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ABSTRACT
This exploratory study investigates the adoption and use of information and communication technologies in Myanmar by examining the nature and structure of the information technology profession. The investigation is based on a theoretical framework consisting of three components: domains of information technology professional expertise; the scope of the information technology professional's knowledge, skills and experience; and specific knowledge and skills associated with the domains of professional expertise. The findings show that specialist skills in systems development, database, network and communications are important. This paper also provides insights that are not found in current literature which investigates information technology skills in Myanmar.

Keywords: Myanmar, IT skills, IT adoption.

1. INTRODUCTION

Myanmar embarked on the path of political and economic reforms in 2011. This created an opportunity and challenges to investigate the use of information and communication technology (ICT) in the country by examining the nature and structure of the information technology (IT) profession. Myanmar is the second largest country in Southeast Asia. It borders five nations and has a population of 48.34 million (The World Bank, 2012). The World Bank categorizes Myanmar as a low income country and its economy is primarily an agricultural economy (The Asian Development Bank, 2012a; The World Bank, 2012). Economic indicator from The Asian Development Bank shows that Myanmar is experiencing 5.5 percent of gross domestic product (GDP) growth in 2011 and its economy is expected to grow at seven to eight percent a year, triple per capita income and become a middle income nation by 2030 (The Asian Development Bank, 2012a). To achieve this goal, the government of Myanmar is developing coherent strategies to overcome many structural impediments to realize the economy's potential by opening foreign investment in a range of sectors (The Asian Development Bank, 2011; The Asian Development Bank, 2012b).

In a report prepared for the United Nations Education Scientific and Cultural Organization (UNESCO), Pernia (2008) reported that Myanmar is a country with high appreciation of technology but low in availability of technology. The Myanmar's government ICT master plan shows that it aims to utilize IT as a vehicle for business organizations penetrating the international market and to have widespread business applications of IT in

organizations to improve productivity (SEACOOP, 2010). The report from SEACOOP (2010) also concludes that although Myanmar is at an early stage of ICT development, there is a clear potential for developing a viable ICT industry and effective use of ICT to make the country more productive and competitive in the international market. In addition, it has identified software development and training to be the key drivers of ICT development in Myanmar (SEACOOP, 2010).

One of the key challenges faced by the ASEAN countries is the extent of digital divide among all ASEAN member countries (ASEAN, 2011). Table 1 shows the 2011 ICT Development Index (IDI) of ten ASEAN member states and ten non-ASEAN countries (ITU, 2012). The IDI is a composite index which compares developments in ICT across countries. It measures differences between countries with different levels of ICT development and the development potential of ICT to which countries can make use of ICT to enhance growth and development (ITU, 2012). The IDI is divided into 3 sub-indices: *access* sub-index (which measures ICT readiness and ICT infrastructure), *use* sub-index (which measures ICT intensity and usage), and *skills* sub-index (which measures ICT capability and skills). From Table 1, it can be observed that Myanmar is one of the least connected countries.

Table 1: ICT Development Index of Ten ASEAN Member States and Ten non-ASEAN Countries (Source: ITU, 2012)

	Country	IDI (0 - 10)	Rank (Out of 155 countries)	Access Sub-Index	Rank	Use Sub-Index	Rank	Skills Sub-Index	Rank
ASEAN member states	Singapore	7.66	12	8.38	8	7.24	6	7.08	71
	Brunei Darussalam	4.95	57	6.46	44	2.38	62	7.08	72
	Malaysia	4.82	58	5.85	54	2.85	56	6.69	90
	Vietnam	3.68	81	4.00	85	2.01	76	6.40	101
	Thailand	3.41	92	3.78	91	1.09	100	7.34	62
	Philippines	3.19	94	3.32	101	1.18	98	6.96	77
	Indonesia	3.19	95	3.37	99	1.40	92	6.41	100
	Lao P.D.R.	1.99	120	2.45	120	0.36	125	4.35	121
	Cambodia	1.96	121	2.53	113	0.19	135	4.38	120
	Myanmar	1.67	131	1.52	149	0.04	155	5.24	111
Non-ASEAN countries	Korea (Rep.)	8.56	1	8.30	11	8.17	1	9.86	1
	Japan	7.76	8	7.81	17	7.29	5	8.59	28
	United Kingdom	7.75	9	8.47	7	6.62	11	8.58	29
	Hong Kong	7.68	11	9.21	1	5.96	17	8.05	48
	United States	7.48	15	7.50	24	6.37	12	9.65	3
	Australia	7.05	21	7.66	20	5.39	23	9.15	10
	Turkey	4.38	69	5.12	69	2.26	65	7.13	68
	Brazil	4.72	60	5.35	66	2.67	59	7.53	53
	China	3.88	78	4.12	82	2.24	66	6.70	89
	India	2.10	119	2.48	116	0.45	120	4.63	115

Table 2 shows the 2011 *Access Indicator*s of ten ASEAN countries compiled by the *International Telecommunication Union* (ITU). This indicator includes fixed-telephone subscriptions, mobile-cellular telephone subscriptions, international Internet bandwidth per Internet user, percentage of households with a computer, and percentage of households with Internet access. The indicators show that Myanmar has the lowest access indicators among the ten ASEAN member countries.

Table 2: Access Indicators of Ten ASEAN Member States (Source: ITU, 2012)

Country	Fixed-telephone subscription per 100 inhabitants	Mobile-cellular subscription per 100 inhabitants	International internet bandwidth bits/s per Internet user	Percentage of households with computer	Percentage of households with Internet access
Singapore	38.90	149.5	54,7064	86.0	85.0
Brunei Darussalam	19.7	109.2	21,995	83.2	69.0
Malaysia	14.7	127.0	10,651	64.1	61.40
Vietnam	11.5	143.4	9,998	16.0	14.0
Thailand	9.7	113.2	10,622	24.7	13.4
Philippines	7.2	92.0	12,360	15.1	15.0
Indonesia	15.90	97.70	7,196	12.0	7.0
Lao P.D.R.	1.7	87.2	2,048	7.8	4.2
Cambodia	3.7	69.9	13,530	4.9	2.8
Myanmar	1.1	2.6	8,180	1.8	1.4

Networked Readiness Index (NRI) is an annual report produced by the World Economic Forum. NRI measures the degree to which economies across the world leverage ICT for global competitiveness (Dutta et al., 2012). Results from the 2012 NRI report only included eight ASEAN member countries and did not include data from Myanmar. This shows that Myanmar trailed the rest of the world in terms of network connectedness and underdevelopment of ICT infrastructure and hence suffers from low uptake of ICT to leverage competitiveness.

Against this background, this study aims to examine current adoption and use of ICT in Myanmar based on the nature and structure of the IT profession using a theoretical framework consisting of the following three components: (i) domains of IT professional expertise; (ii) the scope of the IT professional's knowledge, skills and experience; and (iii) specific knowledge and skills associated with the domains of IT professional expertise. This study extends prior studies by Winley and Lau (2012), Winley and Wongwuttiwat (2012) and Wongwuttiwat (2009). The study also provides an opportunity to investigate current and future state of adoption and use of ICT in Myanmar.

The components of the theoretical framework and related literature are presented in Section 2 follows by a description of the research design and methodology in Section 3. The results of data analysis and discussion of results are presented in Section 4. Section 5 concludes the paper.

2. THEORETICAL FRAMEWORK AND RELATED LITERATURE

The theoretical framework used in this study describes the nature and structure of the IT profession using the following three components: (i) domains of professional expertise; (ii) scope of knowledge, skills and experience; and (iii) domain specific knowledge and skills. This framework was used successfully in three previous studies: Wongwuttiwat (2009) used the framework to compare the nature and structure of the IT profession in organizations classified as IT users or providers in Thailand; Winley and Wongwuttiwat (2012) compared the nature and structure of the IT profession in different organizational sectors in Thailand; Winley and Lau (2012) compared the adoption and use of ICT in medium to large organizations in Vietnam and Thailand.

2.1 Domain of Professional Expertise

The first component of the framework includes five domains of ICT professional expertise. The first four domains (technology infrastructure and services, information design and management, process design and management, relationship sourcing and management) were derived from the study conducted with technologically advanced organizations by Morello

(2005). The fifth domain (professional characteristics of IT professionals) was introduced by Wongwuttiwat (2009) and Winley and Wongwuttiwat (2012) to represent personal attributes of IT professionals. The five domains of expertise and their descriptions are described in Table 3.

Table 3: Domains of IT Professional Expertise (Source: Morello, 2005; Wongwuttiwat, 2009)

Domain Number	Domain Name	Description
1	Technology infrastructure & services	This domain represents the historical foundation of the IT profession. Those working in this domain must demonstrate mastery of complexity, operational consistency, and standardization. They must be excellent in their grasp of a technology and its implications and they must be knowledgeable in related technologies and applications.
2	Information design & management	Work in this domain requires a deep understanding of when and how a particular organization needs, uses, manages, analyzes, and distributes information. Here IT professionals work in business areas, core processes, and new business intelligence programs to learn what constitutes the right information.
3	Process design & management	As standardization increases, processes that support standard operations or are automated will move toward the use of outsourcing while those that fuel differentiation, innovation, and competitive advantage will remain within organizations. This domain will attract multifaceted, versatile IT professionals who can visualize and understand process components and established, critical, and strategic processes.
4	Relationship & sourcing management	Skills here are different from the traditional skills of IT professionals. It is the domain of negotiation, alliances, intangibles, persuasion, behaviors, and social networking. It is driven by the need for organizations to work together effectively on growth in external sourcing, shared services, global service expansion, and business value chains. Technical expertise is not essential for this domain and more important are non-technology soft skills related to experience in driving change, arbitrating conflict, overcoming customer skepticism, and communicating.
5	Personal characteristics of IT professionals	Skills in this domain are concerned with the IT professional's personal traits, problem solving skills, ability to work cooperatively in various types of work environments, communication skills, and the scope of the individual's skills and experience.

