



# **ASEAN ICT Skill Standards Definition and Certification**

**Final Report**

**September 2013**



# Table of Content

<b>Executive Summary .....</b>	<b>i</b>
<b>1. Introduction.....</b>	<b>1</b>
1.1 Overview of this project .....	1
1.2 Why do we need a standard? .....	5
<b>2. Overview of ICT skill standards.....</b>	<b>8</b>
2.1 Understand ICT skill standards .....	8
2.2 Major elements of standard in general .....	9
2.2.1 Skill.....	9
2.2.2 Sub-area of a skill .....	10
2.2.3 Competency level.....	10
2.2.4 Definition .....	10
2.2.5 Mapping to other standards.....	10
2.2.6 Certification approach .....	11
2.3 General definitions of five fields interested in this project .....	12
<b>3. Survey on ICT skill standards.....</b>	<b>14</b>
3.1 Best practices around the world.....	14
3.1.1 Currently available standards.....	15
3.1.2 Analysis of the existing standards .....	26
3.2 Skill Standards within ASEAN.....	30
3.2.1 Currently available standards in ASEAN .....	30
3.2.2 Analysis of the existing standards in ASEAN.....	41

## Table of Content (Cont.)

<b>4. ASEAN ICT skills standard .....</b>	<b>44</b>
4.1 Ideas behind development of the standard.....	44
4.2 Overview of the standard .....	46
4.2.1 Main groups of skill .....	46
4.2.2 Sub-areas.....	46
4.2.3 Competency levels .....	47
4.2.4 Definitions .....	48
4.3 Related activities .....	48
4.3.1 Certification approach .....	48
4.3.2 Accreditation .....	51
4.3.3 Approach to re-auditing accredited training providers.....	53
4.3.4 Mapping to different standards .....	53
4.3.5 Mapping ASEAN ICT skills standard with currently existed standards in ASEAN .....	55
4.3.6 Maintaining the standard.....	57
4.4 Conclusion .....	57
<b>5. Details of the Standard.....</b>	<b>59</b>
Software Development .....	62
ICT Project Management.....	69
Enterprise Architecture Design .....	73
Network and System Administration.....	77
Information System and Network Security .....	82

# Executive Summary

As we all know, creation of ASEAN Community or AC in 2015 will lead to an economic community with more than 600 million people, and combined Gross Domestic Product or GDP at around 2 trillion dollars. Integration is considered to be the main factor that can lead to being able to efficiently working together.

Integration of the ten countries to become a single economic community needs a plan. ASEAN ICT Master plan 2015 (AIM 2015) was adopted in the 10<sup>th</sup> ASEAN Telecommunications and Information Technology Ministers Meeting (TELMIN) on the 13<sup>th</sup> - 14<sup>th</sup> January 2011.

Having “freer flow of skilled labor” is one of the issues that receive large attentions from the community. In order to achieve the movement of skilled workers effectively, therefore it is necessary to have a standard to support the mobility of such workers.

As the first initiative for ASEAN in developing a standard for ICT skills, this project covers five important area of ICT development in general, which are:

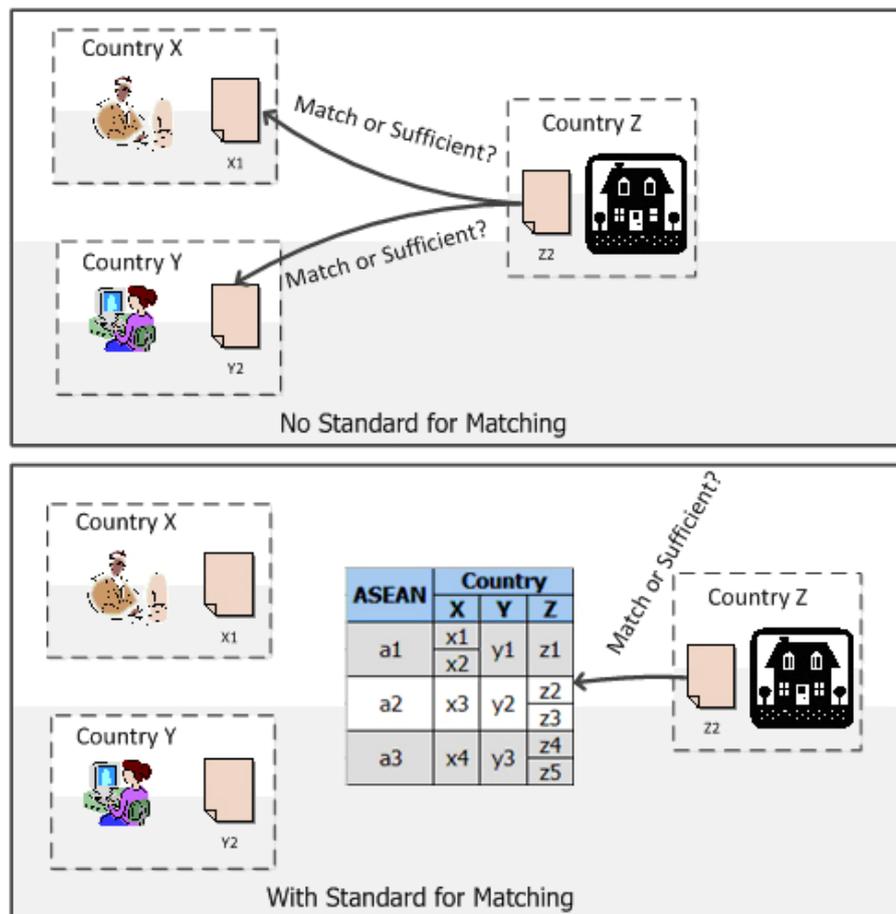
- Software Development
- ICT Project Management
- Enterprise Architecture Design
- Network and System Administration
- Information System and Network Security

This standard also includes standard “definitions” and “certification” approaches for all interested areas of skills.

This project starts from the exploration and study of existing standards existed in various countries around the world. It also includes study of the standards used in the Member States. As a result, standard developed by this project is a summary of the ICT standards, which is developed by taking into account the strengths and weaknesses of all surveyed ICT skills standards currently available in the world.

## Benefits of having standards

In the figure below, assume that a company in country Z is looking for an ICT person to work on a project. The company requires a person with skill "Z2". Apparently, there are 2 candidates for the job. The first candidate comes from country X with skill "X1". The second person is from country Y with skill "Y2". The question to human resource department of the company is that "How can I know whether skill "X1" of the first candidate and skill "Y2" are match or sufficient for the job required?".



Comparison between with and without standard for matching qualification

If there is no standard for matching, the company has to put a lot of effort in investigating if both skill "X1" and "Y1" qualify for the job at hand. The amount of effort can easily increase at least linearly with the number of applicants from overseas. On the other hand, with ICT skill standard in place, as soon as all countries in ASEAN match their standards with the ASEAN standard, a table of comparison similar to the one shown in the Figure 1 can then be used by any company inside ASEAN to see whether a particular skill match or sufficient for their requirements.

## ASEAN ICT Skills Standard

There are 3 levels of competency used in this standard, which are:

- Level 1: Basic level

Basic level of this standard referred to *"Has basic knowledge and skills which is adequate to perform a given task(s) under supervision of management"*.

- Level 2: Intermediate level

Intermediate level of this standard referred to *"Has professional knowledge and skills to perform a given task(s) independently, and, if required, can supervise others; understand a number of comparative approaches to problems in their fields; and be able to apply them efficiently"*.

- Level 3: Advanced level

Advanced level of this standard referred to *"Has professional knowledge and skills in both technical and management to lead a team in inexperienced environment"*

## Accreditation of Skills

There is no a certification body and resources existed in ASEAN that can take care of all certification centrally. As a result, "accreditation" is considered the most suitable approach for ASEAN. In other words, there will be no central certification body and process in ASEAN.

In addition, because of no central resource for this purpose, the accreditation process for accrediting training providers is also left to all ASEAN Member States (AMS) to manage and responsible for accrediting their internal training providers.

## Comparison between ASEAN standard and standards existed within ASEAN

Similar to other standards currently existed, the ASEAN standard also provides guidance on how to map or compare the standard with others. The following table shows comparisons between the ASEAN ICT skills standard and ICT skills standards currently existed within ASEAN.

<b>Competency Level (ASEAN)</b>	<b>Level 3: Advanced Level</b>	<b>Level 2: Intermediate Level</b>	<b>Level 1: Basic Level</b>
<b>Description (ASEAN)</b>	Has professional knowledge and skills in both technical and management to lead a team in inexperienced environment	Has professional knowledge and skills to perform a given task(s) independently, and, if required, can supervise others; understand a number of comparative approaches to problems in their fields; and be able to apply them efficiently	Has basic knowledge and skills which is adequate to perform a given task(s) under supervision of management.
<b>Indonesia</b>	Level 7-9	Level 4-6	Level 1-3
<b>Malaysia</b>	Level 4: Advanced	Level 3: Senior	Level 2: Intermediate
<b>Philippines</b>	Level 3: Specialist	Level 2: Advance	Level 1: Basic
<b>Singapore</b>	Level 4: Senior Management	Level 2: Specialist	Level 1: Entrant
<b>Thailand</b>	Level 4: IT professionals	Level 3: Perform all assigned duties independently	Level 2: Perform assigned duties under the supervision
<b>Vietnam</b>	Level 4: IT professionals	Level 3: Perform all assigned duties independently	Level 2: Perform assigned duties under the supervision

## Conclusion

This project results in a set of ICT standard definitions for 5 areas of ICT. Each of them contains also a set of sub-areas, where all the sub-areas, in turn, are divided into 3 levels of competency. These 3 levels are basic, intermediate, and advance. The proposed standard definitions can be used for both to compare with other standards currently existed in other countries, and as a basis for development of certification programs, if required.

Although the standard has been developed, similar to management of other standards, it has to be regularly updated by TELSOM. It is recommended that the standard has to be revisited every 2-3 years in order to ensure that it is up-to-date with technologies, which are normally rapidly changed.

# 1. Introduction

## 1.1 Overview of this project

ASEAN or ASEAN Community (AC) in the year 2015, the community consists of ten countries, which are Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam. Covering 3% of the total land area of Earth, this 4.46 million km<sup>2</sup> is the land of approximately 600 million people, with an estimated combined gross domestic product (GDP) of \$2.1 trillion; this regional economic integration is not only a central of interest of local people, but also the whole world. Integration or working together as a one single community is a great goal, however, a number of important issues have to be systematically tackled. Some of the well-known issues that require attentions include languages, currencies, infrastructure, which covers both physical infrastructure like roads and railways, and digital infrastructure like computer network, laws, regulations, and working environment. Despite the number of issues that require attentions, the main concern of any kind of integration is having “*standard*” that can be used for everyone in the domain, or this case, ASEAN community. Having a “standard” is the heart of integration between any kinds of entities/parties, especially when they have to work together.

As part of the integration, having free flow of skilled labor within ASEAN is one of the highlight of this new community that receive large amount of attention world-wide. In fact, being able to allow free flow of skilled labor is one of the most essential elements of economic integration in the AEC. Consequently, a standard that can be used in supporting the free flow of this movement is needed, especially when AEC concentrates on regional economic integration with effective facilitation for trade and investment.

As far as Information and Communication Technology or ICT in this region is concerned, this is the reason why developing ICT skills standard is one of the most important projects listed in ASEAN ICT Master Plan that has been adopted

since 2011. When having to work together, the standard will allow ICT skilled labor from one country to be easily recognized in another country(ies) in this region. Instead of developing standards for all 100s of fields in ICT, this first initiative of ASEAN concentrates on five essential areas of ICT, which are: Software Development, ICT Project Management, Enterprise Architecture Design, Network and System Administration, and Information System and Network Security. Similar to what have already been used in other standards currently existed in many parts of the world, by using these five areas of interest as the main groups of skills, the ASEAN ICT Skills Standard also consists of levels of competency, definitions of all skills for every level of competency, and approach to certification, which are suitable for this first initiative of this new economic community.

This report begins with a survey of existing standards currently applied in various parts of the world, then followed by a survey on existing standards used in ASEAN. The report is ended with an ICT skilled standard for ASEAN that has been developed by considering strengths and weaknesses of what have already done in various parts of the world.

***One of the 15 prioritized projects of the master plan on ASEAN  
Connectivity (MPAC)***

As mentioned above, to create the AC by 2015, the most important issues which has to be considered is having a well-connected community. In order to ensure systematic implementation of the issue, a master plan on ASEAN Connectivity or MPAC has been developed. The plan was first published in December 2010.

Being able to efficiently connect physically and digitally to each other both within and outside ASEAN community is one of the most important issues for the region's economic development. Similar to other plans, the MPAC identifies a number of projects and activities that have to be implemented in order to achieve the goals that has been set. With regard to the criticality of this project, it has been listed as one of the prioritized projects for the plan. The following shows the list of all fifteen prioritized projects of the AIM2015.

