
Case/structured programming tools	0	21	2.21	21	2.70	0.01
Transaction processing systems	0	13	2.61	13	2.97	0.08
Internet/navigation browser	0	3	3.36	3	3.67	--
Email tools	0	1	3.88	1	3.94	--
Data warehouse/mart tools	-1	23	1.86	22	2.69	0.00
Statistics tools	-1	25	1.73	24	2.42	0.00
Electronic data interchange tools	-1	16	2.43	15	2.95	0.01
Web page production tools	-2	14	2.46	12	3.01	0.01
Client-server based DB tools	-2	10	2.69	8	3.10	0.04
Local area network tools	-4	9	2.84	5	3.49	0.00
Fourth generation language	-4	18	2.33	14	2.96	0.00
High-level procedural language	-4	15	2.43	11	3.03	0.01
PC operating systems	-6	8	2.94	2	3.82	0.00
Telecommunication tools	-11	20	2.21	9	3.10	0.00
Mini/mainframe operating systems	-13	17	2.37	4	3.63	0.00

LEVEL OF POSSESSED SOFTWARE/TOOLS

The possessed skills in software/tools in Table 9 are somewhat different from the required skills discussed in the previous section. Taiwanese professionals were highly skilled in PC OS, mini/mainframe OS, telecommunication tools, and fourth generation languages, while American professionals mastered project management tools. E-mail tools, internet/navigation browser, and query languages were popular for both professionals. Spreadsheet tools, object-oriented languages, word processing tools, and PC-based DB tools, high-level procedural languages, and LAN tools, however, received about the same ranks from both countries.

Table 9: Proficiency Level of Possessed Software/Tools

VARIABLES	Rank Difference	USA		Taiwan		P-value
		Rank	mean	Rank	mean	
Project management tools	11	8	3.11	19	2.69	0.03
Object-oriented language	7	13	2.69	20	2.67	--
Web page production tools	6	15	2.67	21	2.67	--
Client-server based DB tools	4	10	2.94	14	2.94	--
Presentation graphic tools	2	5	3.61	7	3.31	--
Statistics tools	2	23	2.09	25	2.39	--
Query language	2	6	3.30	8	3.23	--
Simulation/optimization tools	1	27	1.63	28	2.04	0.01
Enterprise resource planning tools	1	22	2.09	23	2.44	0.09
Spreadsheet tools	1	4	3.65	5	3.40	--
Internet/navigation browser	1	3	3.79	4	3.55	--

PC-based DB tools	1	9	2.95	10	3.17	--
Assembly language	1	28	1.61	29	1.77	--
Transaction processing systems	1	14	2.68	15	2.87	--
Expert systems/shells	0	26	1.66	26	2.13	0.01
Word processing tools	0	2	3.95	2	3.65	0.06
Decision support systems	0	18	2.46	18	2.72	--
Email tools	0	1	3.96	1	3.85	--
Tele/video-conference tools	-1	25	1.81	24	2.41	0.00
High-level procedural language	-1	12	2.71	11	3.15	0.05
Data warehouse/mart tools	-2	24	1.86	22	2.61	0.00
Multimedia production tools	-2	29	1.55	27	2.10	0.00
Case/structured programming tools	-2	19	2.32	17	2.75	0.02
Local area network tools	-2	11	2.93	9	3.21	--
PC operating systems	-4	7	3.13	3	3.64	0.01
Fourth generation language	-4	16	2.65	12	2.99	0.09
Electronic data interchange tools	-5	21	2.27	16	2.82	0.01
Telecommunication tools	-7	20	2.27	13	2.95	0.00
Mini/mainframe operating systems	-11	17	2.52	6	3.37	0.00

VII. BUSINESS IMPLICATIONS

NATURE OF IS TASKS IN THE TWO COUNTRIES

U.S. IS/IT professionals in this study performed better for the tasks assigned than their Taiwanese counterpart. In the U.S., at the corporate level, the information systems department is usually considered an integral part of the corporate culture and IS/IT professionals are expected to follow corporate ethics. The discrepancy between the two groups in the efficiency of job performance may perhaps be explained by their perceptions of the corporate ethic. Herndon et al. [2001] found that a high level of corporate ethics perception creates a positive effect on an individual's morale, job satisfaction, and organizational commitment in the U.S. It is likely, as Herndon et al. suggested that many Taiwanese employees were not aware of corporate policies and ethics. Thus, their performance may lie in maximizing individual achievements, which at times may not be consistent with the corporate culture.

