

IS/IT Skills and Competencies: Confirmatory Study

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Abstract

IS/IT positions have different knowledge, skills, and competencies. There are three categories of skills, knowledge, and competencies required which are technical skills, business skills, and soft skills. This research studied the required skills, knowledge, and competencies for each IS/IT position. Companies in SET are selected and employees in these companies were asked to fill the questionnaire. The expected and current levels of each skill were sought to analyze for the required skills of each position. Paired T-tests were used to find the skills needed to improve for each position. Skills required by IS positions and IT positions are different.

Keywords; *Information System, Information Technology, Technical skills, Business skills, Soft skills*

I. INTRODUCTION

As today there are many job positions in areas of Information Systems and Information Technology, for example, programmers, system analysts, computer engineers, software engineers. People who worked in these positions contribute and help to develop the Information Systems, applications, networks, databases, and other related technologies for supporting business processes, and enhancing or improving performance of organizations. People who occupied these positions have knowledge background from different disciplines but still related. Just like to build a house, there are engineers, carpenters, architects, sementers, painters, etc. All of them have different skills and knowledge, even their expertise are different, but they have related skills, especially they work as a

team. Along with the technical skills and knowledge, there must be other non-technical skills or abilities that are important to support team-working and finishing the job assigned.

Moreover, the technologies changed rapidly and new technologies are developed, all businesses and people must utilize them properly for their future competencies. All employees in IS/IT positions must update their skills and knowledge all the time to catch up with modern technologies. Due to technologies are used to support businesses. Each business or organization is different, as technologies used in each of them are also different. To select the suitable technologies for each organization, business knowledge is needed.

There are differences between Information Systems

(IS) and Information Technology (IT). There are many definitions stated for Information Systems. [16] stated that Information Systems are systems designed to collect, process, store and distribute information, which is created and used in the organization. Information Systems can be composed of computers or sometimes they have not required computers [14]. Even Information Systems composed of computers or not, people are needed at least to process or interpret information [5]. [4] stated that “An information system is a set of people, procedures and resources that collects data which it transforms and disseminates.”. These definitions confirm that IS consists of people and also the business process. Also, [18] stated that IS includes software, hardware, data, people, and procedures. [19] defined Information Systems as a set of interrelated components that collect, manipulate, store, and disseminate data and information and provide a feedback mechanism to meet an objective. While IT together with business processes form and Information systems to meet the information needs of businesses, based on the Association for Computing Machinery [22]. [23] defined Information Technology as computer software and hardware solutions that provide support of management, operations, and strategists in the organization. There are many other definitions of Information Technology given by researchers [2], [17], [21]. [25] concluded that IT covers a wide range of information processing and

computer applications in organizations, such as systems of information, Internet, information and communication related technologies, and their infrastructure. From these definitions, IS and IT are related closely but not exactly the same. IS concern more about business processes and people. So, studying IS and IT gain different knowledge. Each position relates to IS and IT differently, also the concern of businesses and people.

From these points of view, the levels of knowledge related to IS/IT, along with skill and business concerns are different among positions. It is important to revisit the body of knowledge and skills each IS/IT position needs regarding the current technologies and current business environment. In addition to update the knowledge, skills and business understanding, it is valuable to find the gaps between the expected knowledge and skills that build each position’s competencies and the current status of competencies each position has. The gaps will bring to the personnel’s development plan for each position and yield the improvement and enhancement to the organization’s abilities, especially in IS/IT areas.

II. KNOWLEDGE AND SKILLS FOR POSITION’S COMPETENCIES

As mentioned above, there are several factors affect the competencies of IS/IT personnel. Several researchers studied knowledge and skills in IS/IT area.

[3] mentioned three kinds of knowledge and skills, which are technical skills, business concepts, and soft

skills. [13] stated that there are 8 skills and knowledge for programmer/analysts, which are software development, software knowledge, business knowledge, social, problem solving, management, computer architecture and network, and hardware. While [20] and [11] concluded from past published papers that there are 3 kinds of skills concerned, which are humanistic skills, business skills, and technical skills. Based on these researchers, it is possible to focus the knowledge and skills for IS/IT positions competencies in 3 aspects: technical skills, business skills, and soft skills. Each aspect consists of several concepts and knowledge related to IS/IT area and based on each aspect's definition.