1. Completion of the ASEAN Highway Network (AHN) missing links and upgrade of Transit Transport Routes (TTRs);
2. Completion of the Singapore Kunming Rail Link (SKRL) missing links;
3. Establish an ASEAN Broadband Corridor (ABC);
4. Melaka-Pekan Baru Interconnection (IMT-GT: Indonesia);
5. West Kalimantan-Sarawak Interconnection (BIMP-EAGA: Indonesia);
6. Study on the Roll-on/roll-off (RoRo) network and short-sea shipping;
7. Developing and operationalising mutual recognition arrangements (MRAs) for prioritized and selected industries;
8. Establishing common rules for standards and conformity assessment procedures;
9. Operationalise all National Single Windows (NSWs) by 2012;
10. Options for a framework/modality towards the phased reduction and elimination of scheduled investment restrictions/impediments;
11. Operationalisation of the ASEAN Agreements on transport facilitation;
12. Easing visa requirements for ASEAN nationals;
13. Development of ASEAN Virtual Learning Resources Centres (AVLRC);
14. **Develop ICT skill standards;** and
15. ASEAN Community building programme.

### ***ASEAN ICT Master Plan***

In addition to MPAC, especially for ICT, in order to systematically and efficiently integrate together all ten nations in ASEAN into one single economic community, a plan is needed. The ASEAN ICT Master plan 2015 or "AIM 2015" was officially adopted at the tenth ASEAN Telecommunications and Information Technology Ministers Meeting (TELMIN) on 13-14 January 2011. The plan explicitly list out actions and projects with targets, timelines, and a vision, which is Towards an Empowering and Transformational ICT: Creating an Inclusive, Vibrant and Integrated ASEAN.

To achieve the goals set by the plan, six strategic thrusts to be implemented are identified, which are:

Strategic Thrust 1: Economic transformation

Strategic Thrust 2: People Empowerment and Engagement

- Strategic Thrust 3: Innovation
- Strategic Thrust 4: Infrastructure Development
- Strategic Thrust 5: Human Capital Development
- Strategic Thrust 6: Bridging the digital divide

In addition, within the next five years and beyond, a number of activities and projects have been listed in the plan with the aim to deliver the four key outcomes, which are:

- ICT as an engine of growth for ASEAN countries,
- Recognition for ASEAN as a global ICT hub,
- Enhanced quality of life for the peoples of ASEAN, and
- Contribution towards ASEAN integration.

With regard to this development of ICT skills standard project, it is classified into **Initiative 5.2: Develop Skills Upgrading and Certification**, which is an initiative under **Strategic Thrust 5: Human Capital Development** of the AIM2015.

#### ***Areas of interest of this project***

As the first initiative for ASEAN in developing a standard for ICT skills, this project covers five important area of ICT development in general, which are:

- Software Development
- ICT Project Management
- Enterprise Architecture Design
- Network and System Administration
- Information System and Network Security

## 1.2 Why do we need a standard?

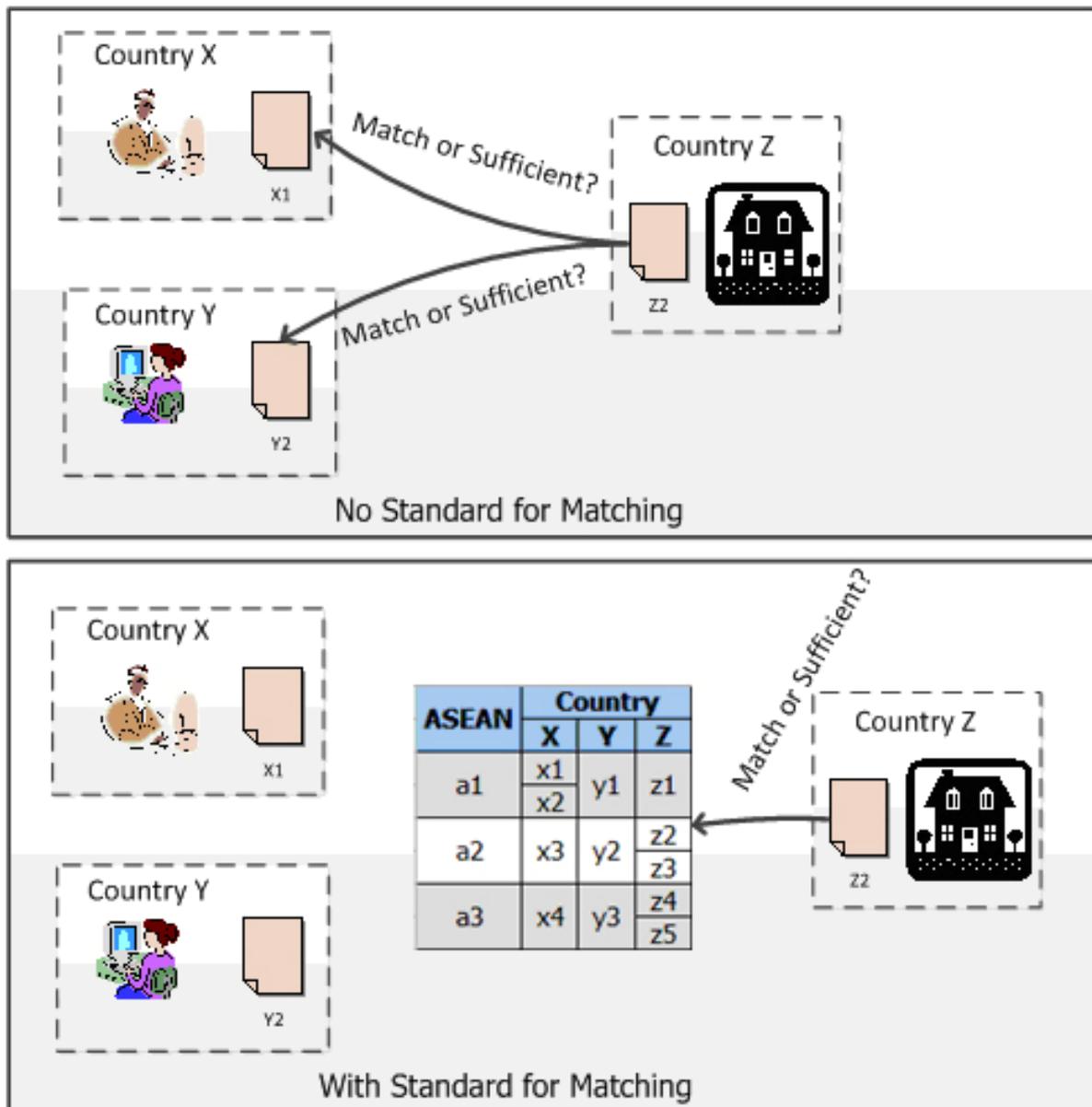
In general, using standards in ICT is a common practice. This is because the nature of ICT is to communicate, integrate, or work others. For a computer to work there are 100s or even 100s of devices within a computer that have to work together. Most of its parts that create output have to consider standards that have been developed and used by majority of devices in order to ensure that it will cooperatively working together. The importance of standards is magnified when the computer has to communicate with external devices like networking devices and another computer.

There are various kinds of standards available even within ICT community. Example of these standards include standard for interfacing between devices, interfacing between programs, standard working process, standard documents, or even standard terminologies used. These standards can also be classified into a number of groups, for example, hardware standards, software standards, process standards, organizational level standards, and people skill standards. This project focuses on ICT skill-related standards for individuals, which are particularly pay attention to only those five areas mentioned above.

With regard to skilled labors, presently, taskforces from one country can freely move and work in other countries, as long as they are qualified for their jobs.

ICT skills standard is essential for implementation of *freer* flow of skilled labor within ASEAN. Without the standard, a company in a country in ASEAN that would like to employ a person from another country will have to invest time and effort in investigating whether skill of the person to be employed is suitable to their job. This investigation has to be repeatedly performed every time when someone comes from the country they have not yet investigated. However, the situation is totally opposite with the standard. With the use of skills standard, if all countries map their standards to the ASEAN standard, if the company is interested in *skills* required for a particular job, not their formal qualifications such as diploma or degrees, then what the company has to do when employing a person is to check that particular person qualification against only with ASEAN standard. This can result in vast amount of efforts saved when employing new employees. Note that with regard to a difference "skills" and "formal qualification", this skills standard focuses mainly only on "skills". Further investigation on formal

qualification of a person may still have to be inspected, if required by the company. Figure 1 shows comparison between having standard and without standard for matching qualification when employing a staff from another country.



**Figure 1:** Comparison between with and without standard for matching qualification

In Figure 1, assume that a company in country Z is looking for an ICT person to work on a project. The company requires a person with skill "Z2". Apparently, there are 2 candidates for the job. The first candidate comes from country X with skill "X1". The second person is from country Y with skill "Y2". The question to human resource department of the company is that "How can I know whether skill "X1" of

the first candidate and skill "Y2" are match or sufficient for the job required?". This is a typical situation when employing a person from another country.

If there is no standard for matching, the company has to put a lot of effort in investigating if both skill "X1" and "Y1" qualify for the job at hand. The amount of effort can easily increase at least linearly with the number of applicants from overseas. This is because investigations have to be conducted for every single country that applicants come from. This is definitely not a good sign for efficiently implementing "free flow" of skilled labor in ASEAN.

On the other hand, with ICT skill standard in place, as soon as all countries in ASEAN match their standards with the ASEAN standard, a table of comparison similar to the one shown in the Figure 1 can then be used by any company inside ASEAN to see whether a particular skill match or sufficient for their requirements. In this example, the company requires skill "Z2", according to the table which shows comparison between skills of all 3 countries, the company can easily identify that skill "X1" is not sufficient for the job, while the skill "Y2" is.

## 2. Overview of ICT skill standards

### 2.1 Understand ICT skill standards

ICT skill standards have been developed in various parts of the world for more than a decade. Because of nature of their environment, Europe is one of the communities that have a long history of ICT skills standard development. Countries in Europe such as England, Germany, and France have created and maintained their ICT skills standard, and in fact, successful of these standards and the need to have a central standard in Europe has led to the creation of European standard, which was agreed upon by the European institutions in 2008. In addition, countries like Japan, South Korea, Hong Kong, and a number of countries in ASEAN have also created and actively maintained their ICT skill standards.

Regardless of how many standards do exist and used in the world today, their main purpose are very similar. In general, in most of the case, these standards are created because of difficulty in understanding and matching qualifications of skilled labor when recruiting and training new members of organizations. With regard to matching qualifications, in general, "definition" of the skill is used for these purposes. For most of the standards existed to-date, definition or short description of a skill, which explains what are required for a certain skill, is described according to a given skill and an interested "level of competency". Figure 2.1 shows relationship between "skill", "competency level", and "definition" of a skill.

Competency Level	Software Development			ICT Project Management			Enterprise Architecture Design			Network and System Administration			Information System and Network Security		
	S1	S2	S3	I1	I2	I3	E1	E2	E3	N1	N2	N3	IS1	IS2	IS3
1															
2															
3															
4															
5															
?															

“Definition” for a given *skill* at a certain *level of competency*

**Figure 2.1.:** Overall elements of skill standards, in general

Most of the skill standards use template similar to the one shown in Figure 2.1. In Figure 2.1, in order to know “definition” of a skill, user of the standard has to specify their interested “skill” and “sub-skill”, then given a “competency level” then can find a definition which explains details of skill at a particular level of competency.

## 2.2 Major elements of standard in general

From the overview of what standard of skills in ICT normally consist of, this section explain in details each of the element of the standard, which are commonly found in most of the ICT skill standards.

### 2.2.1 Skill

The main element of any skill standards is of course the “skill” itself. According to Oxford Dictionary, skill is *“The ability to do something well; expertise”*. As mentioned earlier, this project only concentrates on five groups of skill. Anyone who would like to use this standard has to first specify which group of skill, out of these five, they are interested in.

However, note that, according to UNDP, there is no universally acceptable groups of ICT skills existed.

### **2.2.2 Sub-area of a skill**

Since each of the five skill interested in this project is very broad. A set of more specific skills, which is referred to as "sub-area", is needed for all five skills of this project. An example of sub-areas of skill is, for example, for skill "ICT project management" are "Project management", "Agile project management", and "QA for project management".

### **2.2.3 Competency level**

Another important element of any skill standards is "Competency level". In Oxford Dictionary, competency is referred to "*The ability to do something successfully or efficiently*". Depending on standards, the number of level of competency is varies from one standard to another. However, regardless of their differences, in order to get a definition of a skill, user of any standard has to identify competency level that they are interested in.

### **2.2.4 Definition**

Definition in any skill standard simply referred to "description of skill at a given competency level". The main purpose of having the definition is not only to understand requirement of a skill at a certain level of competency, but the definition is also used as the main material for comparing a certain skill of one standard with another. This is a very crucial aspect of the definition when trying to compare two or more standards in order to see if skill of one person match or meet requirement of a skill at hand.

### **2.2.5 Mapping to other standards**

As mentioned earlier, there are a number of ICT skill standards already existed in various counties/regions. In general, a standard is defined for a particular domain or a country. As a result, if an applicant with a certain skill from one country would like to apply for a job in another country, which uses different standard skill, company that the applicant is applying for a job has to be able to map the applicant's skill to a standard currently used in the country where the company belongs to. As a result, a mechanism for mapping between standards has to be defined in order to ensure that

all mappings are systematically executed. Figure 2.2. shows an example of result of mapping.