This study also found that U.S. professionals are involved more in business issues, system modeling, and end-user education, while Taiwanese professionals were more concerned with technical issues. Since Table 3(a) shows that Taiwanese professionals were not any less skillful than the American professionals, it is likely that American IS development process involves much of the inter-personal communications to resolve problems or issues at the beginning of the project life cycle. On the other hand, Taiwanese professionals work diligently to achieve quality in technical details. The fundamental difference in system development focus between the two groups makes it possible for the two groups to work together. The American group may spearhead the system development projects, but shift the development or related technical work to the Taiwanese group.

BUSINESS VERSUS TECHNICAL FOCUS

This study also suggests that American professionals are more into personal productivity tools, such as word processors and spreadsheets; while Taiwanese professionals were required to be proficient in software that bridges, configures, and fine-tunes hardware components. This finding not only shows the business versus technical focus between the two countries, and the methodological differences in their IS tasks. Object-oriented development methodology supports software reuse at the source code and packaged component levels. Therefore, IS professionals do not build many software components from scratch. Standardization on tools, operating environment, and system architecture, as well as collaborative technology, contribute to the shortened system development cycles, making it possible for American IS professionals to

concentrate on business processes. Thus, object orientation spares efforts and time for business and IS integration as we see in American activities.

Collectively, both Tables 6 and 7 demonstrated that professionals from both countries are able to work independently, and perform critical and creative thinking, as required by their job functions. Furthermore, Taiwanese professionals were capable with technical details but need to bridge their technical achievements with business goals. American professionals, while capable of communicating their deliverables, were less interested in achieving technical soundness in software details. This finding supports Ferguson et al.'s study [1993, p. 122] in part. They showed that the American advantage in the architectural context is based on a massive advantage in rapid innovation and conceptualization, rather than detailed engineering. The current study also shows that Taiwanese IS professionals' perceived ability to do critical thinking and work independently approaches that of American IS professionals.

Tables 8 and 9 indicate that American IS skills matched what were required for their jobs. By allowing such match, IS professionals are likely to spend less time on the job but achieve more. When such match is nearly nonexistent, such as in the Taiwanese work environment, efforts could largely be spent on finding such a match and adjusting to the environment. If the corporate ethics and policies are not clear or formally made apparent, this adjustment can continue blindly, adding unnecessary job stress. In addition, a good skill match can also be attributed to the organization's policy in job standardization.

OUTSOURCING, OFF-SHORING AND BUSINESS OPPORTUNITIES

The discrepancy of tasks at hand for both groups of professionals may also be explained by how the two countries excel in the IT industries. Tsang [1999] shows that US IT firms captured 70% of concept-intensive components (e.g., software and microprocessors) in the mid-1990s, while Taiwanese and Korean IT firms owned 70% of the labor-intensive components (e.g., computer monitors, mice, and keyboards). Apparently, the nature of corporate operations has been influential to the performance of IS professionals.

The economic downturn since 2000 forces businesses to re-think their IT strategies. Outsourcing and off-shoring are the focal point in the news media. Venkatraman [2004] suggests that outsourcing and off-shoring should not be considered synonymous just with sweetshop labor. They are the key element of the next-generation business model that leverages the new and available pool of IT talents globally. Outsourcing and off-shoring require a sound level of business and technical communications. Our study demonstrates that American IT professionals already excel in business communication and inter-personal skills, which lays the groundwork for collaboration with other business professionals or IT professionals outside of the U.S. In addition, IT methodologies employed in American firms already allow for integration with system components built externally. As a result, these firms can work with vendors of routine IT tasks. Taiwanese IT professionals, on the other hand, work at a sound level of technical capability, allowing them to do many of the routine and development details.