According to [9], [10] and [15], technical skills for IS/IT are the specific knowledge and abilities about IS/IT, which persons who work in this area must know more than other people work in the other areas. Also, according to [8], [10], and [12], soft skills are abilities and attitudes to work with other people, getting the job done, communication, self-control and self-management, and ethics. These 2 skills have the same characteristics as [11] concluded in his research and re-use in [20].

For business skills, it is the knowledge about businesses, as IS/IT is one of the efficient technologies used in every organization. It will be more powerful if IS/IT acquired to suit the nature of each organization.

III. DATA COLLECTION AND DATA ANALYSIS

The data are collected from IS/IT employees who

worked in companies registered in SET by questionnaires. First, a stratified random sampling technique was used to select the companies from the list based on industry groups. Then the employees who worked in the IT department in selected companies were selected randomly. They received the tested questionnaires after that.

The questions in the questionnaire are adopted from [1], which studied the knowledge and skills for IT workers, and adjusted or added some abilities to fit with the technologies trends and the business environment. Each knowledge and skill were asked for two answers: the current level they have and expected level using 5 Likert's scale. The samples were asked to put their current working position and brief responsibilities. Also, the data collected were analyzed using mean, standard deviation, and the paired T-test to identify the difference between the current status of each knowledge and skills, along with the expectation. The paired T-test results can give the idea for development plan.

IV. RESULTS

The returned questionnaire consists of 87 organizations from all industries with the proportion closed to the proportion of organizations in the list of SET, about 34.6% returned, which is in range of email response rates [7]. The respondents from these organizations are IT managers, IT supports, programmers, system analysts, system engineers, project managers, business analysts, and software

engineers. The members of respondents working in these positions reflect the distribution of positions in the population.

Base on [6], the score 3.40 and above from 5 Likert’s scale of importance are considered high and very high. The current level of each knowledge, skills, and

abilities are brought to calculate for means, also the expected level. Tables I, II and III present the 3 highest ranks of the necessary skills related to each position.

Base on Paired T-test with statistically significant level 95%. Tables IV, V and VI present most of the needed skills for improvement.

Table I
Technical skills necessary for each position

Position	Technical Skills			
	Modeling and Management Based Knowledge		Technology Based Knowledge	
IT Manager	- Gathering system requirements	- Planning		
	- System analysis and design			
Project Manager	- Business process analysis and design	- Business modeling	- Access management	- ERP
	- Change management	- Documentation	- Business Intelligence	- Implement
	- Gathering system requirements	- Planning	- Database management	- LAN/WAN
	- Project management	- Process modeling	- Database management system	- Maintenance
	- System analysis and design	- Risk management	- Data warehouse	- UML
		- Time Management	- Decision Support System	- Virtualization
			- General knowledge of Architecture/Network	- Package software
			- Knowledge of Technology Trends	- Quality assurance
			- Wireless networks	- Setting up networks
				- System integration

Business Analyst	<ul style="list-style-type: none"> - Ability to identify stakeholders - Business process analysis and design - Change management - Gathering system requirements - General knowledge of Management - Project management - System analysis and design 	<ul style="list-style-type: none"> - Documentation - Monitoring - Planning - Process modeling - Risk management - Time management 	<ul style="list-style-type: none"> - Business Intelligence - Client/Server - Cloud computing - Database management - Decision Support System - Device/Printer/Storage - General Knowledge of Architecture/Network - General Knowledge of H/W - General Knowledge of S/W - Human Computer Interaction - Knowledge of Technology Trends - Setting up networks 	<ul style="list-style-type: none"> - Data mining - Data modeling - Data warehouse - Desktop/PC - Implementation - Internet - Package software - SQL - System integration - UML - Virtualization - Wireless networks
System Analyst	<ul style="list-style-type: none"> - Gathering system requirements - System analysis and design 	<ul style="list-style-type: none"> - Process modeling 	<ul style="list-style-type: none"> - Database management 	<ul style="list-style-type: none"> - Implementation
Programmer	<ul style="list-style-type: none"> - System analysis and design 		<ul style="list-style-type: none"> - Knowledge of Technology Trends 	<ul style="list-style-type: none"> - Programming
Software Engineer	<ul style="list-style-type: none"> - Ability to identify stakeholders - Business process analysis and design - Change management 	<ul style="list-style-type: none"> - Business modeling - Monitoring - Planning - Risk 	<ul style="list-style-type: none"> - Access management - Application/Network Security - Decision Support System 	<ul style="list-style-type: none"> - Data Modeling - Desktop/PC - Internet - LAN/WAN - Maintenance