ASEAN	Country		
	X	Y	Z
a1	x1	y1	z1
	x2		
a2	x3	y2	z2
			z3
a3	x4	y3	z4
			z5

**Figure 2.2.:** Example of standard, in this case ASEAN standard, after mapped with standards of three countries: X, Y, and Z.

In Figure 2.2., assume that ASEAN's standard consists of three levels of competency. Assume further that we are interested in a skill called "a" of the standard. For ASEAN standard, there are three levels of skill "a", which are "a1", "a2", and "a3". After mapping process, this table of standard depicts that, for example, skill "a1" of ASEAN is equal to skill "x1" and "x2" of country "X". Skill "a1" also equal to skill "y1" and "z1" of country "Y" and "Z", respectively.

Note that it is possible that a skill of ASEAN, or any country, may be equal to multiple skills of another country (e.g., "a1" of ASEAN is equal to "x1" and "x2" of country "X" combined), this simply because definition of skill from one country may be broader than another. Description which explains how to map these standards together will be discussed in the next chapter.

### 2.2.6 Certification approach

In general, for a person to be qualified for a certain skill(s), he/she has to be certified by an accredited institute. Consequently, some owner of standards currently existed also provide channels for individuals to certify for the skills that they have. These channels ranked from owner of standard points out to accredited courses or exams, until the standard's owner issues exams for all skills that they have for those who are interested. Regardless of the approaches taken by those standard's owners, a clearly defined steps for

certifications have to be put in place in order to allow individuals who are interested to know how to obtain their attentive certificates.

### 2.3 General definitions of five fields interested in this project

This section overviews general definitions of all five fields of skill interested in this project. Since these five selected fields have been well-established, the following definitions are exact copies of the definitions used in various well-known sources/references.

Field of Interest	Definition	Source/Reference
Software Development	<i>An engineering discipline that is concerned with all aspects of software production from the early stages of specification to maintaining the system after it has gone into use.</i>	Ian Sommerville, Software Engineering, Addison-Wesley, 2010
ICT Project Management	<i>Project management, then, is the application of knowledge, skills and techniques to execute projects effectively and efficiently. It's a strategic competency for organizations, enabling them to tie project results to business goals — and thus, better compete in their markets.</i>	<a href="http://www.pmi.org/About-Us/About-Us-What-is-Project-Management.aspx">http://www.pmi.org/About-Us/About-Us-What-is-Project-Management.aspx</a>

Field of Interest	Definition	Source/Reference
Enterprise Architecture Design	<p><i>The architecture of a program or computing system is the structure or structures of the system, which comprise software elements, the externally visible properties of those elements, and the relationships among them.</i></p> <p><i>"Externally visible" properties refers to those assumptions other elements can make of an element, such as its provided services, performance characteristics, fault handling, shared resource usage, and so on.</i></p>	Software Architecture in Practice (2nd edition), Bass, Clements, Kazman; Addison-Wesley 2003:
Network and System Administration	<p><i>An ontology for network and system administration is a particular type of ontology whose subject domain is constrained to the administration of networks and systems. Administration is defined as the set of management functions required to create, set up, monitor, adjust, tear down, and keep the network or system operational. One and more ontologies must be defined for each device in the network or system that has a different programming model.</i></p>	Handbook of Network and System Administration edited by Jan Bergstra, Mark Burgess
Information System and Network Security	<p><i>An approach and framework to implementing, maintaining, monitoring, and improving information security that is consistent with organizational culture.</i></p>	ISO/IEC 17799, 2005

## 3. Survey on ICT skill standards

### 3.1 Best practices around the world

In order to develop an ICT skill standard for ASEAN, a survey is conducted with the objective to understand how others have developed theirs, and what are their strengths and weaknesses. The survey can be separated into two groups: outside and inside ASEAN. For outside ASEAN, standards of Japan, England, Germany, and the standard that belongs to the entire European community are investigated. On the other hand, for inside ASEAN, up to today, only information about standards from six countries is available for investigations, which are: Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam.

In order to systematically analyze and compare existing ICT skill standards from both outside and inside ASEAN, the following list attributes used in this study together with interested information:

- *Main groups of skill*  
What are the major skills used in this standard?
- *Sub-area*  
What are the sub-areas used for each skill?
- *Competency level*  
How many levels of competency do they use?
- *Definition*  
How do they derive at the set of definitions used this their standards?
- *Mapping to other standards*  
How do they map their standard with others?
- *Certification approach*  
If any, what is the certification approach employed?

### 3.1.1 Currently available standards

#### 3.1.1.1 Skill Standards for IT Professionals (ITSS)

As one of the most extensive standard found to-date, ITSS was first published by the Ministry of Economy, Trade and Industry (METI) of Japan in 2002. Based on requirements of human resource development, the standard identifies business capabilities required for providing IT services. The standard has been regularly updated every year in order to ensure that the standard always reflect business situations and technology trends. More information can be found from <http://www.jitec.ipa.go.jp/index-e.html>

##### 3.1.1.1.1. Main groups of skill

There are 11 “Job Category” listed in ITSS, which can be seen as categories of skills. These are categories are:

- Marketing
- Sales
- Consultant
- IT Architect
- Project Management
- IT Specialist
- Application Specialist
- Software Development
- Customer Service
- IT Service Management
- Education

##### 3.1.1.1.2. Sub-areas

For each of the categories of skills in ITSS, the sub areas of ITSS indicate “Specialty Field” existed for each of the main field. There are totally 35 specialty fields in this standard.

#### 3.1.1.1.3. Competency levels

There are 7 levels of competency used in this standard.

#### 3.1.1.1.4. Definitions

For a given specialty field and competency level, a definition is provided in this standard. Each of the definition describes details of the skill required for a particular specialty field and competency level.

#### 3.1.1.1.5. Mapping of the other standards

The standard has been mapped to both inside and outside Japan. For example, map to Information Technology Engineer

Examination (ITEE) of Japan, to SFIA of England, and to a European framework called e-CF.

#### 3.1.1.1.6. Certification approach

By using ITEE examination, interested person can participate in their examinations both within Japan and other member countries such as Thailand, Vietnam, and Malaysia.

### 3.1.1.2 Skills Framework for the Information Age (SFIA)

SFIA was originated in England by The SFIA Foundation in 2003. SFIA framework allows matching between requirements of business and skills of IT professionals.

By using an easy to understand two-dimensional table, SFIA list out a set of business skills with their seven levels of responsibility. Note that SFIA does not only cover ICT skills, but also other skills such as changing of business and client

interface as parts of their interested skills. The standard is regularly updated by professional in IT industry. More information can be found from <http://www.sfia-online.org/about-sfia/introducing-sfia/>

#### 3.1.1.2.1. Main groups of skill

Unlike most of the standards available to-date, with regard to classifications of skills, SFIA classify their skills into 3 levels, category, sub-category, and skill. The Main groups of skill in this case referred to "Category". There are 6 categories used in the standards, which are:

- Strategy and architectures,
- Business change,
- Solution development and implementation,
- Service management,
- Procurement and management support, and
- Client interface

Note that the main categories used in SFIA are a sequence of activities needed to implement IT systems, from strategic point of view until the support, and finally client interface.

#### 3.1.1.2.2. Sub-areas

Each of the categories mentioned above are sub-divided into a number of sub-categories. In turn, each of the sub-categories then divided into 86 skills in total.

#### 3.1.1.2.3. Competency levels

There are 7 levels of competency used in SFIA. Level 1 and 2 can be seen as basic leveled

skills. Level 3 till 7 are equivalent to professional levels, which are:

- Associate professional,
- Professional,
- Senior professional,
- Lead professional, and
- Principal professional

#### 3.1.1.2.4. Definitions

Similar to ITSS, there is a definition, which explains details of skill required for every skill and its associated level of competency.

#### 3.1.1.2.5. Mapping to other standards

SFIA has been mapped to both European standards like European Quality Framework (EQF) and European e-Competence Framework (e-CF), and courses of accredited training institutes like CompTIA, ISACA, and APM Group.

#### 3.1.1.2.6. Certification approach

SFIA has two kinds of certifications. The first certification is conducted by the organization itself, which is for those who would like to be certified as "SFIA certified consultants".

The second kind of certification is the certification on skill of individuals. This kind of certificate is issued by accredited training institutes whose courses are certified by SFIA.

### 3.1.1.3 **Advanced IT Training System (AITTS)**

Started in 2002, this standard which based on work process-oriented IT training system has been developed by Federal

Institute for Vocational Training together a number of professional parties in Germany. Unlike most of the ICT skill standards, practical IT processes are used to drive this qualification rather than using products and product companies. More information can be found from <http://kibnet.org/english/en.aitts/>

#### 3.1.1.3.1. Main groups of skill

Unlike other standards, AITTS divide their groups of skills unequally between levels of competency. There are three level of competency in this standard, which are:

- Functional groups
- Operative professionals
- Strategic professionals

Each of the level is divided into a number of groups of skill, which are:

- Functional groups
  - Solution developer
  - Developer
  - Technician
  - Administrator
  - Product and client advisor
  - Coordinator
- Operative professionals
  - IT system manager
  - IT business manager
  - IT business consultant
  - IT marketing manager
- Strategic professionals
  - IT technical engineer
  - IT business engineer

Note that the six functional groups are then divided into twenty-nine specialists.

3.1.1.3.2. Sub-areas

Not applicable. There is no sub-area in this standard.

3.1.1.3.3. Competency levels

There are three level of competency in this standard, which are:

- Functional groups
- Operative professionals
- Strategic professionals

3.1.1.3.4. Definitions

Similar to other standards, there is a definition, which explains details of skill required for every skill and its associated level of competency.

3.1.1.3.5. Mapping to other standards

The AITTS standard has been mapped to both EQF and e-CF of Europe.

3.1.1.3.6. Certification approach

AITTS has their own examination for all of their interested skills. However, in order to ensure practicality of their examinations, all vendors' specific knowledge/requirement is also considered in their examinations.

### 3.1.1.4 European Quality Framework (EQF)

European Qualification Framework was initiated by the European Commission to establish & institutionalize a quick

system for the recognition of qualifications. The standard has been agreed upon by the European institutions in 2008.

Unlike most of the standards, which only focus on “workers”, the EQF standards pay attentions to both “workers” and “learners” mobility between countries. In other words, the standard can be used for both academic and professional. The aim of EQF is to be used as a common reference framework for comparing qualifications of different countries. In fact, since 2012, all new European standards reference themselves to this EQF standard. The standard is developed and implemented entirely on a voluntary basis. More information can be found from

[http://ec.europa.eu/education/lifelong-learning-policy/eqf\\_en.htm](http://ec.europa.eu/education/lifelong-learning-policy/eqf_en.htm)

#### 3.1.1.4.1. Main groups of skill

Not applicable. There are only broad descriptions of skill required for eight levels of skill. Since the aim of the EQF is only to be used as a reference framework for comparing different standards, it only list out eight levels of competency/ skill/ knowledge, so other standard can compare with it based on these eight levels.

#### 3.1.1.4.2. Sub-areas

Not applicable.

#### 3.1.1.4.3. Competency levels

There are eight levels of competency/ skill/ knowledge used in this standard. According to the information found from

<http://www.nqai.ie/documents/eqfleaflet.pdf>, the following list eight levels of skill used in this standard:

*Level 1:* Basic skills required to carry out simple tasks

*Level 2:* basic cognitive and practical skills required to use relevant information in order to carry out tasks and to solve routine problems using simple rules and tools

*Level 3:* A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information

*Level 4:* A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study

*Level 5:* A comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems

*Level 6:* Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialized field of work or study

*Level 7:* Specialized problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields

*Level 8:* The most advanced and specialized skills and techniques, including synthesis and evaluation, required to solve critical problems in research and/or innovation and to extend and redefine existing knowledge or professional practice

#### 3.1.1.4.4. Definitions

For a given level of competency/ skill/ knowledge, there are definitions described requirement for each of the level.

#### 3.1.1.4.5. Mapping to other standards

The standard has been mapped to most of the European standards, and as stated earlier, all new European standards after 2012 have been mapped to this standard.

#### 3.1.1.4.6. Certification approach

Since the purpose of the EQF is only to be used as a reference framework for comparing different standards, there is no certification for this particular standard.

### **3.1.1.5 European e-Competence Framework (e-CF)**

European e-Competence Framework version 1.0 was published in 2008. This followed by version 2.0 in 2010. Despite a number of ICT skill standards available in Europe, the e-CF standards can be seen as an attempt to link national frameworks at a European level. The standard has been developed not based on job profiles but on competences. Their thirty-six competences are classified into five ICT business areas. The standard has been regularly updated by European ICT business and HR development, the CEN ICT Skills Workshop community. Currently, version 3.0 is in the process. More information can be found from <http://www.ecompetences.eu/>

#### 3.1.1.5.1. Main groups of skill

According to e-CF user guide

([http://www.ecompetences.eu/site/objects/download/5999\\_EUeCF2.0userguide.pdf](http://www.ecompetences.eu/site/objects/download/5999_EUeCF2.0userguide.pdf)), by using ICT **business process** as a basis for classifying groups of skills, there are five main groups in this standard, which are:

- Plan
- Build
- Run
- Enable
- Manage

#### 3.1.1.5.2. Sub-areas

For each of the main business areas mentioned above, a number of competencies are identified. For example, according to the document found at [ftp://ftp.cen.eu/CEN/AboutUs/Publications/e-CF\\_leaflet.pdf](ftp://ftp.cen.eu/CEN/AboutUs/Publications/e-CF_leaflet.pdf), for “Plan”, its related competencies are:

A.1. IS and Business Strategy Alignment

A.2. Service Level Management

A.3. Business Plan Development

A.4. Product or Project Planning

A.5. Design Architecture

A.6. Application Design

A.7. Technology Watching

A.8. Sustainable Development

#### 3.1.1.5.3. Competency levels

For the e-CF standard, the competency level is called “e-Competence Proficiency Levels”. There are five levels used in the e-CF standard. These levels are:

- Associate
- Basic
- Manager
- Senior Manager
- Principle

#### 3.1.1.5.4. Definitions

Similar to other standards, a definition is given for every interested skill and competency level.