In relation to the domains of expertise in Table 3, Morello (2005) predicted that over the period 2005 to 2010 there would be an increased demand associated with each domain except for the technology infrastructure and services domain where no increase was expected even though in 2010 this domain would continue to account for the largest proportion of ICT professionals (40 to 50 percent). By 2010, the information design and management domain was expected to account for 15 to 30 percent of ICT professionals; the process design and management domain 20 to 25 percent; and the relationship and sourcing management domain 10 percent. In Thailand, Wongwuttiwat (2009) found partial support for Morello's predictions where over the period 2009 to 2013 both ICT provider and user organizations expected an increased demand in three domains (information design and management, process design and management, and personal characteristics of ICT professionals) but no increase in demand in the relationship and sourcing management domain. Also, ICT user organizations expected an increase in demand in the technology infrastructure and services domain while ICT provider organizations agreed with Morello's prediction of no increase in demand in this domain. Winley and Wongwuttiwat (2012) compared changes in demand experienced over the period 2006 to 2011 by organizations from eight organizational sectors in Thailand. Again there was partial support for Morello's predictions with at least half of the

sectors experiencing an increased demand in three domains (information design and management, process design and management, and personal characteristics of ICT professionals) and no increased demand in the technology infrastructure and services domain. However, none of the sectors experienced an increased demand in the relationship and sourcing management domain. In comparison, the Vietnam study shows that the majority of organizations reported a predicted increased demand in all five domains (Winley and Lau, 2012).

2.2 The Scope of Knowledge, Skills and Experience

The second component of the theoretical framework concerned the depth and scope of recognition of an IT professional's skills, roles and experience. Morello (2005) and Plummer et al. (2005) defined generalists, specialists, and versatilists in terms of characteristics as presented in Table 4.

Table 4: Defining Characteristics of Generalists, Specialists and Versatilists (Source: Morello, 2005)

Specialist	Versatilist	Generalist
Deep skills and a narrow scope of roles and experience	Deep skills and a broad scope of roles and experience	Shallow skills and a broad scope of roles and experience
Skills recognized only within the ICT work domain	Skills recognized in ICT and other work domains	Skills recognized in ICT and other work domains

The defining characteristics of a versatilist and a generalist differ greatly with respect to the depth of their skills. Although the versatilists have a broad scope of roles and experience, the scope is wider for the generalist. Morello (2005) notes that the generalist is often quick to respond with fairly superficial information and because of this their inputs are often not regarded as seriously as those provided by a specialist or a versatilist. On the other hand, like the versatilist, the specialist has deep skills but lacks the breadth of roles, experience and recognition by others apart from their ICT colleagues. In technologically advanced organizations Morello (2005) predicted that by 2010, 60 percent of ICT professionals would assume business-facing roles concerned with information, processes and relationships, and by 2011 70 percent of leading-edge organizations would employ more versatilists while reducing the number of specialists and generalists and these predictions were supported by Plummer et al. (2005). In Thailand, Wongwuttiwat (2009) found an increased demand was predicted for versatilists and specialists by IT user and provider organizations over the period 2009 to 2013 with no change to demand for generalists. Winley and Wongwuttiwat (2012) found an increased demand for versatilists among organizations from each of eight organizational sectors but with no increased demand for specialists or generalists among organizations from most of the sectors. Winley and Lau (2012) found that there is an increased demand for specialists, especially in the technology infrastructure and service domain, for Vietnam.

2. 3 Domain Specific Knowledge and Skills

The third component of the theoretical framework for the study was derived from the descriptions by Morello (2005) of the five domains of expertise in Table 3; the definitions of generalists, specialists and versatilists in Table 4 (Morello, 2005; Plummer et al., 2005); and the previous studies identified in Table 5. These sources were used to identify 147 specific knowledge and skill items classified into categories associated with the five domains as shown in Table 3. Each of the items associated with the five domains is shown Appendix 1.

Table 5: Previous Studies of Knowledge and Skill Items (Source: Winley and Lau, 2012)

Item Category	Reference	Domain					*Number of Items in Each Category*
		1	**2**	**3**	**4**	**5**	
Development Methodologies	McAdams, 2007; Winley et al., 2007	3	0	0	0	0	*3*
Design Skills	Bullen et al., 2007; Glenn and Gordon, 2007	10	4	3	0	0	*17*
Tools and Techniques	Catanio, 2005; Morello, 2005; Westervelt, 2005	2	2	2	0	0	*6*
Architecture	Wongwuttiwat et al., 2008 ; Bullen et al., 2007	2	*0*	0	0	0	*2*
Applications	Glenn and Gordon, 2007; Winley et al., 2007	10	3	0	0	0	*13*
Data Management Systems	Bullen et al., 2007; Aasheim et al., 2006	0	5	0	0	0	*5*
Networks and Communications	Winley et al., 2007; Ekstrom et al., 2006	10	0	0	0	0	*10*
Technologies for Security	Wongwuttiwat et al., 2008 ; Winley et al., 2007	4	0	0	0	0	*4*
Technical Support Services	Wongwuttiwat et al., 2008 ; Bullen et al., 2007	7	0	0	0	0	*7*
The Organization and Its Functions	Bullen et al., 2007; McAdams, 2007	0	4	9	9	0	*22*
Management Activities	Bullen et al., 2007; McAdams, 2007; Srinutapong, 2007	0	0	7	4	0	*11*
Managing Physical Resources	Bullen et al., 2007; Aasheim et al., 2006	0	2	0	9	0	*11*
Managing Finances	Australian Government, 2006; Collett, 2006	0	1	3	4	0	*8*
Personal Traits	Bullen et al., 2007; Glenn and Gordon, 2007	0	0	0	0	7	*7*
Problem Solving Expertise	Wongwuttiwat, 2009; Wongwuttiwat et al., 2008	0	0	0	0	4	*4*
Work Environment	Bullen et al., 2007; Glenn and Gordon, 2007	0	0	0	0	7	*7*
Communication Skills	McAdams, 2007; Srinutapong, 2007; Winley et al., 2007	0	0	0	0	5	*5*
Scope of Skills and Experience	Morello, 2005; Plummer et al., 2005	0	0	0	0	5	*5*
Number of Items in Each Domain		*48*	*21*	*24*	*26*	*28*	*147*

Note: *Domain 1: Technology infrastructure and services, Domain 2: Information design and management, Domain 3: Process design and management, Domain 4: Relationship and sourcing management, and Domain 5: Personal characteristics of it professionals.*

3. RESEARCH DESIGN AND METHODOLOGY

A cross-sectional field study was used to collect data from organizations in Myanmar during the period of September to October 2012. The questionnaire (in English language) has been validated in the studies by Wongwuttiwat (2009), Winley and Wongwuttiwat (2012) and Winley and Lau (2012). Section 1 of the questionnaire (see Appendix 1) addressed characteristics of the respondents and their organizations and changes in demand experienced over the last five years (i.e. period 2007 to 2012) in each of the domains of expertise. In sections 2 and 3 of the questionnaire respondents rated the current importance of each of the 147 skills items associated with the five domains of expertise on 5-point scales with 1 as unimportant and 5 as very important.

Two hundred questionnaires were distributed in Myanmar using business directories as sampling frames. The respondents were initially contacted by telephone to request for participation in the study. Due to its length and detail of the questionnaire, organizations that agreed to participate in the study were followed up with phone interview again to complete the questionnaire. Twenty-nine organizations contacted agree to participate in the survey, representing a response rate of 14.5 percent. Table 6 shows breakdown of the organizations by business sector. The average number of employee in the participating organizations is 379 and the average number of IT employee is 20; 93 percent of respondents are from IT-user organizations and 7 percent of respondents are from IT-provider organizations. From Table 6, it is also observed that 69 percent of respondents are from local organizations and 31 percent are from international organizations.

Table 6: Profile of Respondents by Business Sectors

				Scope of Operation			
Business Sector	Number of Organizations	Percent	Percentage of local organization	Percentage of international organization	Average Number of Employees (NE)	Average Number of IT Professionals (NIT)	NIT/NE (%)
Banking	10	34.5	17.2	17.2	1036	25	2.4
ICT	2	6.9	3.4	3.4	540	50	9.3
Education	7	24.1	20.7	3.4	125	7	5.8
Tourism/ Transport	5	17.2	17.2	0	66	3	4.5
Media/ Advertising	5	17.2	10.3	6.9	128	13	10.0
Total	29	100	68.8%	30.9%			
Average					379	19.6	

Table 7 shows distribution of current position held by respondents and Table 8 shows level of education of respondents. On average, the respondents have five years of experience in their current position and a total of eight years experience in IT positions. It was evident that the respondents were well qualified and hold IT-related position in their organizations to provide valid responses to the issues examined in the study.