	- General knowledge of management - Project management	Management - Time management	- Device/Printer/Storage - General Knowledge of Architecture/Network - General Knowledge of H/W - Human Computer Interaction - Multiple Factor Authentication - Service Oriented Architecture - Wireless networks	- Package software - Quality assurance - System integration - UML - Sever
System Engineer	- Change management - General Knowledge Management	- Risk Management	- Client/Server - General Knowledge of Architecture/Network - Setting up networks	- Implementation - Operating System - Package Software
IT Support			- Device/Printer/Storage - General Knowledge of H/W	- Desktop/PC

Table II
Business skills necessary for each position

Position	Business Skills
IT Manager	- Ability to apply IT to business problems - Ability to discuss about IT using language
	- Knowledge of the goals and objectives of the company

	that is easy to understand in the business context so that those who are not IT experts can understand	- Knowing how to use information technology (IT) to add value to the company
Project Manager	<ul style="list-style-type: none"> - Ability to discuss about IT using language that is easy to understand in the business context so that those who are not IT experts can understand - Knowledge and understanding of languages/technical terms of each department - Knowing how to use information technology (IT) to add value to the company 	<ul style="list-style-type: none"> - Ability to apply IT to business problems - Ability to learn business function - Knowledge and understanding of business environment - Knowledge of key factors for the company's success - Knowledge of the company's core competencies - Knowledge of the goals and objectives of the company - Understand organizational culture and political
Business Analyst	<ul style="list-style-type: none"> - Ability to apply IT to business problems - Ability to discuss about IT using language that is easy to understand in the business context so that those who are not IT experts can understand - Knowledge and understanding of languages/technical terms of each department - Knowing how to use information technology (IT) to add value to the company 	<ul style="list-style-type: none"> - Ability to learn business function - Knowledge and understanding of business environment - Knowledge of key factors for the company's success - Knowledge of specific industry, Knowledge of the company's core competencies - Knowledge of the goals and objectives of the company - Understand organizational culture and political
System Analyst	<ul style="list-style-type: none"> - Ability to apply IT to business problems - Ability to discuss about IT using language that is easy to understand in the business 	<ul style="list-style-type: none"> - Knowledge and understanding of languages/technical terms of each department

	context so that those who are not IT experts can understand	- Knowing how to use IT to add value to the company
Programmer	- Ability to discuss about IT using language that is easy to understand in the business context so that those who are not IT experts can understand	- Ability to apply IT to business problems - Knowing how to use IT to add value to the company
Software Engineer	- Entrepreneurial skill - Knowledge and understanding of business environment - Knowledge of specific industry	- Knowledge of the company's core competencies - Understand organization culture and political
System Engineer	- Ability to discuss about IT using language that is easy to understand in the business context so that those who are not IT experts can understand	- Ability to apply IT to business problems - Knowledge and understanding of business environment - Knowing how to use IT to add value to the company
IT Support	- Ability to apply IT to business problems, - Ability to discuss about IT using language that is easy to understand in the business context so that those who are not IT experts can understand	- Knowledge and understanding of languages/technical terms of each department - Knowing how to use IT to add value to the company

Table III
Soft skills necessary for each position

Position	Soft Skills			
IT Manager	- Analytical, logical and critical thinking	- Work in a team	- Honesty/Integrity	- Ethics and professionalism
Project Manager	- Ability to handle ambiguity - Ability to learn and teach others	- Ability to multitask -	- Interpersonal - Listening - Negotiation	- Impression management - Open to a new