#### 3.1.1.5.5. Mapping to other standards

The standard has been mapped to most of the European standards, especially the EQF standard.

#### 3.1.1.5.6. Certification approach

According to information found on <http://www.ecompetences.eu/2174,Applying+the+e-CF.html/> there is no formal certification yet set up.

### **3.1.2 Analysis of the existing standards**

This section analyze what have been discussed so far in this report. The purpose is to find strengths and weaknesses of the standards found in countries outside ASEAN.

#### **3.1.2.1 Main groups of skill**

What we have found here is that most of standards list main groups of skill differently. However, we can classify them into two kinds of listings, one is based on "ICT business process", and another one is based on "Selected groups of skill".

As far as advantage of the type of listing is concerned, the listing based on "ICT business process" seems to have advantages over another. This is because it is easier for user of the standard to see what type of the skill they may be interested in. However, the strength of other approach on listing is that because there is no constraints put on the listing, it is easier to insert a new set of skill into the standard.

#### **3.1.2.2 Sub-areas**

As far as sub-groups of skill is concern, the survey found that, in most cases, most of the standards either do not have sub-groups or have sub-groups which are based on "Selected groups of skill". In other words, there is no real pattern for listing out the sub-groups in the standards found so far.

#### **3.1.2.3 Competency levels**

Despite the difference between standards that have different number of competency levels, which ranked from eight levels of EQF down to three levels of AITTS, there is only one pattern for coming up with the competency level. Most of the standards in this survey use Level 1 as "Basic" level, and

refer the highest level of competency to either “Professional” or “Strategic” level of skills. The strength for this pattern is that it ease mapping of different standards, which is considered to be one the most crucial characteristics of all ICT skill standards.

#### **3.1.2.4 Definitions**

All standards use the same way to index a particular definition of a skill, which is given a particular skill and a level of competency, there will be a definition of the skill provided. The definition is simply an explanation on requirement of a particular skill at a specific competency level. The strength of this kind of indexing of definition is that it allows a simple and widely-known mechanism for locating definitions of different standards.

#### **3.1.2.5 Mapping to other standards**

Most of the standards covered in the survey have been either mapped to other standards, or mapped to ICT courses of training institutes, or both. This proves the benefits of all these standards that have been practically applied in industries. With regard to the strength of the mapping, it can be easily seen that being able to map with other standards is a crucial aspect of any standard. However, note that, without the exact details of how the mappings are conducted, according to the information found for most of the standards, a set of committee seems to involve in the mapping.

#### **3.1.2.6 Certification approach**

Regardless of the fact that some of the standard such as EQF does not have certification process because the purpose of their standard is only to act as a translation protocol, there are three certification approaches existed in the standards currently existed:

- **Certification for consultant of standard given by standard owner**

This kind of certification is offered especially to consultants who would like to be certified for a certain standard such as SFIA of England. The certification process is done by the standard owner, in this case SFIA Foundation. The strength of this kind of standard is that it ensures that whoever would like to give consultation about how to use the standard really know the standard very well. This is essential in order to ensure that the standard is not misinterpreted by a consultant who assists organization in managing skills of their resources.

- **Certification for skill given by standard owner**

ITSS and AITTS both offer this kind of assessment to those who are interested in their certificates. In general, the standard owner such as both ITSS and AITTS are the one who manage all examinations, and also evaluation processes. However, in case of conducting the actual examinations, the standard owner may appoint an accredited institute(s) to do so. For example, ITSS has more than 6-7 countries currently using their standards, and certification processes, in their countries. These countries normally will organize their own examinations under supervision of the standard owner. The strength of this kind of certification is that the examination is tightly controlled by the standard owner. However, note that a reasonable amount of effort has to be invested in their examination processes.

- **Certification for accredited courses given by training institute**

Instead of organizing their own examination and finally certification processes, some standard owners accredit courses of some training institutes, and allow the institutes to manage these certifications. SFIA is one of the standard owners, which applied this kind of certification process. This allows the standard owner to have more courses certified under their standards with help from professional training institutes. The main strength of this kind of certification approach is that the effort invested is much less than doing all certifications and examinations by themselves. However, a certain quality assurance protocol has to be put in place to ensure its quality.

The following table summarizes results of the survey conducted in this project for countries outside ASEAN.

Framework	Number of Competency Levels	Lowest Level	Highest Level	General Description	Grouping of Skills
ITSS	7	Basic knowledge	World-class professionals	Basic >> Advance	Required responsibility
EQF	8	Basic knowledge	Most advanced knowledge	Basic >> Advance	Levels of knowledge
e-CF	5	Associate	Principle	Basic >> Advance	Plan-Build-Run-Enable-Manage
SFIA	7	Follow	Set strategy	Following >> Leading	Steps in system development
AITTS	3	Specialists	Strategic professionals	Basic >> Advance	Roles at different levels

## 3.2 Skill Standards within ASEAN

### 3.2.1 Currently available standards in ASEAN

Currently there are seven countries that have ICT skills standards in place. However, Thailand and Myanmar are currently having ITEE examinations as part of their promotions of ICT skills standard. Vietnam is adopting ITSS as their national standard. The following are results of the survey conducted.

#### 3.2.1.1 Indonesia<sup>1</sup>

The country has a national standard called Indonesian National Standard of Work Competency – Standar Kompetensi Kerja Nasional Indonesia (SKKNI) which covers wide range of skills, not only ICT-related skills. Ministry of Communications and Information Technology (MCIT) use SKKNI as a basis for developing their national ICT skills standard.

##### 3.2.1.1.1. Main groups of skill

Currently there are 19 skills used in the standard. However, this number of skills is gradually and annually added and maintained. This maintenance is considered as mandated activity by National Development Planning Agency.

##### 3.2.1.1.2. Sub-areas

Not applicable. This particular standard list all skill separately, there is no grouping among ICT-related skills found.

---

<sup>1</sup> Ministry of Communication and Information Technology, Indonesia

#### 3.2.1.1.3. Competency levels

There are nine levels of competency used in the standard.

#### 3.2.1.1.4. Definitions

Skill definitions are provided in order to be a basis for certification examinations of the country.

#### 3.2.1.1.5. Mapping to other standards

Only used internally within the country.

#### 3.2.1.1.6. Certification approach

A national institute which is the Profession Certification Institution – Lembaga Sertifikasi Profesi (LSP) conducts certification examination for interested individuals based on requirements of National Agency of Profession Certification – Badan Nasional Sertifikasi Profesi (BNSP). The successful applicants will receive the competency certificate from BNSP, which is the authorized institution that issues National Profession Certificates. Currently, there are two registered LSPs that focus on ICT skill certifications.

### 3.2.1.2 Malaysia<sup>2</sup>

There are two main standards existed in Malaysia. One of which is the National Occupational Skills Standard or NOSS which is developed and maintained by Department of Skills Development (DSD) within Ministry of Human Resources.

---

<sup>2</sup> Multimedia Development Corporation (MDeC), Malaysia

Another standard, which concentrates especially on ICT skills, is the standard called MSC Malaysia Skills Competency Matrix. Considered to be one of the most intensive standards found in this survey, the matrix, which is commissioned by Malaysia's Multimedia Development Corporation (MDeC), contains skills competency requirement of ICT industry with focus on MSC Malaysia. The project is chartered by MDeC's K-Workers Development Department (KWD) with an aim to stimulate the development of the MSC Malaysia and ICT industry through its human resources, especially ICT knowledge workers.

Apparently, the matrix covers four ICT industries, which are: Creative Multimedia, System Design and Development, Information Technology, and Shared Services and Outsourcing. It currently covers 432 ICT skills in total.

#### 3.2.1.2.1. Main groups of skill

According to the Skills Competency Matrix of MSC Malaysia, there are four groups of skills, which are:

- Creative Multimedia,
- System Design and Development,
- Information Technology, and
- Shared Services and Outsourcing

#### 3.2.1.2.2. Sub-areas

Not applicable. There is no sub-areas used in this standard.

#### 3.2.1.2.3. Competency levels

According to the matrix, there are five competency levels in their standard. These levels are:

*Level 1: Entry*

*Level 2: Intermediate*

*Level 3: Senior*

*Level 4: Advanced*

*Level 5: Master*

Note that, unlike other standards, the matrix have two types of competencies, which are: Technical Skills Competency and Soft Skills Competency.

#### 3.2.1.2.4. Definitions

By using a job code as an index, a definition is given for a specific skill for certain type and level of competency.

#### 3.2.1.2.5. Mapping to other standards

Mainly, the standard is used internally within the country.

#### 3.2.1.2.6. Certification approach

Industry certification has been mentioned in the matrix.

### 3.2.1.3 **Philippines**<sup>3</sup>

The Philippines has a national standard called the National ICT Competency Standard (NICS) which is developed and maintained by the National Computer Center (NCC) of the Information and Communications Technology Office (ICTO),

---

<sup>3</sup> National Computer Institute, Department of Science and Technology, Philippines.

under the Department of Science and Technology (DOST). Each NICS defines the fundamental set of knowledge, skills and attitude an individual must possess in a specific job role in order to do his job well.

#### 3.2.1.3.1. Main groups of skill

To date, there are a total of fourteen (14) NICS developed for specific job roles, namely:

- NICS - Basic
- NICS - Advanced
- NICS - Teachers
- NICS - Civil Servants
- NICS - Application Developers [with 3 specialized job roles]
- NICS - Network Professionals [with 3 specialized job roles]
- NICS - CESO (Career Executive Service Officer)
- NICS - CeC Knowledge Workers [with 3 specialized job roles]
- NICS - Webmaster
- NICS - Project Manager
- NICS - Enterprise Architect
- NICS - gCIO (government Chief Information Officer)
- NICS - Information Security Specialist
- NICS - IT Auditor

#### 3.2.1.3.2. Sub-areas

The competencies in every NICS are grouped into three (3): Common Competencies, Core Competencies and Professional (soft skills). Every competency (whether common or core) has several key areas of competency which are further subdivided into several sub-group skills sets. The number of sub-group skills sets depends on the specific key area of competency.

#### 3.2.1.3.3. Competency levels

All NICS present the fundamental or essential level of competency for a specific job role. There are levels of competency used in this standard, which are:

- Specialist
- Advance
- Basic

#### 3.2.1.3.4. Definitions

Each competency is defined in a standard format wherein a specific area of competency is briefly described, the specific skills sets stated in outcome terms focusing on demonstrable performance, with indicators to evidence achievement of a defined knowledge or skill or competent completion of a task. Each competency is supported with underpinning knowledge which identifies the essential areas of learning that underscore the area of competence.

#### 3.2.1.3.5. Mapping to other standards

Mainly, the standard is used internally within the country.

#### 3.2.1.3.6. Certification approach

The National Computer Center (NCC), through the National Computer Institute (NCI), is the sole government agency mandated with the responsibility of verifying and certifying ICT competence.

### 3.2.1.4 Singapore<sup>4</sup>

As far as ICT skills standard is concern, Singapore has the National Infocomm Competency Framework or NICF which is developed and maintained by the Infocomm Development Authority of Singapore (IDA) and Singapore Workforce Development Agency (WDA) in close collaboration with the infocomm industry. Unlike other standard which only concentrates only on the skills, the NICF lists competencies and skills required for different ICT-related occupations, as well as their related training programs for building these skills.

NICF was first launched in 2008. NICF 2011 currently documents 587 competencies (or skill) for 314 job roles.

#### 3.2.1.4.1. Main groups of skill

The standard uses "Job Roles" as the main item for searching. There are 314 job roles available in the standard. However, these job roles are grouped in to 6 groups, which are:

---

<sup>4</sup> Infocomm Development Authority of Singapore, Singapore

- Software and Applications (SA)
- Telecommunication and Networks
- IT Services (IT)
- Horizontals
- Emerging Technologies
- Business Domains

#### 3.2.1.4.2. Sub-areas

##### Software and Applications

- Software Design and Development

##### Telecommunications and Networks

- Telecommunications and Network Operations, Planning and Management
- Enterprise Network Design and Management
- Next Generation Network (NGN) Planning, Operations and Deployment

##### IT Services (IT)

- Database Management
- Data Centre Management
- Infrastructure Architecture
- Infrastructure Support
- IT Outsourcing Management
- Business Analytics

##### Horizontals

- IT Management
- Infocomm Sales & Marketing
- Infocomm Security
- Portfolio Management
- Project Management

## Emerging Technologies

- Green ICT
- Cloud Computing
- Service Innovation Design

## Business Domains

- Financial Services
- Healthcare
- Education.