Table 7: Characteristics of Current Position of Respondents

Current position	Frequency	Percentage
IS Manager	13	44.8
CIO	5	17.2
IS Project Manager	11	37.9
Total	29	100.0

Table 8: Level of Education of Respondents

Level of Education	Frequency	Percentage
Diploma	1	3.4
Bachelor degree	25	86.2
Master degree	3	10.3
Total	29	100.0

Table 9 shows the expected change in IT budget in the next five years. The results show that 93 percent of respondents have indicated there will be significant increased in IT budget in the next five years. Table 10 shows the expected change in demand of four domains identified by the respondents. The results show majority of the respondents expected significant increase of demands in all domains, especially in the domains of technology infrastructure and services, and information design and management.

Table 9: Expected Change in IT Budget in the Next Five Years

Expected Change in IT Budget	Frequency	Percent
Significant Increase	27	93.1
No Significant Change	2	6.9
Significant Decrease	0	0.0
Total	*29*	*100.0*

Table 10: Change in Demands of Four Domains Expected in the Next Five Years.

Domain	Change in Demand Experienced by Percentage of Organizations		
	Significant Increase	No Significant Change	Significant Decrease
Technology infrastructure and services	93	7	0
Information design and management	76	24	0
Process design and management	59	41	0
Relationship and sourcing management	59	41	0

4. ANALYSIS AND DISCUSSIONS

For each of the 147 skills items the importance rating was calculated as the mean of the ratings assigned by the respondents and, based on the value of the mean, the relative importance of the item among all of the items was determined by its rank position ranging from 1 most important to 147 least important. These ranks were then classified as High (H), Medium (M), or Low (L) according to whether the rank was in the top, middle, or bottom one third of the distribution of the ranks. The mean (importance) rating, rank and type of rank for each item are shown in Appendix 2. T-test shows that all importance ratings (present and future) are statistically significantly different at a level of 0.05.

4.1 Comparison of Present and Future Types of Ranks for Skills in Each Domain

Tables 11, 12, 13, 14 and 15 show the change in ranking form present to future for Domain 1 to 5 respectively. In each table, the skill category is shown in bold followed by the individual skill item in that category. Spearman rank order correlation coefficient between present and future rankings was computed. The result shows that the correlation between present and future rankings is significant at 0.001 level (2-tailed test).

4.1.1 Domain 1: Technology Infrastructure and Services

Skills in this domain represent the historical foundation of the IT profession and those working in this domain must demonstrate mastery of complexity, operational consistency, and standardization (Winley and Lau, 2012). Table 11 shows change in ranking from present to future for this domain. The results show that none of the rankings have changed significantly (i.e. from H to L or from L to H). Skills in this domain show that IT professionals must have an excellent grasp of a technology and its implications. Many of the skills associated with this domain are required for technical aspects of systems development and support especially involving enterprise wide systems critical for the continuous operation of organizations. Results from Table 11 support this observation. Skills in program and code, design web sites, integrate applications/systems, software testing, microcomputers architecture, transaction processing and web applications are predicted to be important at present and in the future. In addition network and communication skills of local area network (cable and radio/wireless), Internet, email systems, technology for security (networks, operating systems, data/information, websites/applications) and technical support services (hardware, network, databases, computer operations and websites) are also viewed as highly important at present and in the future.

Table 11: Change in Ranking from Present to Future for Domain 1

Present Ranking	Future Ranking		
	High	Medium	Low
High	***Design Skills*** Program and code, Design web sites, Integrate applications/systems ***Tools/Techniques*** Software testing ***Architecture*** Micro computers ***Applications*** Transaction processing (TPS), Web applications ***Networks and Communications*** Local area networks (Cable), Local area networks (Radio/Wireless), Internet, E-mail systems ***Technologies for Security*** Networks, Operational systems, Data/information, Web sites/applications ***Technical Support Services*** Hardware, Networks, Databases, Computer operations, Web sites	***Design Skills*** Understand current/emerging technologies, Determine systems requirements, Design networks	*Nil*
Medium	*Nil*	***Design Skills*** Completely develop applications/systems ***Tools/Techniques*** Network performance tools ***Architecture*** Mobile computers ***Applications*** Customer relationship management (CRM), Multimedia applications ***Networks and Communications*** Extranets, Intranets, Wide area networks (WAN), File server architectures ***Technical Support Services*** End-users	***Development Methodologies*** Object-oriented analysis and design (OOAD), Frameworks for development (e.g. Agile) ***Design Skills*** Select open source applications/systems, Select applications/systems sold by vendors, Tailor purchased applications/systems ***Applications*** Management information (MIS), Decision support (DSS), Enterprise resource planning (ERP), Internal governance applications
Low	*Nil*	***Development Methodologies*** System development life cycle	***Applications*** E-learning applications, External regulation applications ***Networks and Communications*** Cellular or Internet telephony, Wireless and mobile technologies ***Technical Support Services*** Data warehouses/marts

4.1.2 Domain 2: Information Design and Management

Skills in this domain involve a deep understanding of when and how an organization needs, uses, manages, analyzes and distributes information (Winley and Lau, 2012). IT professionals with these skills work in business areas, core processes, business intelligence programs and understand what constitutes the right information. Table 12 shows the change in ranking from present to future for this domain. Skills that are considered to be important at present and in the future relate to database management systems such as relational database and database query language. Database skills that are moderately important at present but predicted to be highly important in the future include design databases, object relational databases and object oriented databases. The results also indicate organizations have expressed a low priority for data warehousing and knowledge management skills. This observation can be explained as

follow. Due to current low usage of operational IT systems, organizations in Myanmar are more concerned with ensuring smooth operations of transactional IT systems and have placed more emphasis on transactional processing applications. Thus there is low importance placed on data warehouse and knowledge management skills such as data mining, multidimensional database and knowledge bases.

Table 12: Change in Ranking from Present to Future for Domain 2

Present Ranking	**Future Ranking**		
	High	Medium	Low
High	***Tools/Techniques*** Database query languages ***Data Management Systems*** Relational databases ***The Organization and Its Function***s Privacy	*Nil*	***Data Management Systems*** Data warehouses/marts
Medium	***Design Skills*** Design databases, Integrate information, Design web aesthetics ***Data Management Systems*** Object relational databases, Object oriented databases ***Managing Finances*** Determine the costs of information requirements	***Design Skills*** Model/design information requirements ***The Organization and Its Functions*** Information requirements	***The Organization and Its Functions*** Knowledge management
Low	*Nil*	***Tools/Technique***s Data modeling ***Application***s Document management systems (DMS) ***Managing Physical Resources*** Databases/data warehouse/mart	***Applications*** Data mining, Knowledge management systems (KMS) ***Data Management Systems*** Multidimensional databases ***The Organization and Its Functions*** Information flows ***Managing Physical Resources*** Knowledge bases

4.1.3 Domain 3: Process Design and Management

The skill that is viewed as important in the present and the future is in the category of managing finances in determining the costs of ICT developments (Winley and Lau, 2012). Table 13 shows change in ranking from present to future for this domain. The results show that none of the rankings have changed significantly. Skills that are viewed as medium to high importance in the future include skills in managing ICT projects such as managing finances of ICT developments, determining the costs of processes, change/risk management and quality assurance. On the other hand, ICT strategic planning, ICT performance indicators and ICT support for internal/external regularly compliance are low in importance. It is also observed that standard operational processes, model/design processes, redesign/re-engineer processes are predicted to be of medium importance in future. Our results show skills that are related to standard operational processes and redesign/reengineer business processes are predicted to be more important in the future although these skills are low in importance at present.

Table 13: Change in Ranking from Present to Future for Domain 3

Present Ranking	Future Ranking		
	High	Medium	Low
High	***Managing Finances*** Determine the costs of ICT developments	*Nil*	*Nil*
Medium	*Nil*	***The Organization and Its Functions*** Standard operational processes, Quality assurance, Change/risk management ***Management Activities*** ICT projects, System recovery procedures ***Management Activities*** Determine the costs of processes	***Management Activities*** ICT innovations
Low	*Nil*	***Design Skills*** Model/design processes, Redesign/re-engineer processes, Participate in R&D projects ***Tools/Techniques*** Computer aided systems engineering (CASE) ***The Organization and Its Functions*** Internal governance regulations ***Management Activities*** Aligning ICT plans with the organization's mission ***Managing Finances*** Help and support functions	***Tools/Techniques*** Process modeling tools ***The Organization and Its Functions*** Regulation by external authorities, Competitive processes, Workflows, Business process outsourcing (BPO), Supply chain management ***Management Activities*** ICT strategic planning, ICT performance indicators, ICT support for internal/external regulatory compliance

4.1.4 Domain 4: Relationship and Sourcing Management

Skills in this domain are different from the traditional technically oriented skills of IT professionals and are driven by the need for organizations to work together effectively on growth in external sourcing, shared services, global service expansion, and business value chains (Winley and Lau, 2012). Table 14 shows change in ranking from present to future for this domain. The results show that none of the rankings have changed significantly. Organizations in Myanmar placed a much higher level of importance on skills related to understanding the organization's relationships with partners and alliances, customer/client base, managing physical resources and managing finance which include preparing and managing ICT budgets. It is worth noting that skills in negotiations with stakeholders, managing telecommunications, recruitment of ICT staff, plan and manage education/training for ICT staff are predicted to increase in importance from low at present to medium importance in the future. Although education/training for ICT staff is predicted to be increased in importance in the future, similar observation is not predicated for education/training for ICT users. Skills that will remain in low importance in the future include activities related to culture, mission, strategic plans, ICT sourcing strategies and business process outsourcing relationships, preparing tenders for external provision of ICT and evaluating bids from ICT providers.