	<ul style="list-style-type: none"> - Ability to resolve conflict professionally - Ability to work under pressure - Analytical, logical and critical thinking - Ethics and professionalism - User/Customer relationship management 	<ul style="list-style-type: none"> Adaptive/Flexible - Empathetic outlook - Creative thinking - Decision making - Global awareness - Honesty/Integrity 	<ul style="list-style-type: none"> - Oral skill - Presentation - Proactive - Problem solving 	<ul style="list-style-type: none"> experience - Relationship building - Stress management - Work in a team - Writing
Business Analyst	<ul style="list-style-type: none"> - Ability to handle ambiguity - Ability to learn and teach others - Ability to resolve conflict professionally - Ability to work under pressure - Analytical, logical and critical thinking - Ethics and professionalism - User/Customer relationship management 	<ul style="list-style-type: none"> - Adaptive/Flexible - Decision making - Dependable - Empathetic outlook - Global awareness - Honesty/Integrity - Interpersonal 	<ul style="list-style-type: none"> - Leadership - Listening - Negotiation - Oral skill - Proactive - Problem solving 	<ul style="list-style-type: none"> - Ability to multitask - Impression management - Open to a new experience - Relationship building - Writing - Work in a team
System Analyst	<ul style="list-style-type: none"> - Dependable - Ethics and professionalism 	<ul style="list-style-type: none"> - Global awareness 	<ul style="list-style-type: none"> - Problem solving - Work in a 	<ul style="list-style-type: none"> - Relationship building

		Honesty/Integrity	team	
Programmer	<ul style="list-style-type: none"> - Analytical, logical and critical thinking - Ethics and professionalism - Open to a new experience 	<ul style="list-style-type: none"> - Decision making - Dependable - Honesty/Integrity 	<ul style="list-style-type: none"> - Listening - Oral skill - Problem solving 	<ul style="list-style-type: none"> - Relationship building - Work in a team
Software Engineer	<ul style="list-style-type: none"> - Ability to handle ambiguity - Ability to learn and teach others - Ability to resolve conflict professionally - Ability to work under pressure - Analytical, logical and critical thinking - Ethics and professionalism - Problem solving - User/Customer relationship management 	<ul style="list-style-type: none"> - Adaptive/Flexible - Creative thinking - Decision making - Dependable - Empathetic outlook - Global awareness - Honesty/Integrity - Interpersonal 	<ul style="list-style-type: none"> - Knowledge reuse - Leadership - Listening - Negotiation - Oral skill - Organizing - Presentation - Proactive 	<ul style="list-style-type: none"> - Ability to multitask - Knowledge management - Impression management - Open to a new experience - Relationship building - Stress management - Work in a team - Writing
System Engineer	<ul style="list-style-type: none"> - Analytical, logical and critical thinking - User/Customer relationship management 	<ul style="list-style-type: none"> - Open to a new experience 	<ul style="list-style-type: none"> - Problem solving 	
IT	<ul style="list-style-type: none"> - Ability to work under pressure 	<ul style="list-style-type: none"> - Oral skill 	<ul style="list-style-type: none"> - Writing 	<ul style="list-style-type: none"> - Listening

Support	
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Table IV
Technical skills needed to improve

Position	Technical Skills	
	Modeling and Management Based Knowledge	Technology Based Knowledge
IT Manager	- Gathering system requirements - System analysis and design	- Planning
Project Manager	- Business process analysis and design - Change management - Gathering system requirements - System analysis and design	- Documentation - Process modeling - Risk management - Time management
Business Analyst	- Data modeling - System analysis and design	- Risk management
System Analyst	- Gathering system requirements - System analysis and design	- Process modeling
Programmer	- System analysis and design	- Knowledge of Technology Trends
		- Access management - Business Intelligence - Database management system - Data warehouse - Decision Support System - General Knowledge of Architecture/Network - Setting up networks
		- Data mining - LAN/WAN - Package software - Quality assurance - System integration - UML - Virtualization
		- Client/Server - Cloud computing
		- Database management - Implementation
		- Data mining - Data warehouse
		- Programming

Software Engineer	<ul style="list-style-type: none"> - Ability to identify stakeholders - Business process analysis and design - Change management - General Knowledge of Management - Project management 	<ul style="list-style-type: none"> - Business modeling - Data modeling - Planning - Risk management - Time management 	<ul style="list-style-type: none"> - Application/Network Security - Decision Support Systems - General Knowledge of Architecture/Network - Human Computer Interaction - Multiple Factor Authentication - Service Oriented Architecture 	<ul style="list-style-type: none"> - Access management - LAN/WAN - Monitoring - Quality assurance - System Integration - Wireless networks
System Engineer	<ul style="list-style-type: none"> - Ability to identify stakeholders - General Knowledge of Management 	<ul style="list-style-type: none"> - Change management - Risk management 	<ul style="list-style-type: none"> - Service Oriented Architecture 	
IT Support			<ul style="list-style-type: none"> - Desktop/PC Device/Printer/Storage - General Knowledge of H/W 	