### 3.2.1.4.3. Competency levels

There are 4 competency levels in this standard, which are:

- Entrant
- Specialist
- Expert/Management
- Senior management

### 3.2.1.4.4. Definitions

For a given "Job role", there is a "Job description" given, which is equivalent to the definition of the skills required.

### 3.2.1.4.5. Mapping to other standards

Mainly, the standard is used internally within the country.

### 3.2.1.4.6. Certification approach

The certifications for different skills are mainly provided by accredited training institutes.

### 3.2.1.5 Thailand

In general, Thailand uses a number of already existed standards within the country. For example, NSTDA Academy is using ITPE of Japan as their main certification for ICT skills qualifications, National Electronics and Computer Technology Center (NECTEC) and TOT are using ISO and TOGAF in their works, and Software Industry Promotion Agency (Public Organization) (SIPA) is promoting CMMI certification.

An entity that has already developed a standard that is closely related to ICT skills standard seems to be only work done by the Thailand Research Fund (TRF). However, the standard developed by TRF concentrates on "academic knowledge" of individuals, not "skills". The closest match project that concerns directly with developing ICT skills standard is a work-in-progress project currently carrying out by Professional Qualification Institute (Public Organization). They are developing a set of ICT skills standard for the country. As a result, the following details listed according to the existing examination used for certifying ICT skills, which based on ITSS, especially ITEE of Japan.

#### 3.2.1.5.1. Main groups of skill

There are 11 "Job Category" listed in ITSS.

#### 3.2.1.5.2. Sub-areas

There are totally 35 specialty fields in ITSS.

#### 3.2.1.5.3. Competency levels

There are 7 competency levels used in ITSS.

#### 3.2.1.5.4. Definitions

For a given specialty field and competency level, a definition is provided in this standard. Each of the definition describes details of the

skill required for a particular specialty field and competency level.

#### 3.2.1.5.5. Mapping to other standards

The standard has been mapped to both inside and outside Japan. For example, map to Information Technology Engineer

Examination (ITEE) of Japan, to SFIA of England, and to a European framework called e-CF.

#### 3.2.1.5.6. Certification approach

By using ITEE examination, interested person can participate in the various levels of examinations provided by ITEE.

### 3.2.1.6 Vietnam

Vietnam has Vision 2010 has their master plan of the entire country. The country has a plan called Master Plan in IT Resource Development 2015 for their human resource development. In 2013, there are 125 IT training centers reside within universities/colleges with approximately 200,000 learners. In addition, there are also around 50 informal training institutes, which can produce up to 7,000 – 10,000 people per year. The country focus on bringing its IT training to be in line with international standards.

#### 3.2.1.6.1. Main groups of skill

There are 11 “Job Category” listed in ITSS.

#### 3.2.1.6.2. Sub-areas

There are totally 35 specialty fields in ITSS.

#### 3.2.1.6.3. Competency levels

There are 7 competency levels used in ITSS.

#### 3.2.1.6.4. Definitions

For a given specialty field and competency level, a definition is provided in this standard. Each of the definition describes details of the skill required for a particular specialty field and competency level.

#### 3.2.1.6.5. Mapping to other standards

The standard has been mapped to both inside and outside Japan. For example, map to Information Technology Engineer

Examination (ITEE) of Japan, to SFIA of England, and to a European framework called e-CF.

#### 3.2.1.6.6. Certification approach

By using ITEE examination, interested person can participate in the various levels of examinations provided by ITEE.

### **3.2.2 Analysis of the existing standards in ASEAN**

#### **3.2.2.1 Main groups of skill**

In general, similar to what currently occurred with standards outside ASEAN, most of the countries used different ways to group their skills. However, one common pattern found among all standards currently existed in ASEAN is that there is no standard that classify their skills according to "Business Process" like some of the standards do in Europe.

#### **3.2.2.2 Sub-areas**

Except Vietnam which is currently applying ITSS of Japan as their standard, all of the standards found in ASEAN do not have sub-areas.

#### **3.2.2.3 Competency levels**

Despite differences in number of competency levels found in all standards found in ASEAN, similar to what currently used in both Europe and Japan, most of the standards in this survey use Level 1 as "Basic" level, and the highest level of competency is used for something equivalent to "Professional" level of skills. Therefore, similar to standards existed outside ASEAN, the strength for this kind of pattern is that it makes mapping of different standards, which is one the most critical characteristics of all ICT skill standards, become something that is easy to understand for most of the people.

#### **3.2.2.4 Definitions**

Similar to the standards occurred outside ASEAN, all standards found in ASEAN use the same way to index a particular definition of a skill, which is given a particular skill and a level of competency, there will be a definition of the skill provided. Therefore, the strength of this kind of indexing of definition is that it allows a simple and widely-known technique for locating definitions of different standards.

#### **3.2.2.5 Mapping to other standards**

All of the standards used inside ASEAN are only internal use only.

#### **3.2.2.6 Certification approach**

There are two kind of certification approaches currently existed in ASEAN. The first approach is certification is done by government agencies. This kind of certification is employed by Malaysia, Thailand, Vietnam, Philippines, and Indonesia. For

this type of certification, a government agency (or supported by government, in case of Malaysia) is setup or appointed to responsible for all certification process, including the examination.

On the other hand, the second approach is leaving the certifications to either accredited or endorsed training institutes. Apparently, Singapore is using the second approach. The country allows the certifications to done by either Singapore Workforce Development Agency (WSQ) accredited or Critical Infocomm Technology Resource Programme (CITREP) endorsed training institutes.

The following table summarizes results of the survey conducted in this project for countries inside ASEAN.

Country	Number of Competency Levels	Lowest Level	Highest Level	General Description	Grouping of Skills
Indonesia	9	Basic	Advance	Basic >> Advance	Varied
Malaysia	5	Operation	Management	Basic >> Advance	Varied
Philippines	3	Basic	Specialist	Basic >> Advance	Varied
Singapore	4	Entrant	Senior Management	Basic >> Advance	Types of problem domains
Thailand	7*	Basic knowledge*	World-class professionals*	Basic >> Advance*	Required responsibility*
Vietnam	7	Basic knowledge	World-class professionals	Basic >> Advance	Required responsibility

**NOTE:**

- Thailand: \* indicates that Thailand only use examinations of ITSS/ITEE which have these characteristics.
- Malaysia: Information for Malaysia is based on what have been found on NOSS

## 4. ASEAN ICT skills standard

From the information discussed so far about how other standards have been developed both outside and inside ASEAN community, this section discuss the ASEAN ICT Skills Standard, which result from analysis of what currently adopted in other standards.

### 4.1 Ideas behind development of the standard

Before beginning the discussion on how details of the standard, the result of analysis of other standards described in the previous sections have let to the following three simple philosophy of this ASEAN standard, which are: Use existing standards, Not replace what currently existed in ASEAN, and Simple.

- *Use existing standards*

Developing a brand new standard by reinventing everything is not at all easy. Large amount of effort is required especially in making everyone agree on everything in the standard. As can be seen from the survey, many ICT skill standards already existed around the world and inside ASEAN.

As a result, in developing this ASEAN standard, instead of coming up with a brand new concepts and terminologies, the idea behind developing this ASEAN skills standard is to put together what already been recognized as best-practices from around the world, and package them according to our requirements. Example of these requirements are, for example, only interested in five fields of ICT, to make the standard simple to use, there should be only a small number of competency levels, and definitions of skills, where possible, should be referenced from well-known sources.

- *No replace what currently existed*

Most of the standards currently existed have been put in place for quite a few years. Organizations, protocol, people, and even related regulations have already been settled down. Large numbers of activities have already been running. It is impractical to even attempt to replace them by using any new standard. As a result, similar to how EQF and e-CF of Europe do not attempt to replace what have already been established in various countries in Europe, the ASEAN skills standard also do not attempt to replace any of the existing standards.

For those countries that already have standards set up and used, the main idea is to use this ASEAN standard as a reference framework for comparing skills between countries similar to what EQF or e-CF of Europe are for.

On the other hand, for those countries that do not yet have any standard set up within the country, the standard is details enough to be used internally. This is similar to the way e-CF of Europe works.

- *Simple*

In general, regardless of the type of standards available, most of standards in any domain are widely known as something that requires lots of effort in understanding and using them. Most of them require a number of steps before anything can be achieved. This can easily lead people to stop using it, or in the worst case, do not even want to start to understand it.

One way to make a standard attractive to use is to make it simple. In order to ensure simplicity of mapping with other standards currently existed, the ASEAN standard consists of just three competency levels. It applies simple two dimensional tables to record its details. Similar to how a number of standards work, given a skill and a competency level, user can directly check out "definition" or details of skill required rather than having to go to a number of steps and related documents.

## 4.2 Overview of the standard

The following describe details of the ASEAN skills standard.

### 4.2.1 Main groups of skill

There are five main groups of the skills which have been predefined from the beginning of the project that these are the only five groups of skills interested in this project. They are:

- Software Development
- ICT Project Management
- Enterprise Architecture Design
- Network and System Administration
- Information System and Network Security

### 4.2.2 Sub-areas

According to most of the standards surveyed, one of the key essential of ICT skill standard is having listed skills which are relevant to what currently the interests of commercial. This is because that way the individual who is certifies can have more chance in getting a job related to their skill. This has been considered by most of the standards available to date.

As a result, for each of the five main groups of skill mentioned above, sub-areas used in this standard are derived from referring to best practices of what currently existed in commercial world.

The following shows sub-areas used in this standard.

Main Group of Skill	Sub-Area
Software Development	Business analysis
	System analysis
	Software design
	Software development
	Software testing
	Quality assurance
ICT Project Management	Project management
	Agile project management
	QA for project management
Enterprise Architecture Design	Enterprise architecture
	Security architecture
	Integration architecture
Network and System Administration	Network architect
	Network engineer
	System architect
	System engineer
Information System and Network Security	Data security analysis
	System security analysis
	Network security analysis
	Data security engineer
	System security engineer
	Network security engineer
	Information Security Management System engineer

**Table 4.1** sub-areas used in this standard

### 4.2.3 Competency levels

In order to allow "simple-to-map" process to other standards, this standard consists of three levels of competency, which are:

- Level 1: Basic level

Basic level of this standard referred to *"Has basic knowledge and skills which is adequate to perform a given task(s) under supervision of management"*.

- Level 2: Intermediate level

Intermediate level of this standard referred to *"Has professional knowledge and skills to perform a given task(s) independently,*

*and, if required, can supervise others; understand a number of comparative approaches to problems in their fields; and be able to apply them efficiently”.*

- Level 3: Advanced level

Advanced level of this standard referred to *“Has professional knowledge and skills in both technical and management to lead a team in inexperienced environment”*

Note that the three levels of competency refer to knowledge and skills necessary for:

- Level 1, which can also be seen as **“Performer”** level,
- Level 2, which could be seen as **“Supervisor”** level, and
- Level 3, which can be considered as **“Manager”** level.

#### **4.2.4 Definitions**

Similar to other standards, there is a definition of described for all skills at a given competency level. The definition generally describes detailed requirements for a certain skill at a particular level of competency. As mentioned earlier, rather than coining new definitions for all these well-known field of studies, definitions used in this standard are adapted from what already existed in the field each of the field.

### **4.3 Related activities**

This section discusses a number of crucial activities required when using and maintaining this standard.

#### **4.3.1 Certification approach**

According to the survey conducted, especially standards existed outside ASEAN, there are three types of certification approaches existed, which are:

*Type 1: No certification provided*

The first type of certification approach referred to the case where the standard owner does not offer any certification. In this case, the standard is only used as a “reference” for mapping one standard to another. Examples of this kind of standard are the EQF and e-CF of Europe.

*Type 2: Standard owner (or related agencies) conducts certification by themselves*

The second type of certification approach is used to refer to the situation where the standard owner develop, manage, and maintain their certification process by themselves, which include issuing examination, conducting examination, and issuing certificates. Examples of this type of standard are SFIA, ITSS and AITSS. However, for the case of ITSS, the owner of standard also allow member countries to organize their own examinations, however, all examination papers are issued by the standard owner, in this case Japan’s IT Professionals Examination Council (ITPC). On the other hand, in case of SFIA, the SFIA foundation issues examination for those who would like to be “SFIA accredited consultant”. For individual’ certificate, SFIA foundation leaves this process to certify training providers, who have SFIA certified courses.

*Type 3: Standard owner (or related agencies) certifies training providers who then run certified courses*

The third type of certification is where the standard owner certifies training providers or institutes. In this case, the certification process is responsible by institutes with certify courses to arrange and manage their certifications for those certified courses. However, all trainings have to be conducted by “Certified instructors” only. Example of a standard that applied is type of certification is SFIA. The SFIA foundation certifies training providers with courses that are taught by “SFIA accredited

consultant". Therefore, the individual's certification process is left to these certified providers.

The following table summarizes certification approaches existed in standards outside ASEAN.