Table 14: Change in Ranking from Present to Future for Domain 4

Present Ranking	Future Ranking		
	High	Medium	Low
High	***The Organization and Its Functions*** Relationships with partners/alliances, Customer/client base ***Managing Physical Resources*** Hardware, Software, Networks ***Managing Finances*** Preparing and managing ICT budgets	*Nil*	*Nil*
Medium	*Nil*	***The Organization and Its Functions*** Structure/internal relationships, Public relations management ***Management Activities*** Relationships with external ICT providers ***Managing Physical Resources*** Assess ICT staff performance ***Managing Finances*** Preparing contracts with ICT providers	***The Organization and Its Functions*** Workplace behavior requirements, Supply/demand analysis/forecasts ***Managing Physical Resources*** Forecast ICT workforce supply/demand
Low	*Nil*	***Management Activities*** Negotiations with stakeholders ***Managing Physical Resources*** Telecommunications, Recruit ICT staff, Plan and manage education/training for ICT staff	***The Organization and Its Functions*** Culture, Mission, Strategic plans ***Management Activities*** ICT sourcing strategies, Business processing outsourcing relationships ***Managing Physical Resources*** Plan and manage education/training for ICT users ***Managing Finances*** Preparing tenders for external provision of ICT, Evaluating bids from ICT providers

4.1.5 Domain 5: Personal Characteristics of IT Professionals

Organizations are placing a much higher importance on attributes related to personal traits such as organizational awareness, professional and ethical behavior, managing conflict, form good relationships and problem solving expertise that deal with complexity (Winley and Lau, 2012). Table 15 shows the change in ranking from present to future for this domain. The results show that none of the rankings have changed significantly. Skills that are predicted to be high in importance at present and in the future include organizational awareness, professional and ethical behavior, service oriented, manage conflict, develop others and form good relationships. Communications skills that are rated as important include reading and speaking. Skills that are recognized only within ICT work domain, deep skills and a narrow scope of roles and experience are predicted to be of high importance in the future too. Skills that are of low importance at present and in the future include working in virtual, multi-disciplinary, cross-functional and cross-cultural teams, as well as be fluent in more than one language in the communication skill category.

Table 15: Change in Ranking from Present to Future for Domain 5

Present Ranking	Future Ranking		
	High	Medium	Low
High	***Personal Traits*** Organizational awareness, Professional and ethical behavior, Service oriented, Develops others, Manage conflict, Form good relationships ***Problem Solving Expertise*** Deal with complexity ***Work Environment*** With customers/clients ***Communication Skills*** Reading, Speaking ***Scope of Skills and Experience*** Skills recognized only within the ICT work domain	***Personal Traits*** Innovative ***Scope of Skills and Experience*** Shallow skills and a broad scope of roles and experience	*Nil*
Medium	***Scope of Skills and Experience*** Deep skills and a narrow scope of roles and experience	***Problem Solving Expertise*** Deal with ambiguity, Deal with intangibles, Understand the organizational/social implications of ICT ***Work Environment*** With vendors/suppliers, On multiple tasks ***Communication Skills*** Listening ***Scope of Skills and Experience*** Deep skills and a broad scope of roles and experience, Skills recognized in ICT and other work domains	***Communication Skills*** Writing
Low	*Nil*	*Nil*	***Work Environment*** In virtual teams, In multi-disciplinary teams, In cross-functional teams, In cross-cultural environments ***Communication Skills*** Fluency in more than 1 language

4.2 Importance of Specialists, Versatilists and Generalists

Table 16 is derived from the scope of skills and experience items. The results show relative importance of the items that characterize specialists, versatilists and generalists. The results show that there is an increased demand for specialists in the ICT domain in Myanmar. This result is consistent with results reported by Winley and Lau (2012) for Vietnam in which there was a moderate to high demand for specialists. The ICT Development Index from Table 1 shows that Myanmar was ranked 131 and the skill sub-index was 111 among 155 countries surveyed. As Myanmar emerges from decades of isolation and broadening its economic reforms (The Asian Development Bank, 2012a), organizations need more specialists with deep skills in the ICT domains to help in improving productivity and delivering better services. The Asian Development Bank (2012b) identified inadequate telecommunications infrastructure as one of the major constraints faced by Myanmar in transitioning to economic reform. It is worth noting that Myanmar is under-developed even in comparison with other less developed ASEAN countries. Current lack of ICT infrastructure in Myanmar will need to be developed to ensure adequate network infrastructure to support an emerging economy. Thus as market reform progresses and more international investment occurs, demand for specialist ICT knowledge and skills are expected to be in stronger demand. It is worth pointing out

generalists who have shallow skills and a broad scope of roles and experience are predicted to be less important in the future.

Table 16: The Relative Importance of Characteristics of Specialists, Versatilists and Generalists

	Present	Future
Specialists		
Deep skills and a narrow scope of roles and experience	M	H
Skills recognized only within the ICT work domain	H	H
Versatilist		
Deep skills and a broad scope of roles and experience	M	M
Skills recognized in ICT and other work domains	M	M
Generalist		
Shallow skills and a broad scope of roles and experience	H	M
Skills recognized in ICT and other work domains	M	M

Legend: H, M, and L indicate that item was ranked with high, medium, or low relative importance, respectively.

4.3 Sourcing Strategies for Technology Infrastructure and Services Skills

The study also investigates sourcing strategies (in-house or outsource) used by the organization at present and in the future. T-test is used to identify skills where the measure for sourcing was significantly different from 3 ($p < 0.05$) which represented using a *mixed-sourcing* strategy involving both outsourced and in-house skills. For the skills with a measure for sourcing which was significantly less than 3 the strategy is mainly to use in-house skills while for those where the measure for sourcing is significantly greater than 3 the strategy is to outsource the provision of the skills. If the measure is not significantly different from 3 then the strategy involves a mixed-sourcing approach. Table 17 shows the present and future sourcing strategies and Table 18 shows the twenty-eight skills in which the main strategy identified as using a mixed-sourcing approach at present and in the future.

Table 17: The Present and Future Sourcing Strategies re

Present Strategy	**Future Strategy**		
	In-House	Mixed-Sourcing	Outsourced
In-House	***Design Skills*** Design networks ***Architecture*** Micro computers Mobile computers ***Applications*** External regulation applications ***Networks and Communications*** Local area networks (Cable), Local area networks (Radio/Wireless), Internet ***Technologies for Security*** Networks, Operational systems ***Technical Support Services*** Hardware, Networks, Computer operations, End-users	***Tools/Techniques*** Network performance tools ***Applications*** Internal governance applications ***Networks and Communications*** Intranets ***Technologies for Security*** Data/information ***Technical Support Services*** Databases	*Nil*
Mixed-Sourcing	*Nil*	See Table 18	***Design Skills*** Select applications/systems sold by vendors, Tailor purchased applications/systems
Outsourced	*Nil*	*Nil*	*Nil*

From Table 17 it can be observed that a large proportion of skills in the category of using in-house strategy are also skills that have been categorized as highly important in the future, in particular for skills in the area of design networks, networks and communications, technologies for security and technical support services. On the other hand it can be observed

that skills that are using a mixed-sourcing strategy include skills that are of high as well as low importance. Pearlson and Saunders (2010) explain that organization chooses outsourcing strategy when it wants to focus on its core activities and organization also selects outsourcing option when the outsourcing providers are able to provide greater capacity in terms of skills and expertise that are not available within the organizations. Our results show that organizations in Myanmar may need to rely on mixed-sourcing strategy to support an increased demand of specialist skills. At the same time, outsourcing decision is made for skills that are considered to be of low importance to allow the organizations to focus on core IT activities. It is worth noting that organizations do not employ pure outsourcing strategy at present as well as in the future.

Table 18: Skills Where the Main Strategy is to Use Mixed-Sourcing at Present and in the Future

	Skills
Development Methodologies	System development life cycle, Object-oriented analysis and design (OOAD), Frameworks for development (e.g. Agile)
Design Skills	Understand current/emerging technologies, Determine systems requirements, Program and code, Design web sites, Integrate applications/systems, Select open source applications/systems, Completely develop applications/systems
Tools/Techniques	Software testing
Applications	Transaction processing (TPS), Management information (MIS), Decision support (DSS), Enterprise resource planning (ERP), Customer relationship management (CRM), Multimedia applications, Web applications, E-learning applications
Networks and Communications	Extranets, Wide area networks (WAN), Cellular or Internet telephony, Wireless and mobile technologies, File server architectures, E-mail systems
Technologies for Security	Web sites/applications
Technical Support Services	Data warehouses/marts, Web sites

5. CONCLUSION

This study extends prior studies conducted by the authors (Winley and Lau, 2012; Winley and Wongwuttiwat, 2012) and uses a theoretical framework to provide a valid means of analyzing the nature and structure of the IT profession at organizational level. Results from the study show that significant increase in IT budget is expected in Myanmar and there are strong predicted demands for skills in the domains of technology infrastructure and services, and information design and management; in particular for skills that are of specialists in nature such as technical specialist skills necessary for systems development and implementation, database management systems as well as networks and communications. The results also indicate there will be an increased in demand for skills relating to managing finance and projects such as determining costs of ICT developments, preparing and managing ICT budget.