In the outsourcing and off-shoring literature, the ability to define and manage system technology and architecture emerged as a particularly important aspect for outsourcing success [Feeny and Willcocks, 1998]. Our study shows that Taiwanese professionals were more involved in the manage/plan feasibility/approval process for new system. IT professionals from both the US and Taiwan considered manage/plan corporate IS strategies/strategic applications/technical architecture and manage systems development/ implementation important aspects of IT jobs and did well in those areas. A good match between the two IT professional groups seems possible. Ross and Westerman [2004] suggest, most outsourcing arrangements deliver one or more of the following capabilities: infrastructure services, data center operations, application development and maintenance, and business processes. They also point out that standardization of IT processes and system architecture are the key to outsourcing success. Findings from our study also suggest that a good start for the partnership between the two groups of IT professionals may

be for American IT professionals to develop the needs assessment, project requirements, and business processes, while Taiwanese professionals undertake the detailed implementation.

VII. CONCLUSIONS

This study contributes to the body of literature in several ways.

1. It is one of the first empirical studies that examines the core capabilities of IS professionals in the USA and Taiwan.

2. Results from this study show that it is possible for a good match to deliver low-cost and high quality systems with American professionals being the driving force for design and planning, and with Taiwanese professionals being the implementers. This is due to in part from our findings that American professionals were very capable in inter-personal communications and business processes, while Taiwanese professionals exhibited their technical soundness. In addition, many Taiwanese businesses are already an extended manufacturing partner of American hardware and software giants.

3. Our study offers an empirical reference for firms to further their partnership with countries outside the US. Such collaboration requires an understanding of what the partners can bring to the relationship and how the partners may be able to complement each other's core competency.

Our empirical evidence shows that American and Taiwanese IS professionals are quite different in (1) the IS activities in which they engage, (2) their ability to carry out these activities, (3)the knowledge/skills and software/tools expertise required and (4) proficiency levels achieved/possessed. This study shows that American IS professionals were more involved in business problem analyses and interpersonal communications, while Taiwanese IS professionals were very much into technical details in software tools, hardware configurations, and legacy systems.

These American IS professionals performed better for the job assigned. It may be inappropriate to jump to the conclusion that simply for being highly involved in business analyses and interpersonal communications would lead to higher level of productivity in the IS environment. After all, both technical activities and business processes are the essential parts to transform conceptual designs to reality. American professionals seemed to spend less time in development details but achieve a better performance. As this study shows, this can be largely due to their adoption of modern design methodologies. Taiwanese professionals were tied into legacy systems, traditional development procedures, and hardware compatibility issues. As a result, Taiwan became technically oriented, while the USA became process oriented in their information systems practices.

As the American experience shows, the process focus approach requires that development and deployment platforms be standardized, development tools be automated, and software components be modularized and perhaps outsourced when necessary. Since successful implementation of information systems is based on the quality of the end product and the degree to which the end product matches user requirements and business goals, Taiwanese IS professionals should also advance their skills in business areas. As the Taiwanese example shows, the lack of corporate culture to support a match between the company ethics and the employee skill sets can lead to inferior performance. This difference may further lower employee's job satisfaction and thus contributes to lower job commitment [Buchko, 1993].

LIMITATIONS

Because of the large number of inferences and the relatively small sample, it is difficult to provide implications at the per-variable level. Taking the importance of the topic into consideration, both the internal validity and external validity may not be sufficient. Therefore, a richer data set and a comprehensive study for the optimal model of IS activities can be exploited further.

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APPENDIX I. QUESTIONNAIRE

Your Company
Type: (mark as necessary)
□ consulting: information technology
□ consulting: business process improvement
□ consulting: other area ( )
□ non-consulting: manufacturing □ non-consulting: service
□ non-consulting: other area ( )
Employees : (number of people)
□ under 100 □ 100–499 □ 500–999 □ 1,000–4,999 □ 5,000–9,999
□ 1,0000 or over
Revenue : (Gross, $ Million)
□ under 100 □100–250 □250–500 □ 500–1,000 □ 1,000–2,000 □ over 2,000

Your Working Environment
Department /Team Type:
□ Information Systems □ Business Functional Area
□ other ( )
Department/Team Size: (number of people)
□ under 10 □ 10–24 □ 25–49 □ 50–99 □ 100-499 □ 500 or over
Hardware Platforms: (mark as necessary)
□ mainframe □ mini □ client-server □ PC