Standard	Type 1	Type 2	Type 3
ITSS	-	√	-
EQF	√	-	-
e-CF	√	-	-
SFIA	-	√	√
AITTS	-	√	-

Table 4.2: Certification approaches existed in standards outside ASEAN

For the ASEAN skills standard, certification Type 3 is adopted. There are a number of reasons why Type 3 is considered the most appropriate approach for ASEAN.

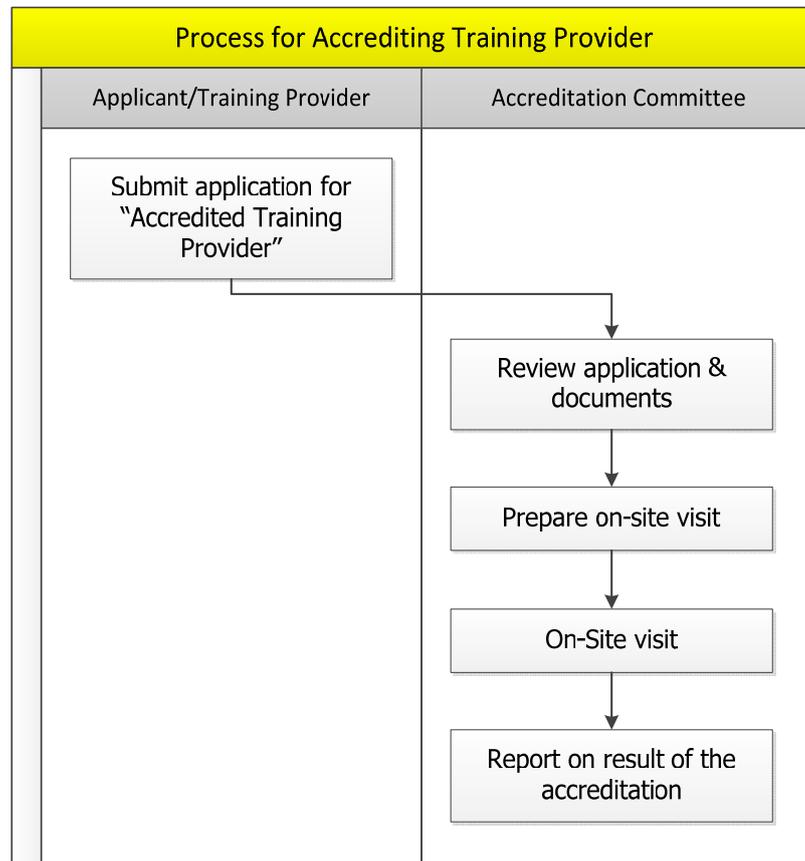
For each AMSs, due to nature of ICT related technologies, which are rapidly changed, most of the AMSs do not centrally certify their ICT skills and courses. This is because centrally controlled courses can easily limit flexibility, creativity, and updatability of knowledge that have to be quickly adapted into these courses.

At the ASEAN level, since there is no clear answer why these certifications should be centrally controlled and managed, there is no a certification body and resources existed in ASEAN that can take care of all certification centrally. As a result, the Type 3 is considered to be the most suitable approach for ASEAN. In other words, there will be no central certification body and process in ASEAN. This is identical to how EQF of Europe works.

In addition, because of no central resource for this purpose, the accreditation process for accrediting training providers is also left to all ASEAN Member States (AMS) to manage and responsible for accrediting their internal training providers.

### 4.3.2 Accreditation

In case of AMS that do not have an accreditation process in place, Figure 4.1. shows an example of the process that can be applied.



**Figure 4.1.:** An example of accreditation process

In Figure 4.1., there are two type of elements existed in the process, which are: Stakeholders and Activities. The following describes these elements in details.

#### ***Stakeholders***

- Applicant/Training Provider

Applicant or Training provider is an institute that wishes to provide certified courses to individuals who are interested. They will be the one who is responsible for issuing certificates for those who successfully pass their examinations.

- Accreditation Committee

A committee setup to responsible for accrediting and re-auditing training providers. This committee may consist of both ICT professional and committee who are certified in an accreditation process(es).

### ***Activities***

- Submit application for "Accredited Training Provider"

This particular activity is done by applicant or training provider.

- Review application & documents

This activity is conducted by the accreditation committee, who will check for, for example:

- Legal documents with regard to setting up of the training center
- Documents which show qualifications of their instructors concerned
- Training materials and examination papers with regard to all concerned courses

- Prepare on-site visit

This activity is performed by the accreditation committee, which could involve:

- Checking of all required documents
- Preparing audit documents
- Confirming the on-site visit with applicant

- On-Site visit

This task is conducted on premise of the training provider by the accreditation committee in order to see if the provider is qualified for all courses proposed.

- Report on result of the accreditation

This task is done by the accreditation committee to report to the training provider on whether they are accredited.

#### **4.3.3 Approach to re-auditing accredited training providers**

In order to ensure standard of all certified courses managed by those accredited training provided, a re-auditing process has to be put in place. Depending on ratio between accredited training providers and the number of auditing committee, the re-auditing should be conducted every 2-3 years. Activities that could be involved in this re-auditing process are:

- Inspect documents which show qualifications of their instructors concerned
- Inspect training materials and examination papers with regard to all concerned courses
- Inspect example of 10 (or more) examinations and their results that have been done by previous trainees
- Interview both previous and existing trainees (2-3 trainees per group)

#### **4.3.4 Mapping to different standards**

For those countries that already have ICT skills standard in place, an important question when using this ASEAN standard is "How can I map what I already have to this new standard?". The following materials explain this mapping mechanism in details.

Recall the three levels of competency of the ASEAN ICT skills standard. The following two steps explain how to map the ASEAN standard with another country standard.

Assume that country A would like to map their standard to the ASEAN standard.

**Step 1:** Understand "definitions" of all levels of competency of ASEAN

**Step 2:** Compare “definition” of each level of competency of their standard with what currently in ASEAN standard. The result of this step could be:

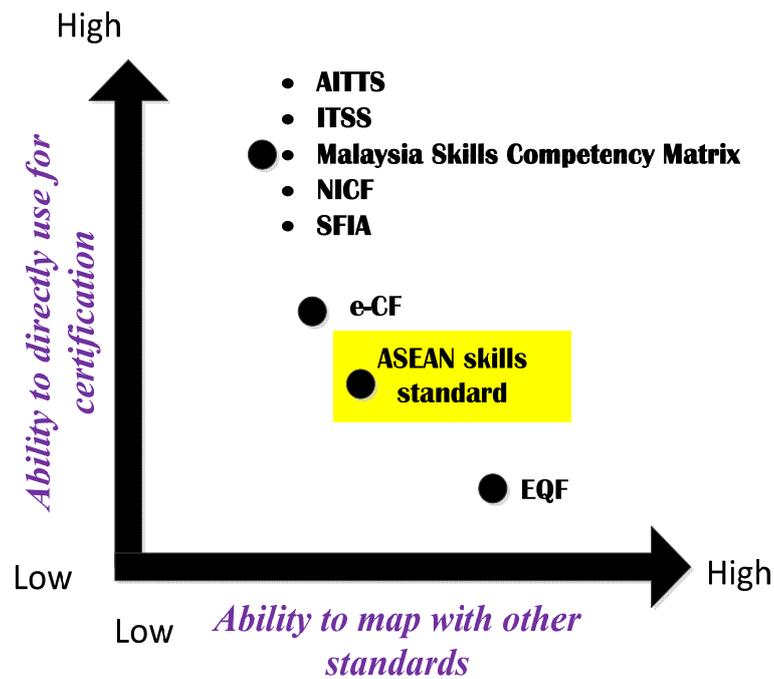
- A particular level of competency used in the ASEAN standard match with exactly one level of competency of their standard
- A particular level of competency existed in ASEAN standard covers more than one level of their competency, or
- A particular level of competency of their standard covers more than one level of competency of the ASEAN standard

Note that, when mapping standards, it is possible to see two or more results mentioned above occur together. For example, in mapping between EQF and e-CF of Europe, Level e-2 of e-CF is equal to Level 4 and 5 of EQF combined together.

In addition, when considering “mapping” of standards, an interesting point is that the standard such as EQF has been mapped to many (if not all) standards in Europe. On the other hand, the other standards, if comparison between standards is required, have to be mapped through EQF standard.

On the other hand, when considering **contents** of EQF standard, all **definitions** used in the standard are quite generic in nature. This is to allow mapping to be done easily. According to our analysis, generic contents encourage mapping between standards, however, this kind of contents is not suitable for certification due to lacking of sufficient details for evaluation.

Figure 4.2. visualizes “*Ability to directly use for certification*” and “*Ability to map with other standards*” of most of the standards considered in this project.



**Figure 4.2.:** Positions of most of the standards considered in this project

In case of ASEAN skills standard, the standard has been developed with the aim of balancing both using the standard as a reference for:

- mapping between two or more standards, and
- accrediting training providers

#### 4.3.5 Mapping ASEAN ICT skills standard with currently existed standards in ASEAN

Table 4.3. shows comparisons between the ASEAN ICT skills standard and ICT skills standards currently existed within ASEAN.

Competency Level (ASEAN)	Description (ASEAN)	Indonesia	Malaysia	Philippines	Singapore	Thailand	Vietnam
Level 3: Advanced Level	Has professional knowledge and skills in both technical and management to lead a team in inexperienced environment	Level 7-9	Level 4: Advanced	Level 3: Specialist	Level 4: Senior Management	Level 4: IT professionals	Level 4: IT professionals
					Level 3: Expert /Management		
Level 2: Intermediate Level	Has professional knowledge and skills to perform a given task(s) independently, and, if required, can supervise others; understand a number of comparative approaches to problems in their fields; and be able to apply them efficiently	Level 4-6	Level 3: Senior	Level 2: Advance	Level 2: Specialist	Level 3: Perform all assigned duties independently	Level 3: Perform all assigned duties independently
Level 1: Basic Level	Has basic knowledge and skills which is adequate to perform a given task(s) under supervision of management.	Level 1-3	Level 2: Intermediate	Level 1: Basic	Level 1: Entrant	Level 2: Perform assigned duties under the supervision	Level 2: Perform assigned duties under the supervision

**Table 4.3.:** Result of comparisons between ASEAN ICT skills standard and ICT skills standards currently existed within ASEAN

In Table 4.3., for example, according to the three levels of competency used in ASEAN ICT skills standard, competency level 2 of Malaysia's standard is equal to level 1 of the ASEAN skills standard, Level 3 of Malaysian's standard is equal to level 2 of the ASEAN skills standard, and so on. However, note that mapping of levels between two standards not necessary to be only one-to-one relationship. For example, competency level 3 of ASEAN skills standard is equal to level 3 and 4 of Singapore's standard combined together. This situation also occurs with mapping between EQF and e-CF standards used in Europe.

Note also that according to the fact that most of the standards existed to date do not have equal number of competency levels, as a result, it is not necessary that all levels of competency of one standard have to be mapped solely with competency levels of another standard. For example, there are five levels of competency used in Malaysia's standard, but, according to the definitions used in both Malaysia and ASEAN's standards, only level 2, 3, and 4 are mapped to competency levels of ASEAN skills standard. Again, similar situation also exists when mapping between a number of standards used in Europe and Japan.

#### **4.3.6 Maintaining the standard**

Every standard existed in the world have to be updated and maintained. It is recommended that TELSOM has to lead this standard maintaining task. It should be reviewed every 2-3 years.

### **4.4 Conclusion**

Only a few years from now, all ten countries of ASEAN will join together in order to become a single economic community. Despite large amount of benefits that will result from this integration, there are a number of issues waiting to be resolved before the incorporation can actually take place. One of the most important issues that have to be systematically tackled is the issue of having freer flow of skilled labor within ASEAN. One of the main puzzles required toward

the freer flow of this group of taskforces is to have a set of “standard definitions” for the skills to be used as a reference when ones want to work in another country(ies) within ASEAN.

This project proposes a set of definitions for 5 set of area-of-skill, which are: Software Development, ICT Project Management, Enterprise Architecture Design, Network and System Administration, and Information System and Network Security. The 5 areas of skill have also been broken into a number of sub-areas. The proposed standard definitions are classified into three competency levels, which are: Basic, Intermediate, and Advanced Levels. When compared to other currently exist standard definitions used in other countries, the proposed set of definitions is developed for both *mapping with others* and used as a basic set of *definitions for certification* purpose.

Finally, despite the fact that the standard has already developed, one of the most important issues after this is “How can the standard be maintained?”. Every standard has to be updated or maintained. Apparently, a solution is to leave this particular task to TELSOM to organize maintenance of the standard every 2-3 years. This will ensure that the standard, as much as possible, is up to date with the technologies that, as we know, rapidly changing almost every day.

## 5. Details of the Standard

Similar to other standards, there is a definition of described for all skills at a given competency level. The definition generally describes detailed requirements for a certain skill at a particular level of competency. As mentioned earlier, rather than coining new definitions for these entire well-known fields of studies, definitions used in this standard are adapted from what already existed in the field each of the field. The followings are definitions proposed in this standard.

In order to ensure standard of writing for all definitions, according to the 3 levels of competency used in this standard, the following format of writing is used.