Myanmar can be considered as a factor-driven economy country as it has abundance natural resources and a large youth population providing low-cost labor force (The Asian Development Bank, 2012b). Country in the factor-driven economy competes based on unskilled labor and abundance natural resources and its economic development is primarily driven by basic requirements (Sala-i-Martin et al., 2011; Porter et al., 2002). Organizations in factor-driven economy country produce relatively simple products that utilize standardized technology. Porter et al. (2002) further explained that organizations in factor-driven economy have limited role in value chain and are focused on assembly or labor intensive manufacturing activities. The challenge for the organizations is to get basic business and production systems working properly. Our results which show skills that underline transactions processing information systems are predicted to be important at present and in

the future reflect the expected IT demand in factor-driven economy. The results also show that skills that involved systems development methodologies (such as system development life cycle and object-oriented analysis and design), design skills (such as determine system requirement, program and code, integrate applications/systems), applications (such as transaction processing, enterprise resource planning, web applications) are relying on mixed-sourcing strategy to meet the demand at present and in the future. On the other hand networks and communication skills (local area networks) and technologies for security and technical support services are using in-house strategy. The Asian Development Bank (2012b) reported that Myanmar is currently constrained by lack of infrastructure especially in the telecommunication sector, thus in-house strategy is used by organizations to meet the increased demand in networks and communications.

On the other hand skills that focus on inter-organizational processes such as supply chain management, data warehouse, knowledge management and strategic planning skills were identified as low in importance in the future ranking. These observations can be explained by firms in the factor-driven economy do not have direct access to consumers (Porter et al., 2002), therefore technology that facilitates inter-organizational processes such as supply chain management and business analytics such as data warehouse/mart, multidimensional database, decision support systems are viewed as not important by the organizations. In addition tasks related to business analytics require skilled workforce that has training, experience and capability to use the analytics tools (Pearlson and Saunders, 2010). This category of skills may not be currently available in Myanmar.

In the area of personal characteristics, professionals who are able to deal with complexity, customers and clients will be in increased demand in the future. There will also be increased demands for IT specialists who have specialized and narrow scope of skills. It is worth noting that professional and ethical behaviors, be able to form good relationship and be organizational aware are predicted to be of increased importance in the future. The results from this study are similar to results reported in prior study conducted in Vietnam which also shows an increased demand of specialist skills (Winley and Lau, 2012). In addition skill relating to e-learning applications is predicted to be relatively low in importance. This observation is comparable to that reported by Winley and Lau (2012), Winley and Wongwuttiwat (2012) and Wongwuttiwat (2009) where organizations in Thailand and Vietnam also indicated preference to provide staff education and training by traditional face-to-face methods. The current low access of ICT infrastructure in Myanmar may have also prohibited deployment of virtual teams and e-learning applications.

In a recent report by Oxford Business Group, it has been reported that there are major concerns on shortage of ICT professionals in Myanmar (Oxford Business Group, 2013). Basu (2013) reports that a review of ICT capacity in academic institutions is expected to take place in the near future in Myanmar to ensure skilled human resources in the ICT domains are able to meet capacity development in all aspects of ICT development. Results from this study can contribute to planning of ICT professionals in Myanmar.

This study is limited by the small sized sample of organizations from Myanmar. It is recommended that the study be repeated in future with larger size samples and to investigate prediction of skills demand as Myanmar makes progress in economic and market reform.

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APPENDIX 1: QUESTIONNAIRE

Section 1: Information about Respondents and Organizations

Please provide the following information about yourself and your organization.

1. Current position: □ IS/IT Manager □ CIO (or equivalent) □ IS/IT Strategist □ IS/IT Project Manager □ Other (please specify):_____

2. Number of years of experience in current position: _____ years?

3. Total number of years of experience in IS/IT positions: _____ years?

4. Highest level of education: □ Secondary school (or equivalent) □ Diploma □ Bachelor degree □ Master degree □ Doctoral degree

5. Is your organization mainly an "IS User organization" (where the core activity **is not** the development or provision of IS products or services for the market) or is it mainly an "IS Provider organization" (where the core activity **is** the development or provision of IS products or services for the market)? □ IS User □ IS Provider

6. Which sector best describes your organization? □ Government □ Banking/Finance □ Information and Communication Technology

□ Manufacturing/Engineering □ Wholesale/Retail □ Education □ Health □ Tourism/Transport □ Other (please specify): _____

7. Does your organization operate: □ Only within one nation □ Internationally ?

8. Please indicate for your organization the: Total number of employees :_____ Total number of IS/IT staff: _____

9. What do you expect for the IS/IT budget in your organization over the next 5 years?

□ Significant increase □ No significant change □ Significant decrease

10. What is your expectation about changes in demand over the next 5 years for IS/IT staff in your organization working in each of the following 4 domains of expertise?

Domain of Expertise	Significant Increase	No Significant Change	Significant Decrease
Technology infrastructure and services			
Information design and management			
Process design and management			
Relationship and sourcing management			

Section 2: Expertise in Technology Infrastructure and Services

For each item listed below please indicate (✓):

1. *The **importance** of the item for your organization at present and in the future (i.e. within 5 years) where **1** means **"unimportant"** and **5** means **"very important"**.*
2. *The **sourcing strategy** used by your organization at present and in the future where **1** means **provided completely "in-house"** and **5** means **completely "outsourced"**.*
3. *If an item is **"unimportant (1)"** for your organization then there is no need to answer the question about the sourcing strategy.*

Expertise in Technology Infrastructure and Services	Importance										Sourcing Strategy									
	Present					Future					Present					Future				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Development Methodologies																				
System development life cycle																				
Object-oriented analysis and design (OOAD)																				
Frameworks for development (e.g. Agile)																				
Design Skills																				
Understand current/emerging technologies																				
Determine systems requirements																				
Program and code																				
Design networks																				
Design web sites																				
Integrate applications/systems																				
Select open source applications/systems																				
Select applications/systems sold by vendors																				
Tailor purchased applications/systems																				
Completely develop applications/systems																				
Tools/Techniques																				
Software testing																				
Network performance tools																				
Architecture																				
Micro computers																				
Mobile computers																				
Applications																				
Transaction processing (TPS)																				
Management information (MIS)																				
Decision support (DSS)																				
Enterprise resource planning (ERP)																				
Customer relationship management (CRM)																				
Multimedia applications																				
Web applications																				
E-learning applications																				
Internal governance applications																				
External regulation applications																				
Networks and Communications																				
Local area networks (Cable)																				
Local area networks (Radio/Wireless)																				
Internet																				
Extranets																				
Intranets																				
Wide area networks (WAN)																				
Cellular or Internet telephony																				
Wireless and mobile technologies																				
File server architectures																				
E-mail systems																				
Technologies for Security																				
Networks																				
Operational systems																				
Data/information																				

Expertise in Technology Infrastructure and Services	Importance										Sourcing Strategy									
	Present					Future					Present					Future				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Web sites/applications																				
Technical Support Services																				
Hardware																				
Networks																				
Databases																				
Data warehouses/marts																				
Computer operations																				
End-users																				
Web sites																				

Section 3: Other Areas of IS Professional Expertise

*For each item listed below please indicate (✓) the importance of the item for your organization at present and in the future (i.e. within 5 years) where **1 means "unimportant"** and **5 means "very important"**.*

Expertise in Information Design and Management	Importance									
	Present					Future				
Design Skills	1	2	3	4	5	1	2	3	4	5
Model/design information requirements										
Design databases										
Integrate information										
Design web aesthetics										
Tools/Techniques										
Data modeling										
Database query languages										
Applications										
Data mining										
Knowledge management systems (KMS)										
Document management systems (DMS)										
Data Management Systems										
Relational databases										
Object relational databases										
Object oriented databases										
Multidimensional databases										
Data warehouses/marts										
The Organization and Its Functions										
Information requirements										
Information flows										
Knowledge management										
Privacy										
Managing Physical Resources										
Databases data warehouse/mart										
Knowledge bases										
Managing Finances										
Determine the costs of information requirements										
Expertise in Process Design and Management										
Design Skills										
Model/design processes										
Redesign/re-engineer processes										
Participate in R&D projects										
Tools/Techniques										

Computer aided systems engineering (CASE)										
Process modeling tools										
The organization and Its Functions										
Internal governance regulations										
Regulations by external authorities										
Standard operational processes										
Competitive processes										
Workflows										
Business process outsourcing (BPO)										
Quality assurance										
Supply chain management										
Change/risk management										
Management activities										
ICT strategic planning										
Aligning ICT plans with organization's mission										
ICT performance indicators										
ICT support for internal/external regulatory compliance										
ICT innovations										
ICT projects										
System recovery procedures										
Help and support functions										
Managing Finances										
Determine the costs of ICT developments										
Determine the costs of processes										
Expertise in Relationship and Sourcing Management										
The organization and Its Functions										
Culture										
Structure/internal relationships										
Mission										
Strategic plans										
Relationships with partners/alliances										
Workplace behavior requirements										
Customer/client base										
Supply/demand analysis/forecasts										
Public relations management										
Management Activities										
ICT sourcing strategies										
Negotiations with stakeholders										
Relationships with external ICT providers										
Business processing outsourcing relationships										
Managing Physical Resources										
Hardware										
Software										
Networks										
Telecommunications										
Forecast ICT workforce supply/demand										
Recruit ICT staff										
Assess ICT staff performance										
Plan and manage education/training for ICT staff										
Plan and manage education/training for ICT users										
Managing Finances										
Preparing tenders for external provision of ICT										
Evaluating bids from ICT providers										