Yourself
Gender

□ male □ female

Age

□ under 20 □ 20 – 24 □ 25 –29 □ 30 –39 □ 40 –49 □ 50 –59 □ over 60

Type of Job: (mark as necessary)

□ operator □ application programmer □ system programmer
□ system analyst □ data communications □ end-user support
□ database specialist □ AI/expert systems specialists □ IS manager
□ other IS specialist ( )
□ non-IS specialist

Organizational Position

□ senior management □ middle management □ non-management
□ other ( )

Experience (years)

□ under 1 □ 1 – 3 □ 3 – 5 □ 5 – 10 □ 10 – 20 □ 20 -30 □ over 30

Education (Choose the last degree):

□ high school □ technical or community □ bachelor's degree □ master's degree □ doctoral degree □ other

I. Please rate how much time ***You*** have spent to do each of the following IS activity/task during the last year. Please also rate how well you think ***You*** have performed it.

IS Activities/Tasks	Time Spent (Little → Much)					Performance (Poor → Excellent)				
Manage/plan systems development/implementation	1	2	3	4	5	1	2	3	4	5
Manage/plan feasibility/approval process for new systems and technology	1	2	3	4	5	1	2	3	4	5
Manage/plan corporate IS strategies, strategic applications, technology architecture	1	2	3	4	5	1	2	3	4	5
Analyze business problems	1	2	3	4	5	1	2	3	4	5
Design IS solutions to business problems	1	2	3	4	5	1	2	3	4	5
Analyze software packages – evaluation and selection	1	2	3	4	5	1	2	3	4	5
Develop application software – purchase and tailor	1	2	3	4	5	1	2	3	4	5
Develop in-house application programs	1	2	3	4	5	1	2	3	4	5
Develop databases	1	2	3	4	5	1	2	3	4	5
Develop data warehouse	1	2	3	4	5	1	2	3	4	5
Implement data management procedures	1	2	3	4	5	1	2	3	4	5
Implement system evaluation processes	1	2	3	4	5	1	2	3	4	5
Implement new or changed computer-supported business process	1	2	3	4	5	1	2	3	4	5
Support existing portfolio of applications	1	2	3	4	5	1	2	3	4	5
Support user-developed systems	1	2	3	4	5	1	2	3	4	5
Support end-user computing (e.g., info. center, hot line)	1	2	3	4	5	1	2	3	4	5
Support hardware	1	2	3	4	5	1	2	3	4	5
Support information access and security	1	2	3	4	5	1	2	3	4	5
Integrate existing and new business applications	1	2	3	4	5	1	2	3	4	5
Integrate networks	1	2	3	4	5	1	2	3	4	5
Integrate data types (e.g., video, voices)	1	2	3	4	5	1	2	3	4	5
Train and educate IS professionals	1	2	3	4	5	1	2	3	4	5
Train and educate end-users	1	2	3	4	5	1	2	3	4	5
Learn new IS technologies	1	2	3	4	5	1	2	3	4	5
Learn knowledge other than new IS technologies	1	2	3	4	5	1	2	3	4	5

II. Followings are categories of knowledge/skills and personal traits that an IS professional is supposed to have to do his job successfully. Please rate how high the level of proficiency ***Required*** for ***You*** to do ***Your Job*** successfully is. Please also rate how high the level of proficiency ***Possessed*** by ***You*** now for each category of knowledge/skills is.