1. Find definition for a certain skill, which is used by a number of organizations.
2. For competency level 1, its definition is begun by saying that "Under supervision of senior...", then followed by definition of skill.
3. For competency level 2, its definition is started with saying that "Has ability to supervise", this followed definition of skill which is the same as what used in level 1, and then ended the definition with "Responsible for a group of ... with no more than 10 members in the team."
4. For competency level 3, its definition is started with saying that "Has ability to manage one or more team", this followed definition of skill which is the same as what used in level 1, and then ended the definition with "Responsible for a group of ... with no more than 10-50 members in total."

Note that for competency level 3, if someone has experience of managing more than 50 members in a team, if they like, they can also be considered as having 3<sup>rd</sup> level of competency. The limit of 50 members is only used in this first version of standard to begin with. If required, this will allow extension of the standard at later stage, for example, having level 4, 5, and so on.

Skill	Source of Sub-areas
<p><b>1. Software Development</b></p> <ul style="list-style-type: none"> <li>○ Business Analysis</li> <li>○ System Analysis</li> <li>○ Software Design</li> <li>○ Software Development</li> <li>○ Software Testing</li> <li>○ Quality Assurance</li> </ul>	<p>IBM and Thomson Reuters</p>
<p><b>2. ICT Project Management</b></p> <ul style="list-style-type: none"> <li>○ Project Management</li> <li>○ Agile Project Management</li> <li>○ QA for Project Management</li> </ul>	<p>Project Management Institute or PMI</p>
<p><b>3. Enterprise Architecture Design</b></p> <ul style="list-style-type: none"> <li>○ Enterprise Architecture</li> <li>○ Security Architecture</li> <li>○ Integration Architecture</li> </ul>	<p>IBM and The FEAC™ Institute, in partnership with the California State University at East Bay and the National University in San Diego</p>
<p><b>4. Network and System Administration</b></p> <ul style="list-style-type: none"> <li>○ Network Architecture</li> <li>○ Network Engineer</li> <li>○ System Architect</li> <li>○ System Engineer</li> </ul>	<p>CISCO related training parties and Salary guide from Robert Half</p>

Skill	Source of Sub-areas
<p><b>5. Information System and Network Security</b></p> <ul style="list-style-type: none"> <li>○ Network Security Analysis</li> <li>○ Network Security Engineer</li> <li>○ System Security Analysis</li> <li>○ System Security Engineer</li> <li>○ Data Security Analysis</li> <li>○ Data Security Engineer</li> <li>○ Information Security Management System Engineer</li> </ul>	<p>A number of ISSA chapters and Salary guide from Robert Half</p>

The following template is used for listing out all definitions in this standard.

<b>Skill:</b>	
<b>Sub-Area:</b>	
<b>Level</b>	<b>Definition</b>
1	
2	
3	

(1) is the main group of skill. Therefore, it will be one of the five groups of skill interested in this project.

(2) is the sub-area of skills as listed above. Each table will have one sub-area only.

(3) is the three levels of competency used in this standard.

(4) is the actual "definition" for all three levels of competency for a given sub-area of skill.

## **Software Development**

<b>Skill: Software Development</b>	
<b>Sub-Area: Business analysis</b>	
<b>Level</b>	<b>Definition</b>
3	Has ability to manage one or more team in communicating with clients and domain experts when gathering their requirements, resolving clients issues, creating and maintaining documentation related to requirements, performing functional reviews of system, and supporting users during their system validations. Responsible for a group of analysts with 10-50 members in total.
2	Has ability to supervise a team in communicating with clients and domain experts when gathering their requirements, resolving clients issues, creating and maintaining documentation related to requirements, performing functional reviews of system, and supporting users during their system validations. Responsible for a group of analysts with no more than 10 members in the team.
1	Under supervision of senior analysts, has ability to directly communicate efficiently with clients and domain experts in gathering their requirements, resolving clients issues, creating and maintaining documentation related to requirements, performing functional reviews of system, and supporting users during their system validations.

<b>Skill: Software Development</b>	
<b>Sub-Area: System analysis</b>	
<b>Level</b>	<b>Definition</b>
3	Has ability to manage one or more team in performing feasibility analysis, cost benefit analysis and return-on-investment, suggest alternative solutions, create and maintain data and process models. Also, able to assist project management in scoping of the project, recommending deliverable priorities of all sub-systems, and planning. Responsible for a group of analysts with no more than 10-50 members in total.
2	Has ability to supervise a team in performing feasibility analysis, cost benefit analysis and return-on-investment, suggest alternative solutions, create and maintain data and process models. Also, able to assist project management in scoping of the project, recommending deliverable priorities of all sub-systems, and planning. Responsible for a group of analysts with no more than 10 members in the team.
1	Under supervision of senior system analyst, has ability to perform feasibility analysis, cost benefit analysis and return-on-investment, suggest alternative solutions, create and maintain data and process models. Also, able to assist project management in scoping of the project, recommending deliverable priorities of all sub-systems, and planning.

<b>Skill: Software Development</b>	
<b>Sub-Area: Software design</b>	
<b>Level</b>	<b>Definition</b>
3	Has ability to lead design aspect of all responsible projects manage one or more team in designing software by using a set of modeling tools and techniques widely recognized and suitable to a problem at hand. Responsible for a group of designers with no more than 10-50 members in total.
2	Has ability to lead design aspect of a project and supervise a team in designing software by using a set of modeling tools and techniques widely recognized and suitable to a problem at hand. Responsible for a group of designers with no more than 10 members in the team.
1	Under supervision of senior software designer, has ability to design software by using a set of modeling tools and techniques widely recognized and suitable to a problem at hand.

<b>Skill: Software Development</b>	
<b>Sub-Area: Software development</b>	
<b>Level</b>	<b>Definition</b>
3	Given a set of requirements of a software project, regardless of whether the requirements are for a new or existing software, has ability to lead technical aspect of all responsible projects and manage one or more team in working closely with analysts, designers, and related staff in proposing ideas for system improvements, producing detailed specifications, writing the program codes, conducting unit-test of the software. Responsible for a group of developers with no more than 10-50 members in total.
2	Given a set of requirements of a software project, regardless of whether the requirements are for a new or existing software, has ability to lead technical aspect of a responsible project and supervise a team in working closely with analysts, designers, and related staff in proposing ideas for system improvements, producing detailed specifications, writing the program codes, conducting unit-test of the software. Responsible for a group of developers with no more than 10 members in the team.
1	Given a set of requirements of a software project, regardless of whether the requirements are for a new or existing software, under supervision of senior software developer, has ability to work closely with analysts, designers, and related staff in proposing ideas for system improvements, producing detailed specifications, writing the program codes, conducting unit-test of the software.

<b>Skill: Software Development</b>	
<b>Sub-Area: Software testing</b>	
<b>Level</b>	<b>Definition</b>
3	Given a set of requirements of a software project, regardless of whether the requirements are for a new or existing software, has ability to manage one more team of testers in developing and maintaining test plan, test strategy, test cases, and systematically design test values to be used for integration tests, system test, load test, and stress test, if required. Responsible for a group of testers with no more than 10-50 members in total.
2	Given a set of requirements of a software project, regardless of whether the requirements are for a new or existing software, has ability to supervise development and maintenance of test plan, test strategy, test cases, and systematically design test values to be used for integration tests, system test, load test, and stress test, if required. Responsible for a group of testers with no more than 10 members in the team.
1	Given a set of requirements of a software project, regardless of whether the requirements are for a new or existing software, under supervision of senior software tester, has ability to develop and maintain test plan, test strategy, test cases, and systematically design test values to be used for integration tests, system test, load test, and stress test, if required.

<b>Skill: Software Development</b>	
<b>Sub-Area: Quality assurance</b>	
<b>Level</b>	<b>Definition</b>
3	Given an agreed standard, has ability to manage one or more team in performing quality engineering, inspecting/reviewing of all documentation used in a software project according to the agreed standard, communicating issues identified during quality assurance activities, and proposing solution(s) to process improvements to management. Responsible for a group of quality assurance engineers with no more than 10-50 members in total.
2	Given an agreed standard, has ability to supervise a team in performing quality engineering, inspecting/reviewing of all documentation used in a software project according to the agreed standard, communicating issues identified during quality assurance activities, and proposing solution(s) to process improvements to management. Responsible for a group of quality assurance engineers with no more than 10 members in the team.
1	Under supervision of senior software quality assurance engineer, given an agreed standard, has ability to perform quality engineering, inspect/review of all documentation used in a software project according to the agreed standard, communicate issues identified during quality assurance activities, and propose solution(s) to process improvements to management.

# **ICT Project Management**

<b>Skill: ICT Project Management</b>	
<b>Sub-Area: Project Management</b>	
<b>Level</b>	<b>Definition</b>
3	Has ability to carry out Scope Planning, Scope Definition, Create WBS, Scope Verification, and Scope Control, as a person responsible for the project with between 10-50 members in the team.
2	Has ability to carry out Scope Planning, Scope Definition, Create WBS, Scope Verification, and Scope Control, as a person responsible for the project with no more than 10 members in the team.
1	As a project member, has ability to carry out Scope Planning, Scope Definition, Create WBS, Scope Verification, and Scope Control under the direction of the project manager.

<b>Skill: ICT Project Management</b>	
<b>Sub-Area: Agile Project Management</b>	
<b>Level</b>	<b>Definition</b>
3	By using an agile-based method such as SCRUM as a basis for software development, has ability to manage requirements, development team members, product owners, and all related stakeholders in order to develop software, as a person responsible for one or more projects with no more than 10-50 members in total.
2	By using an agile-based method such as SCRUM as a basis for software development, has ability to manage requirements, development team members, product owners, and all related stakeholders in order to develop software, as a person responsible for the project with no more than 10 members in the team.
1	As a project member, by using an agile-based method such as SCRUM as a basis for software development, has ability to manage requirements, development team members, product owners, and all related stakeholders in order to develop software under the direction of the project manager.

<b>Skill: ICT Project Management</b>	
<b>Sub-Area: QA for Project Management</b>	
<b>Level</b>	<b>Definition</b>
3	By using a well-known project management standard(s) as a framework for quality assurance, has ability to manage evaluating and ensuring that the project management discipline is set up to produce quality deliverables, communicating issues identified during quality assurance activities, and proposing solution(s) to process improvements to management. Responsible for a group of quality assurance engineers with no more than 10-50 members in the team.
2	By using a well-known project management standard(s) as a framework for quality assurance, has ability to supervise evaluating and ensuring that the project management discipline is set up to produce quality deliverables, communicating issues identified during quality assurance activities, and proposing solution(s) to process improvements to management. Responsible for a group of quality assurance engineers with no more than 10 members in the team.
1	As a project member, by using a well-known project management standard(s) as a framework for quality assurance has ability to evaluate and ensure that the project management discipline is set up to produce quality deliverables, communicate issues identified during quality assurance activities, and propose solution(s) to process improvements to management.

# **Enterprise Architecture Design**

<b>Skill: Enterprise Architecture Design</b>	
<b>Sub-Area: Enterprise architecture</b>	
<b>Level</b>	<b>Definition</b>
3	By using a well-known enterprise architecture concept, modeling languages, and technique, has ability to oversee an entire architect of an organization, manage one or more team in gathering of required information, analyzing the required information, creating of architecture, suggesting a solution(s) or strategy(ies) in making sure that: (1) the IT and company are in the same path; and (2) leads a company's business strategy and defines IT systems architecture to support that strategy, anticipating future needs to management, and maintaining all blueprints created. Responsible for a group of enterprise architect with no more than 10-50 in total.
2	By using a well-known enterprise architecture concept, modeling languages, and technique, has ability to supervise gathering of required information, analyzing the required information, creating of architecture, suggesting a solution(s) or strategy(ies) in making sure that: (1) the IT and company are in the same path; and (2) leads a company's business strategy and defines IT systems architecture to support that strategy, anticipating future needs to management, and maintaining all blueprints created. Responsible for a group of enterprise architect with no more than 10 members in the team.
1	Working under supervision of a senior enterprise architect, by using a well-known enterprise architecture concept, modeling languages, and technique, has ability to gather required information, analysis, create, suggest a solution(s) or strategy(ies) in making sure that: (1) the IT and company are in the same path; and (2) leads a company's business strategy and defines IT systems architecture to support that strategy, anticipate future needs to management, and maintaining all blueprints created.

<b>Skill: Enterprise Architecture Design</b>	
<b>Sub-Area: Security architecture</b>	
<b>Level</b>	<b>Definition</b>
3	By using a well-known enterprise architecture concept, modeling languages, and technique, especially focused on "Security architecture", has ability to oversee an entire security architect of an organization, manage one or more team in gathering of required information, analyzing the required information, creating of architecture, suggesting a solution(s) or strategy(ies) in making sure that: (1) the IT security and company are in the same path; and (2) leads a company's business strategy and defines security systems architecture to support that strategy, anticipating future needs to management, and maintaining all blueprints created. Responsible for a group of enterprise architect with no more than 10-50 in total.
2	By using a well-known enterprise architecture concept, modeling languages, and technique, especially focused on "Security architecture", has ability to supervise a team in gathering required information, analyzing the gathered information, creating of architecture, suggesting a solution(s) or strategy(ies) in making sure that: (1) the IT security and company are in the same path; and (2) leads a company's business strategy and defines security systems architecture to support that strategy, anticipating future needs to management, and maintaining all blueprints created. Responsible for a group of security architect with no more than 10 members in the team.
1	Working under supervision of a senior security architect, by using a well-known enterprise architecture concept, modeling languages, and technique, especially focused on "Security architecture", has ability to gather required information, analysis, create, suggest a solution(s) or strategy(ies) in making sure that: (1) the IT security and company are in the same path; and (2) leads a company's business strategy and defines security systems architecture to support that strategy, anticipate future needs to management, and maintaining all blueprints created.