Preparing contracts with ICT providers										
Preparing and managing ICT budgets										
Personal Characteristics of IS Professionals										
Personal Traits										
Organizational awareness										
Professional and ethical behavior										
Service oriented										
Develops others										
Innovative										
Manage conflict										
Form good relationships										
Problem Solving Expertise										
Deal with ambiguity										
Deal with complexity										
Deal with intangibles										
Understand the organizational/social implications of ICT										
Work Environment										
In virtual teams										
In multi-disciplinary teams										
In cross-functional teams										
In cross-cultural environments										
With vendors/suppliers										
With customers/clients										
On multiple tasks										
Communication Skills										
Reading										
Writing										
Listening										
Speaking										
Fluency in more than 1 language										
Scope of Skills and Experience										
A deep but narrow set of skills										
A shallow but broad set of skills										
Deep skills and a broad scope of roles and experience										
Skills that are recognized only within the ICT work domain										
Skills that are recognized in ICT and other work domains										

APPENDIX 2: DESCRIPTIVE STATISTICS FOR THE RATINGS OF SKILLS

Skills	Present				Future			
	Importance Rating	Std. Dev.	Skewness	Kurtosis	Importance Rating	Std. Dev.	Skewness	Kurtosis
System development life cycle	2.28	1.192	.509	.307	3.31	1.004	-.005	-.097
Object-oriented analysis and design (OOAD)	2.34	1.111	.757	.475	3.10	.900	.101	.474
Frameworks for development (e.g. Agile)	2.41	1.268	.715	-.272	3.00	1.000	.460	.013
Understand current/emerging technologies	2.97	1.267	-.157	-.956	3.59	.907	.033	-.698
Determine systems requirements	2.93	1.252	-.096	-.872	3.52	.986	-.531	.235
Program and code	3.28	1.509	-.373	-1.291	3.76	1.215	-.785	-.076
Design networks	3.17	1.365	-.153	-1.172	3.59	1.053	-.441	-.142
Design web sites	3.14	1.217	-.282	-.996	4.07	.884	-.474	-.756
Integrate applications/systems	3.21	1.292	-.200	-1.108	4.17	.966	-.879	-.274
Select open source applications/systems	2.45	1.183	.828	.281	3.10	1.012	.446	.113
Select applications/systems sold by vendors	2.66	1.203	.201	-.749	3.10	1.205	-.080	-.754
Tailor purchased applications/systems	2.48	1.184	.460	-.396	3.00	1.309	-.103	-1.001
Completely develop applications/systems	2.83	1.136	.048	-.592	3.34	1.111	-.250	-.175
Software testing	3.17	1.227	-.352	-.553	3.83	.966	-.907	1.302
Network performance tools	2.69	1.168	.516	-.278	3.28	.922	.279	.859
Micro computers	3.38	1.015	-.859	.449	4.07	.530	.094	.958
Mobile computers	2.41	.825	-.115	-.441	3.24	.739	.143	-.079
Transaction processing (TPS)	2.97	1.267	.069	-.927	3.72	1.032	-.655	.307
Management information (MIS)	2.59	1.296	.642	-.478	3.10	1.113	.284	-.797
Decision support (DSS)	2.52	1.299	.800	-.325	3.10	1.047	.383	-.245
Enterprise resource planning (ERP)	2.38	1.265	.576	-.664	2.86	1.274	.053	-1.025
Customer relationship management (CRM)	2.52	1.184	.788	.061	3.14	1.060	.287	-.421
Multimedia applications	2.69	1.365	.248	-1.250	3.41	1.119	.067	-1.340
Web applications	3.24	1.354	-.287	-1.072	4.21	.819	-.832	.296
E-learning applications	2.28	1.461	1.031	-.303	2.79	1.264	.304	-.653
Internal governance applications	2.41	1.211	.670	-.390	3.10	1.175	.495	-.758
External regulation applications	1.79	.819	.832	.296	2.41	.780	.065	-.202
Local area networks (Cable)	3.86	1.356	-1.026	-.081	4.34	.857	-1.125	.460
Local area networks (Radio/Wireless)	2.86	1.302	.273	-1.081	3.86	1.060	-.674	.189
Internet	3.79	1.146	-.942	.603	4.52	.738	-1.783	3.681
Extranets	2.52	1.271	.127	-1.311	3.59	1.119	-.561	.192
Intranets	2.76	1.573	.311	-1.406	3.52	1.243	-.402	-.731
Wide area networks (WAN)	2.52	1.430	.475	-1.018	3.55	1.213	-.710	.027
Cellular or Internet telephony	1.59	.946	2.048	4.962	2.48	1.122	1.024	.739
Wireless and mobile	1.93	1.307	1.063	-.386	2.72	1.192	.714	-.228

Skills	Present				Future			
	Importance Rating	Std. Dev.	Skewness	Kurtosis	Importance Rating	Std. Dev.	Skewness	Kurtosis
technologies								
File server architectures	2.48	.949	.456	.542	3.48	.871	-.466	1.281
E-mail systems	2.90	1.235	.332	-.856	3.66	1.010	-.569	.317
Networks	3.14	1.217	-.154	-.821	3.86	.915	-.011	-1.256
Operational systems	3.69	1.072	-.813	.920	4.17	.759	-.306	-1.151
Data/information	3.24	1.123	-.189	-.476	4.14	.833	-.273	-1.511
Web sites/applications	3.17	1.256	-.465	-.899	4.17	.805	-.775	.341
Hardware	3.59	1.150	-.453	-.078	4.03	.865	-.424	-.679
Networks	3.45	1.183	-.563	.000	4.07	.753	-.116	-1.157
Databases	3.21	1.264	-.191	-.947	3.93	.961	-1.151	1.937
Data warehouses/marts	2.17	1.197	.717	-.514	3.03	1.239	-.070	-.734
Computer operations	3.72	1.131	-.843	.507	4.24	.689	-.357	-.767
End-users	2.79	1.398	.144	-1.240	3.28	1.066	-.029	-.593
Web sites	3.10	1.291	-.312	-.815	4.14	.915	-.890	.128
Model/design information requirements	2.48	1.243	.042	-.754	3.62	1.015	-.023	-1.071
Design databases	2.62	1.374	-.049	-1.040	3.86	1.060	-.287	-1.263
Integrate information	2.69	1.391	.090	-.690	3.76	.872	-.183	-.569
Design web aesthetics	2.48	1.271	.097	-.891	3.79	.940	-.110	-.994
Data modeling	2.31	1.168	.206	-.307	3.31	1.004	.223	-.945
Database query languages	3.00	1.604	-.167	-1.342	3.90	.939	-.616	-.282
Data mining	2.07	1.193	.672	-.060	3.03	1.052	.125	-.084
Knowledge management systems (KMS)	2.07	1.067	.613	.811	2.83	.889	.033	.575
Document management systems (DMS)	2.31	1.198	.417	-.339	3.14	.915	.011	.259
Relational databases	2.90	1.780	.085	-1.689	4.00	1.165	-1.019	.158
Object relational databases	2.59	1.376	-.149	-1.303	3.69	.850	-.083	-.511
Object oriented databases	2.66	1.587	.098	-1.501	3.93	1.033	-.481	-.964
Multidimensional databases	1.52	.871	1.163	1.217	2.28	.996	.325	-.840
Data warehouses/marts	2.97	5.871	5.118	26.984	3.10	1.012	-.220	-.078
Information requirements	2.48	1.299	.356	-.254	3.45	1.021	.042	-1.043
Information flows	2.24	1.091	.369	.378	3.00	.886	.330	-.913
Knowledge management	2.34	1.111	.254	.150	3.00	1.000	.460	.013
Privacy	3.07	1.462	-.275	-.867	4.00	.802	.000	-1.423
Databases data warehouse/mart	2.07	1.132	.650	.324	3.41	1.086	-.211	-.587
Knowledge bases	2.10	1.113	.451	.169	2.90	.976	.466	-.137
Determine the costs of information requirements	2.83	1.365	-.028	-.665	3.93	.961	-.373	-.918
Model/design processes	2.21	1.236	.309	-1.141	3.38	1.147	.089	-.810
Redesign/re-engineer processes	2.31	1.339	.438	-.684	3.52	1.122	-.372	-.649
Participate in R&D projects	2.17	1.284	.743	-.050	3.24	1.023	.121	-.224
Computer aided systems engineering (CASE)	2.07	1.132	1.127	1.809	3.14	1.026	.346	-.099
Process modeling tools	2.00	1.069	.754	.987	2.66	.857	.759	.766
Internal governance regulations	2.28	1.334	.812	-.023	3.21	1.146	.330	-.736
Regulation by external authorities	1.79	1.114	1.271	1.617	2.52	1.184	.927	.052
Standard operational processes	2.69	1.228	-.225	-.177	3.55	.910	.447	-.790
Competitive processes	2.21	1.292	.546	-.327	3.03	1.085	.288	-.814
Workflows	2.24	1.215	.785	.412	2.90	.976	.961	.105