IS Knowledge/Skill	Level of Proficiency									
	Required					Possessed				
	Low				High	Low				High
Hardware	1	2	3	4	5	1	2	3	4	5
Packaged products (spreadsheet, word processing, etc.)	1	2	3	4	5	1	2	3	4	5
Operating systems	1	2	3	4	5	1	2	3	4	5
Networking/communication software and languages	1	2	3	4	5	1	2	3	4	5
Application programs	1	2	3	4	5	1	2	3	4	5
Programming languages	1	2	3	4	5	1	2	3	4	5
Systems development methodologies (Life cycle, Structured programming, CASE methods or tools, etc.)	1	2	3	4	5	1	2	3	4	5
Implementation, operation and maintenance issues	1	2	3	4	5	1	2	3	4	5
Visions about IS/IT for competitive advantage	1	2	3	4	5	1	2	3	4	5
IS Technological trends	1	2	3	4	5	1	2	3	4	5
Knowledge of specific business functional areas (finance, marketing, production, etc.)	1	2	3	4	5	1	2	3	4	5
Knowledge of specific industries (retail, automobile, textile, etc.)	1	2	3	4	5	1	2	3	4	5
Knowledge of specific organizations (your own company, your host company, etc.)	1	2	3	4	5	1	2	3	4	5
General environment (economic, legal, etc.)	1	2	3	4	5	1	2	3	4	5
Teaching and training skills	1	2	3	4	5	1	2	3	4	5
Interpersonal behavior skills (involves organizing, leading, working cooperatively, and planning collaboratively)	1	2	3	4	5	1	2	3	4	5
Interpersonal communication skills (oral and written)	1	2	3	4	5	1	2	3	4	5
International communication ability (involves foreign languages and cultures)	1	2	3	4	5	1	2	3	4	5
Personal motivation and working independently	1	2	3	4	5	1	2	3	4	5
Creative thinking (involves synthesis and generation of new ideas)	1	2	3	4	5	1	2	3	4	5
Critical thinking (involves analysis, evaluation and reasoning)	1	2	3	4	5	1	2	3	4	5

III. Now we are looking into IS technical specialties in detail. Please rate how high the level of proficiency ***Required*** for ***You*** to do ***Your Job*** successfully is. Please also rate how high the level of proficiency ***Possessed*** by *You* now is.

Technical Skill Set	Level of Proficiency									
	Required					Possessed				
	Low				High	Low				High
Spreadsheet Tools	1	2	3	4	5	1	2	3	4	5
Word Processing Tools	1	2	3	4	5	1	2	3	4	5
Presentation Graphics Tools	1	2	3	4	5	1	2	3	4	5
PC-Based Database Tools	1	2	3	4	5	1	2	3	4	5

Client-Server Based Database Tools	1	2	3	4	5	1	2	3	4	5
Data Warehouse/Mart Tools	1	2	3	4	5	1	2	3	4	5
Enterprise Resource Planning Tools (e.g., SAP)	1	2	3	4	5	1	2	3	4	5
Project Management Tools (e.g., MS Project)	1	2	3	4	5	1	2	3	4	5
Multimedia Production Tools (e.g., DIRECT)	1	2	3	4	5	1	2	3	4	5
Transaction Processing Systems	1	2	3	4	5	1	2	3	4	5
Decision Support Systems	1	2	3	4	5	1	2	3	4	5
Expert Systems/ Shells	1	2	3	4	5	1	2	3	4	5
Simulation/Optimization Tools	1	2	3	4	5	1	2	3	4	5
Statistics Tools	1	2	3	4	5	1	2	3	4	5
Assembly Language	1	2	3	4	5	1	2	3	4	5
High Level Procedural Languages	1	2	3	4	5	1	2	3	4	5
4th Generation Languages	1	2	3	4	5	1	2	3	4	5
Object-Oriented Languages	1	2	3	4	5	1	2	3	4	5
Query Languages	1	2	3	4	5	1	2	3	4	5
CASE/Structured Programming Tools	1	2	3	4	5	1	2	3	4	5
Internet/Navigation Browser	1	2	3	4	5	1	2	3	4	5
Web Page Production Tools (e.g., HTML, Java)	1	2	3	4	5	1	2	3	4	5
Electronic Mail Tools	1	2	3	4	5	1	2	3	4	5
Electronic Data Interchange Tools	1	2	3	4	5	1	2	3	4	5
Teleconference/Video-conference Tools	1	2	3	4	5	1	2	3	4	5
Local Area Network Tools (e.g., Windows NT)	1	2	3	4	5	1	2	3	4	5
Telecommunication Tools	1	2	3	4	5	1	2	3	4	5
PC Operating Systems	1	2	3	4	5	1	2	3	4	5
Mini/Mainframe Operating System	1	2	3	4	5	1	2	3	4	5

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