<b>Skill: Enterprise Architecture Design</b>	
<b>Sub-Area: Integration architecture</b>	
<b>Level</b>	<b>Definition</b>
3	By using a well-known enterprise architecture concept, modeling languages, and technique, especially focused on "Integration architecture", has ability to oversee an entire integration architect of an organization and manage one or more team in gathering required information, analyzing the information gathered, creating of architecture, suggesting a solution(s) or strategy(ies) in making sure that: (1) the integration of all architects and company are in the same path; and (2) leads a company's business strategy and defines integration architecture to support that strategy, anticipate future needs to management, and maintaining the integrated blueprint created. Responsible for a group of security architect with no more than 10-50 members in total.
2	By using a well-known enterprise architecture concept, modeling languages, and technique, especially focused on "Integration architecture", has ability to supervise a team in gathering required information, analyzing the information gathered, creating of architecture, suggesting a solution(s) or strategy(ies) in making sure that: (1) the integration of all architects and company are in the same path; and (2) leads a company's business strategy and defines integration architecture to support that strategy, anticipate future needs to management, and maintaining the integrated blueprint created. Responsible for a group of security architect with no more than 10 members in the team.
1	Working under supervision of a senior integration architect, by using a well-known enterprise architecture concept, modeling languages, and technique, especially focused on "Integration architecture", has ability to gather required information, analysis, create, suggest a solution(s) or strategy(ies) in making sure that: (1) the integration of all architects and company are in the same path; and (2) leads a company's business strategy and defines integration architecture to support that strategy, anticipate future needs to management, and maintaining the integrated blueprint created.

## **Network and System Administration**

<b>Skill: Network and System Administration</b>	
<b>Sub-Area: Network architecture</b>	
<b>Level</b>	<b>Definition</b>
3	Has ability to oversee an entire network architecture of an organization and manage one or more groups of network architects in using of network computer-aided design (CAD) software packages to create/optimize/maintain network designs, developing plans or budgets for network equipment replacement, and, if required, estimating time and materials needed to complete network related projects. Responsible for a group of network architect with no more than 10-50 members in total.
2	Has ability to supervise using of network computer-aided design (CAD) software packages to create/optimize/maintain network designs, developing plans or budgets for network equipment replacement, and, if required, estimating time and materials needed to complete network related projects. Responsible for a group of network architect with no more than 10 members in the team.
1	Working under supervision of a senior network architect, has ability to use network computer-aided design (CAD) software packages to create/optimize/maintain network designs, develop plans or budgets for network equipment replacement, and, if required, estimate time and materials needed to complete network related projects.

<b>Skill: Network and System Administration</b>	
<b>Sub-Area: Network engineer</b>	
<b>Level</b>	<b>Definition</b>
3	Has ability to oversee an entire network operation of an organization and manage one or more team to operational monitoring of the voice and network infrastructures, installs network hardware, conduct day to day operation of the networks and carrying out scheduled maintenance activities, resolution of network faults, carry out approved changes to the voice and network infrastructures, and maintain documentation of the environment and operational procedures. Responsible for a group of network engineer with no more than 10-50 members in total.
2	Has ability to supervise a team to operational monitoring of the voice and network infrastructures, installs network hardware, conduct day to day operation of the networks and carrying out scheduled maintenance activities, resolution of network faults, carry out approved changes to the voice and network infrastructures, and maintain documentation of the environment and operational procedures. Responsible for a group of network engineer with no more than 10 members in the team.
1	Work under supervision of senior network engineer, has ability to operational monitoring of the voice and network infrastructures, installs network hardware, conduct day to day operation of the networks and carrying out scheduled maintenance activities, resolution of network faults, carry out approved changes to the voice and network infrastructures, and maintain documentation of the environment and operational procedures.

**Skill: Network and System Administration****Sub-Area: System architect**

<b>Level</b>	<b>Definition</b>
3	Has ability to oversee overall system architect of an organization and manage a team in developing high level design choices for the software, hardware, infrastructure, and interfaces used between them, determine development tools and techniques to be used, including validation requirements, communicating with various parties in an organization to evaluate feasibility of requirements and determine priorities for development with regard to business's goal(s) set by the organization. Responsible for a group of system architects with no more than 10-50 members in total.
2	Has ability to supervise a team in developing high level design choices for the software, hardware, infrastructure, and interfaces used between them, determine development tools and techniques to be used, including validation requirements, communicating with various parties in an organization to evaluate feasibility of requirements and determine priorities for development with regard to business's goal(s) set by the organization. Responsible for a group of system architects with no more than 10 members in the team.
1	Work under supervision of senior system architect, has ability to develop high level design choices for the software, hardware, infrastructure, and interfaces used between them, determine development tools and techniques to be used, including validation requirements, communicate with various parties in an organization to evaluate feasibility of requirements and determine priorities for development with regard to business's goal(s) set by the organization.

<b>Skill: Network and System Administration</b>	
<b>Sub-Area: System engineer</b>	
<b>Level</b>	<b>Definition</b>
3	Has ability to manage one or more them of system engineer in designing, implementing, and maintaining computer systems, software and networks include understanding complex system requirements, determining system specifications, and processes. Responsible for a group of system engineer with no more than 10 members in the team. Responsible for a group of system engineer with no more than 10-50 members in total.
2	Has ability to supervise design, implement, and maintain computer systems, software and networks include understanding complex system requirements, determining system specifications, and processes. Responsible for a group of system engineer with no more than 10 members in the team.
1	Work under supervision of senior system engineer, has ability to design, implement, and maintain computer systems, software and networks includes understanding complex system requirements, determining system specifications, and processes.

## **Information System and Network Security**

<b>Skill: Information System and Network Security</b>	
<b>Sub-Area: Network security analysis</b>	
<b>Level</b>	<b>Definition</b>
3	Has ability to manage one or more teams of network security analyst in planning and introducing appropriate procedures together with security measure that can be used to within an organization in order to protect its infrastructure from security breaches and computer viruses, when incident with regard to security occurred, investigating the issue and identify root of the problem, and promoting a proactive approach to the protect the organization's networking system. Responsible for a group of network security analysts with no more than 10-50 members in total.
2	Has ability to supervise a network security analysis team in planning and introducing appropriate procedures together with security measure that can be used to within an organization in order to protect its infrastructure from security breaches and computer viruses, when incident with regard to security occurred, investigating the issue and identify root of the problem, and promoting a proactive approach to the protect the organization's networking system. Responsible for a group of network security analysts with no more than 10 members in the team.
1	Work under supervision of senior security analyst, has ability to plan and introduce appropriate procedures together with security measure that can be used to within an organization in order to protect its infrastructure from security breaches and computer viruses, when incident with regard to security occurred, investigate the issue and identify root of the problem, and promote a proactive approach to the protect the organization's networking system.

<b>Skill: Information System and Network Security</b>	
<b>Sub-Area: Network security engineer</b>	
<b>Level</b>	<b>Definition</b>
3	Has ability to manage one or more teams of network security engineers to gather and analyze network security needs, design, integrate, and installation of hardware and software, analyze and correct network problems, maintain and monitor security systems such as firewalls and intrusion detection systems. Responsible for a group of network security engineers with no more than 10-50 members in total.
2	Has ability to supervise a team to gather and analyze network security needs, design, integrate, and installation of hardware and software, analyze and correct network problems, maintain and monitor security systems such as firewalls and intrusion detection systems. Responsible for a group of network security engineers with no more than 10 members in the team.
1	Work under supervision of senior network security engineer, has ability to gather and analyze network security needs, design, integrate, and installation of hardware and software, analyze and correct network problems, maintain and monitor security systems such as firewalls and intrusion detection systems.

<b>Skill: Information System and Network Security</b>	
<b>Sub-Area: System security analysis</b>	
<b>Level</b>	<b>Definition</b>
3	Has ability to manage one or more team of system security analysts in developing a framework(s) for controls and levels of access, including develop standards, policies, and procedures, coordinate with facilities security, and recommending improvements for computer and terminal physical security. Responsible for a group of system security analysts with no more than 10-50 members in total.
2	Has ability to supervise a team in developing a framework for controls and levels of access, including develop standards, policies, and procedures, coordinate with facilities security, and recommending improvements for computer and terminal physical security. Responsible for a group of system security analysts with no more than 10 members in the team.
1	Work under supervision of senior security analysts, has ability to develop a framework for controls and levels of access, including develop standards, policies, and procedures, coordinate with facilities security, and recommend improvements for computer and terminal physical security.

<b>Skill: Information System and Network Security</b>	
<b>Sub-Area: System security engineer</b>	
<b>Level</b>	<b>Definition</b>
3	Has ability to manage one or more team of system security engineers in developing and implementing security solutions, including the ongoing assessment and tracking of activities within organization according to required security guidelines across the enterprise computing environment, ensuring authorized access, monitoring information requests by new programming, and recommending improvements. Responsible for a group of system security engineers with no more than 10-50 members in total.
2	Has ability to supervise a team in developing and implementing security solutions, including the ongoing assessment and tracking of activities within organization according to required security guidelines across the enterprise computing environment, ensuring authorized access, monitoring information requests by new programming, and recommending improvements. Responsible for a group of system security engineers with no more than 10 members in the team.
1	Work under supervision of senior security engineer, has ability to develop and implement security solutions, including the ongoing assessment and tracking of activities within organization according to required security guidelines across the enterprise computing environment, ensure authorized access, monitoring information requests by new programming, and recommend improvements.

<b>Skill: Information System and Network Security</b>	
<b>Sub-Area: Data security analysis</b>	
<b>Level</b>	<b>Definition</b>
3	Has ability to manage one or more team in communicating with users to discuss issues such as computer data access needs and security violations, developing and maintaining documents related to data security and emergency measures policies, procedures, and tests, monitoring use of data files and regulate access to safeguard information in computer files. Responsible for a group of data security analysts with no more than 10 members in the team. Responsible for a group of data security analysts with no more than 10-50 members in total.
2	Has ability to supervise a team in communicating with users to discuss issues such as computer data access needs and security violations, developing and maintaining documents related to data security and emergency measures policies, procedures, and tests, monitoring use of data files and regulate access to safeguard information in computer files. Responsible for a group of data security analysts with no more than 10 members in the team.
1	Work under supervision of senior data security analyst, has ability to communicate with users to discuss issues such as computer data access needs and security violations, develop and maintain documents related to data security and emergency measures policies, procedures, and tests, monitor use of data files and regulate access to safeguard information in computer files.

<b>Skill: Information System and Network Security</b>	
<b>Sub-Area: Data security engineer</b>	
<b>Level</b>	<b>Definition</b>
3	Given a set of data security controls, procedures and assessments identified, has ability to manage one or more team of data security engineers in overseeing for any results or weaknesses identified, communicate security procedures to program management and the end customer, review and evaluate progress and results, and recommend major changes in procedures, if necessary. Responsible for a group of data security engineers with no more than 10-50 members in total.
2	Given a set of data security controls, procedures and assessments identified, has ability to supervise a team of data security engineers in overseeing for any results or weaknesses identified, communicate security procedures to program management and the end customer, review and evaluate progress and results, and recommend major changes in procedures, if necessary. Responsible for a group of data security engineer with no more than 10 members in the team.
1	Given a set of data security controls, procedures and assessments identified, by working under supervision of senior data security engineer, has ability to oversee for any results or weaknesses identified, communicate security procedures to program management and the end customer, review and evaluate progress and results, and recommend major changes in procedures, if necessary.

<b>Skill: Information System and Network Security</b>	
<b>Sub-Area: Information Security Management System engineer</b>	
<b>Level</b>	<b>Definition</b>
3	Has ability to manage one or more teams in developing and continuously improving organization's information security management system according to an industrial standard(s) and best practices, designing, implementing and documenting information security concepts and controls for the organization, and performing information security audits and vulnerability assessments. Responsible for a group of ISMS engineers with no more than 10-50 members in total.
2	Has ability to supervise a team in developing and continuously improving organization's information security management system according to an industrial standard(s) and best practices, designing, implementing and documenting information security concepts and controls for the organization, and performing information security audits and vulnerability assessments. Responsible for a group of ISMS engineers with no more than 10 members in the team.
1	Work under supervision of senior ISMS engineer, has ability to develop and continuously improve organization's information security management system according to an industrial standard(s) and best practices, design, implement and document information security concepts and controls in the organization, and perform information security audits and vulnerability assessments.







Ministry of Information and Communication Technology

Faculty of Science and Technology, Assumption University

<http://www.mict.go.th/>

<http://www.scitech.au.edu>