Skills	Present				Future			
	Importance Rating	Std. Dev.	Skewness	Kurtosis	Importance Rating	Std. Dev.	Skewness	Kurtosis
Business process outsourcing (BPO)	1.69	.850	.293	-.897	2.24	.739	.143	-.079
Quality assurance	2.41	1.268	.264	-.414	3.14	.953	.770	-.056
Supply chain management	2.00	1.195	.809	.120	2.66	1.010	.996	.229
Change/risk management	2.34	1.317	.715	-.079	3.28	1.099	.446	-1.060
ICT strategic planning	2.17	1.284	.961	.598	2.97	1.017	.510	-.094
Aligning ICT plans with the organization's mission	2.24	1.300	.774	.209	3.14	1.187	.266	-1.096
ICT performance indicators	2.10	1.235	1.013	.680	2.83	1.136	.676	-.153
ICT support for internal/external regulatory compliance	2.24	1.300	.879	.305	3.00	1.134	.631	-.459
ICT innovations	2.41	1.427	.543	-.593	3.03	1.117	.258	-.357
ICT projects	2.66	1.317	.091	-.518	3.41	1.086	-.211	.176
System recovery procedures	2.66	1.289	-.047	-.649	3.48	1.090	.136	-1.244
Help and support functions	2.24	1.154	.837	.973	3.14	1.026	.560	-.712
Determine the costs of ICT developments	2.86	1.329	-.024	-.519	3.93	.799	.128	-1.397
Determine the costs of processes	2.83	1.338	.049	-.587	3.83	.805	.333	-1.361
Culture	1.52	.986	1.867	4.531	2.03	.944	1.295	2.490
Structure/internal relationships	2.41	1.086	.507	1.202	3.21	.819	.846	.704
Mission	2.14	1.156	.903	1.144	2.76	1.057	.522	-.325
Strategic plans	2.28	1.222	.438	-.454	2.86	1.060	.100	-1.031
Relationships with partners/alliances	3.07	1.163	-.582	.898	3.83	.889	.033	-1.124
Workplace behavior requirements	2.55	.985	-.395	.288	2.93	.799	.580	.088
Customer/client base	3.28	1.251	-.683	.635	4.03	.823	-.066	-1.518
Supply/demand analysis/forecasts	2.41	1.240	.695	.356	3.03	1.085	.288	-.814
Public relations management	2.66	1.078	.026	1.023	3.38	.862	.581	-.176
ICT sourcing strategies	1.97	1.180	.912	.400	2.90	1.291	.526	-.736
Negotiations with stakeholders	2.31	.967	-.435	-.201	3.24	.872	-.511	.316
Relationships with external ICT providers	2.52	.986	-.531	.235	3.55	.870	-.345	-.432
Business processing outsourcing relationships	1.83	.848	-.027	-.862	2.66	.936	.495	.143
Hardware	3.03	1.375	-.331	-.435	3.83	.805	.333	-1.361
Software	3.14	1.432	-.416	-.606	4.17	.759	-.306	-1.151
Networks	2.97	1.322	-.331	-.255	3.90	.900	-.101	-1.143
Telecommunications	2.21	1.114	.892	1.486	3.24	.988	.431	-.703
Forecast ICT workforce supply/demand	2.34	1.261	.549	-.200	3.03	1.180	.490	-.886
Recruit ICT staff	2.31	1.228	.598	.088	3.17	1.037	.249	-1.188
Assess ICT staff performance	2.59	1.350	.271	-.692	3.34	1.045	.243	-1.051
Plan and manage education/training for ICT staff	2.28	1.192	.644	.424	3.41	1.053	.244	-1.081
Plan and manage education/training for ICT users	2.17	1.197	.851	.689	2.90	1.113	.384	-.511

Skills	Present				Future			
	Importance Rating	Std. Dev.	Skewness	Kurtosis	Importance Rating	Std. Dev.	Skewness	Kurtosis
Preparing tenders for external provision of ICT	1.97	.823	-.347	-.440	2.69	.761	-.439	.230
Evaluating bids from ICT providers	2.21	.978	-.446	-.730	2.76	.872	-.183	-.569
Preparing contracts with ICT providers	2.72	1.066	-.351	.601	3.52	.785	-.299	-.194
Preparing and managing ICT budgets	2.97	1.085	-.828	1.023	3.76	.830	.093	-.792
Organizational awareness	3.03	1.375	-.066	-.614	3.76	.951	.256	-1.422
Professional and ethical behavior	3.00	1.195	-.404	.380	3.79	.861	.429	-1.537
Service oriented	3.55	1.242	-1.329	1.729	4.28	.702	-1.112	2.595
Develops others	3.10	1.291	-.312	-.051	3.72	.960	-.176	-.868
Innovative	2.97	1.210	-.320	.179	3.52	1.056	.147	-1.166
Manage conflict	3.24	1.300	-.588	.074	3.83	.966	-.142	-1.115
Form good relationships	3.76	1.300	-1.403	1.902	4.31	.660	-.431	-.628
Deal with ambiguity	2.48	1.153	.720	1.021	3.45	.783	.902	.047
Deal with complexity	3.17	1.227	-.726	.393	4.14	.875	-.627	-.515
Deal with intangibles	2.45	1.152	.812	1.143	3.24	.830	.711	.363
Understand the organizational/social implications of ICT	2.66	1.203	.201	.264	3.28	1.099	.273	-1.223
In virtual teams	1.45	.827	1.395	2.292	1.90	.772	.684	.552
In multi-disciplinary teams	1.52	.829	1.153	1.767	2.03	.823	.347	-.440
In cross-functional teams	1.83	.805	.333	1.171	2.59	.780	-.065	-.202
In cross-cultural environments	1.38	.775	1.669	3.895	1.83	.805	.775	.341
With vendors/suppliers	2.83	.966	-1.162	1.702	3.55	.686	.158	-.085
With customers/clients	3.59	1.181	-1.619	2.845	4.14	.581	.003	.110
On multiple tasks	2.69	1.168	.083	.047	3.52	.911	.554	-.715
Reading	3.21	1.207	-.820	.714	3.97	.778	.062	-1.303
Writing	2.38	.979	.118	.259	3.07	1.067	.613	-.830
Listening	2.72	1.192	.171	.243	3.38	1.147	.089	-1.424
Speaking	3.17	1.071	-1.303	2.161	3.97	.865	-.286	-.810
Fluency in more than 1 language	1.76	1.244	1.212	.506	2.28	1.533	.713	-1.042
Deep skills and a narrow scope of roles and experience	2.83	1.197	-.181	.359	3.76	1.057	-.452	-.076
Shallow skills and a broad scope of roles and experience	2.86	1.187	-.679	-.515	3.62	.862	-.222	-.408
Deep skills and a broad scope of roles and experience	2.72	1.306	.347	-.399	3.55	1.021	-.042	-1.043
Skills recognized only within the ICT work domain	2.97	1.085	-.648	1.433	3.69	.806	-.233	-.183
Skills recognized in ICT and other work domains	2.72	1.251	.213	-.278	3.55	1.088	.126	-1.288

T-tests showed that all of the importance ratings (present and future) are statistically significantly different from 1 *unimportant* and 5 *very important* at a level of 0.05.

APPENDIX 3: RANKINGS AND TYPES OF RANKINGS FOR SKILLS

Domains and Items	Present			Future		
	Importance Rating	Rank	Type of Rank	Importance Rating	Rank	Type of Rank
Domain 1: Technology Infrastructure and Services						
Development Methodologies						
System development life cycle	2.28	108.0	L	3.31	80.5	M
Object-oriented analysis and design (OOAD)	2.34	98.5	M	3.10	103.0	L
Frameworks for development (e.g. Agile)	2.41	91.0	M	3.00	116.0	L
Design Skills						
Understand current/emerging technologies	2.97	38.0	H	3.59	53.0	M
Determine systems requirements	2.93	42.0	H	3.52	63.5	M
Program and code	3.28	11.5	H	3.76	42.0	H
Design networks	3.17	21.0	H	3.59	53.0	M
Design web sites	3.14	25.0	H	4.07	16.0	H
Integrate applications/systems	3.21	17.0	H	4.17	8.5	H
Select open source applications/systems	2.45	86.5	M	3.10	103.0	L
Select applications/systems sold by vendors	2.66	66.5	M	3.10	103.0	L
Tailor purchased applications/systems	2.48	82.5	M	3.00	116.0	L
Completely develop applications/systems	2.83	50.0	M	3.34	78.5	M
Tools/Techniques						
Software testing	3.17	21.0	H	3.83	35.0	H
Network performance tools	2.69	61.0	M	3.28	83.5	M
Architecture						
Micro computers	3.38	10.0	H	4.07	16.0	H
Mobile computers	2.41	91.0	M	3.24	88.0	M
Applications						
Transaction processing (TPS)	2.97	38.0	H	3.72	45.5	H
Management information (MIS)	2.59	72.0	M	3.10	103.0	L
Decision support (DSS)	2.52	77.0	M	3.10	103.0	L
Enterprise resource planning (ERP)	2.38	95.5	M	2.86	125.5	L
Customer relationship management (CRM)	2.52	77.0	M	3.14	96.5	M
Multimedia applications	2.69	61.0	M	3.41	72.5	M
Web applications	3.24	14.0	H	4.21	6.0	H
E-learning applications	2.28	108.0	L	2.79	129.0	L
Internal governance applications	2.41	91.0	M	3.10	103.0	L
External regulation applications	1.79	138.5	L	2.41	140.0	L
Networks and Communications						
Local area networks (Cable)	3.86	1.0	H	4.34	2.0	H
Local area networks (Radio/Wireless)	2.86	46.0	H	3.86	31.0	H
Internet	3.79	2.0	H	4.52	1.0	H
Extranets	2.52	77.0	M	3.59	53.0	M
Intranets	2.76	54.0	M	3.52	63.5	M
Wide area networks (WAN)	2.52	77.0	M	3.55	57.5	M
Cellular or Internet telephony	1.59	142.0	L	2.48	139.0	L
Wireless and mobile technologies	1.93	135.0	L	2.72	132.0	L
File server architectures	2.48	82.5	M	3.48	67.5	M
E-mail systems	2.90	43.5	H	3.66	49.0	H
Technologies for Security						
Networks	3.14	25.0	H	3.86	31.0	H
Operational systems	3.69	5.0	H	4.17	8.5	H
Data/information	3.24	14.0	H	4.14	12.5	H
Web sites/applications	3.17	21.0	H	4.17	8.5	H
Technical Support Services						
Hardware	3.59	6.5	H	4.03	18.5	H
Networks	3.45	9.0	H	4.07	16.0	H