Table V
Business skills needed to improve

Position	Business Skills	
IT Manager	<ul style="list-style-type: none"> - Ability to apply IT to business problems - Ability to discuss about information technology (IT) using language that is easy to understand in the business context so that those who are not IT experts can understand 	<ul style="list-style-type: none"> - Knowing how to use information technology (IT) to add value to the company - Knowledge of the goals and objectives of the company
Project	<ul style="list-style-type: none"> - Ability to discuss about information 	<ul style="list-style-type: none"> - Ability to learn business function

Manager	technology (IT) using language that is easy to understand in the business context so that those who are not IT experts can understand	- Knowledge of the company's core competencies - Knowledge of key factors for the company's success
Business Analyst		- Knowledge of the company's core competencies
System Analyst	- Ability to apply IT to business problems - Ability to discuss about information technology (IT) using language that is easy to understand in the business context so that those who are not IT experts can understand	- Knowing how to use information technology (IT) to add value to the company - Knowledge and understanding of languages/technical terms of each department
Programmer	- Ability to discuss about information technology (IT) using language that is easy to understand in the business context so that those who are not IT experts can understand	- Ability to apply IT to business problems - Knowing how to use information technology (IT) to add value to the company
Software Engineer	- Entrepreneurial	- Knowledge and understanding of business environment
System Engineer	- Knowledge and understanding of business environment	
IT Support	- Ability to apply IT to business problems - Ability to discuss about information technology (IT) using language that is easy to understand in the business context so that those who are not IT experts can understand	- Knowing how to use information technology (IT) to add value to the company - Knowledge and understanding of languages/technical terms of each department

Table VI
Soft skills needed to improve

Position	Soft Skills			
IT Manager	- Analytical, logical and critical thinking	- Ethics and professionalism	- Work in a team	- Honesty/Integrity
Project Manager	- Ability to handle ambiguity - Ability to learn and teach others - Decision making - Empathetic outlook	- Global awareness - Impression management - Interpersonal	- Oral skill - Presentation - Proactive	- Relationship building - Stress management - Writing
Business Analyst	- Ability to handle ambiguity - Listening	- Oral skill - Presentation	- Proactive - Writing	
System Analyst	- Ethics and professionalism - Dependable	- Honesty/Integrity - Relationship building	- Problem solving - Work in team	- Global awareness
Programmer	- Analytical, logical and critical thinking - Decision making - Ethics and professionalism	- Dependable - Open to new experience - Honesty/Integrity	- Problem solving - Listening - Oral skill	- Relationship building - Work in a team
System Engineer	- Analytical, logical and critical thinking - User/Customer relationship management	- Open to new experience	- Problem solving	
IT Support	- Ability to work under pressure	- Listening	- Oral skill	- Writing

V. DISCUSSION

According to the results, the technical skills can be separated into 2 categories, technology based

knowledge, and modeling and management based knowledge. Each position focuses on technical skills and each category differently. However, the results can suggest that studied positions can separate into 2 sides:

Information Systems and Information Technology. Information Systems focus more on modeling and management based knowledge than technology based knowledge; while Information Technology focuses more on technology based knowledge than the other knowledge categories in the technical skills group.

For business skills, business skills required ability to apply IT for business problems and ability to discuss about IT with easy to understand language. Also, knowing how to use IT to add value to the company is important. All positions are required to have ethics and professionalism, honesty, and team working ability. Moreover, IS/IT persons need to have analytical, logical, and critical thinking ability, along with presentation ability.

VI. CONCLUSION AND RECOMMENDATIONS

All IS/IT positions requires all technical skills, business skills, and soft skills. Each position requires technical skills differently. However, every position needs the same business skills and soft skills. Technical skills focusing on modeling and management base knowledge needs long-term experience. The organizations must develop their employees by using team working, mentoring, etc. Technical skills focusing on technology based knowledge can be built by training and sightseeing. For business skills, training and working as a team are hopeful for each IS/IT position to collect knowledge and experience.

Soft skills are required, so the organization should have some training courses about writing, presentation, etc. The organization should educate every employee to have an IS/IT knowledge and new technology trend. High level managers or administrative officers should have an effective IS/IT plan and also have clear policies to direct the development of IS/IT in the organization. The attitude above using IS/IT to yield the efficiency to work and raise the overall organization's performance should be a concern.

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