Domains and Items	Present			Future		
	Importance Rating	Rank	Type of Rank	Importance Rating	Rank	Type of Rank
Databases	3.21	17.0	H	3.93	25.5	H
Data warehouses/marts	2.17	121.5	L	3.03	110.5	L
Computer operations	3.72	4.0	H	4.24	5.0	H
End-users	2.79	53.0	M	3.28	83.5	M
Web sites	3.10	27.5	H	4.14	12.5	H
Domain 2: Information Design and Management						
Design Skills						
Model/design information requirements	2.48	82.5	M	3.62	50.5	M
Design databases	2.62	70.0	M	3.86	31.0	H
Integrate information	2.69	61.0	M	3.76	42.0	H
Design web aesthetics	2.48	82.5	M	3.79	38.5	H
Tools/Techniques						
Data modeling	2.31	103.0	L	3.31	80.5	M
Database query languages	3.00	33.5	H	3.90	28.5	H
Applications						
Data mining	2.07	128.5	L	3.03	110.5	L
Knowledge management systems (KMS)	2.07	128.5	L	2.83	127.5	L
Document management systems (DMS)	2.31	103.0	L	3.14	96.5	M
Data Management Systems						
Relational databases	2.90	43.5	H	4.00	20.5	H
Object relational databases	2.59	72.0	M	3.69	47.5	H
Object oriented databases	2.66	66.5	M	3.93	25.5	H
Multidimensional databases	1.52	144.0	L	2.28	141.5	L
Data warehouses/marts	2.97	38.0	H	3.10	103.0	L
The Organization and Its Functions						
Information requirements	2.48	82.5	M	3.45	69.5	M
Information flows	2.24	113.0	L	3.00	116.0	L
Knowledge management	2.34	98.5	H	3.00	116.0	L
Privacy	3.07	29.5	H	4.00	20.5	H
Managing Physical Resources						
Databases/data warehouse/mart	2.07	128.5	L	3.41	72.5	M
Knowledge bases	2.10	125.5	L	2.90	122.5	L
Managing Finances						
Determine the costs of information requirements	2.83	50.0	M	3.93	25.5	H
Domain 3: Process Design and Management						
Design Skills						
Model/design processes	2.21	117.5	L	3.38	76.0	M
Redesign/re-engineer processes	2.31	103.0	L	3.52	63.5	M
Participate in R&D projects	2.17	121.5	L	3.24	88.0	M
Tools/Techniques						
Computer aided systems engineering (CASE)	2.07	128.5	L	3.14	96.5	M
Process modeling tools	2.00	131.5	L	2.66	135.0	L
The Organization and Its Functions						
Internal governance regulations	2.28	108.0	L	3.21	91.5	M
Regulation by external authorities	1.79	138.5	L	2.52	138.0	L
Standard operational processes	2.69	61.0	M	3.55	57.5	M
Competitive processes	2.21	117.5	L	3.03	110.5	L
Workflows	2.24	113.0	L	2.90	122.5	L
Business process outsourcing (BPO)	1.69	141.0	L	2.24	143.0	L
Quality assurance	2.41	91.0	M	3.14	96.5	M
Supply chain management	2.00	131.5	L	2.66	135.0	L
Change/risk management	2.34	98.5	M	3.28	83.5	M
Management Activities						
ICT strategic planning	2.17	121.5	L	2.97	119.0	L

Domains and Items	Present			Future		
	Importance Rating	Rank	Type of Rank	Importance Rating	Rank	Type of Rank
Aligning ICT plans with the organization's mission	2.24	113.0	L	3.14	96.5	M
ICT performance indicators	2.10	125.5	L	2.83	127.5	L
ICT support for internal/external regulatory compliance	2.24	113.0	L	3.00	116.0	L
ICT innovations	2.41	91.0	M	3.03	110.5	L
ICT projects	2.66	66.5	M	3.41	72.5	M
System recovery procedures	2.66	66.5	M	3.48	67.5	M
Managing Finances						
Help and support functions	2.24	113.0	L	3.14	96.5	M
Determine the costs of ICT developments	2.86	46.0	H	3.93	25.5	H
Determine the costs of processes	2.83	50.0	M	3.83	35.0	M
Domain 4: Relationship and Sourcing Management						
The Organization and Its Functions						
Culture	1.52	144.0	L	2.03	144.5	L
Structure/internal relationships	2.41	91.0	M	3.21	91.5	M
Mission	2.14	124.0	L	2.76	130.5	L
Strategic plans	2.28	108.0	L	2.86	125.5	L
Relationships with partners/alliances	3.07	29.5	H	3.83	35.0	H
Workplace behavior requirements	2.55	74.0	M	2.93	120.0	L
Customer/client base	3.28	11.5	H	4.03	18.5	H
Supply/demand analysis/forecasts	2.41	91.0	M	3.03	110.5	L
Public relations management	2.66	66.5	M	3.38	76.0	M
Management Activities						
ICT sourcing strategies	1.97	133.5	L	2.90	122.5	L
Negotiations with stakeholders	2.31	103.0	L	3.24	88.0	M
Relationships with external ICT providers	2.52	77.0	M	3.55	57.5	M
Business processing outsourcing relationships	1.83	136.5	L	2.66	135.0	L
Managing Physical Resources						
Hardware	3.03	31.5	H	3.83	35.0	H
Software	3.14	25.0	H	4.17	8.5	H
Networks	2.97	38.0	H	3.90	28.5	H
Telecommunications	2.21	117.5	L	3.24	88.0	M
Forecast ICT workforce supply/demand	2.34	98.5	M	3.03	110.5	L
Recruit ICT staff	2.31	103.0	L	3.17	93.0	M
Assess ICT staff performance	2.59	72.0	M	3.34	78.5	M
Plan and manage education/training for ICT staff	2.28	108.0	L	3.41	72.5	M
Plan and manage education/training for ICT users	2.17	121.5	L	2.90	122.5	L
Managing Finances						
Preparing tenders for external provision of ICT	1.97	133.5	L	2.69	133.0	L
Evaluating bids from ICT providers	2.21	117.5	L	2.76	130.5	L
Preparing contracts with ICT providers	2.72	56.5	M	3.52	63.5	M
Preparing and managing ICT budgets	2.97	38.0	H	3.76	42.0	H
Domain 5: Personal Characteristics of IT Professionals						
Personal Traits						
Organizational awareness	3.03	31.5	H	3.76	42.0	H
Professional and ethical behavior	3.00	33.5	H	3.79	38.5	H
Service oriented	3.55	8.0	H	4.28	4.0	H
Develops others	3.10	27.5	H	3.72	45.5	H
Innovative	2.97	38.0	H	3.52	63.5	M
Manage conflict	3.24	14.0	H	3.83	35.0	H
Form good relationships	3.76	3.0	H	4.31	3.0	H

Domains and Items	Present			Future		
	Importance Rating	Rank	Type of Rank	Importance Rating	Rank	Type of Rank
Problem Solving Expertise						
Deal with ambiguity	2.48	82.5	M	3.45	69.5	M
Deal with complexity	3.17	21.0	H	4.14	12.5	H
Deal with intangibles	2.45	86.5	M	3.24	88.0	M
Understand the organizational/social implications of ICT	2.66	66.5	M	3.28	83.5	M
Work Environment						
In virtual teams	1.45	146.0	L	1.90	146.0	L
In multi-disciplinary teams	1.52	144.0	L	2.03	144.5	L
In cross-functional teams	1.83	136.5	L	2.59	137.0	L
In cross-cultural environments	1.38	147.0	L	1.83	147.0	L
With vendors/suppliers	2.83	50.0	M	3.55	57.5	M
With customers/clients	3.59	6.5	H	4.14	12.5	H
On multiple tasks	2.69	61.0	M	3.52	63.5	M
Communication Skills						
Reading	3.21	17.0	H	3.97	22.5	H
Writing	2.38	95.5	M	3.07	107.0	L
Listening	2.72	56.5	M	3.38	76.0	M
Speaking	3.17	21.0	H	3.97	22.5	H
Fluency in more than 1 language	1.76	140.0	L	2.28	141.5	L
Scope of Skills and Experience						
Deep skills and a narrow scope of roles and experience	2.83	50.0	M	3.76	42.0	H
Shallow skills and a broad scope of roles and experience	2.86	46.0	H	3.62	50.5	M
Deep skills and a broad scope of roles and experience	2.72	56.5	M	3.55	57.5	M
Skills recognized only within the ICT work domain	2.97	38.0	H	3.69	47.5	H
Skills recognized in ICT and other work domains	2.72	56.5	M	3.55	57.5	M

Notes: (a) *Rank 1 is the most important skill and rank 147 is the least important skill;* ***(b)*** *H, M, L represent a high (position 1 - 49), medium (position 50 - 98), and low (position 99 - 147) type of ranking, respectively.*