OCCUPATIONAL FRAMEWORK

SECTION J: INFORMATION AND COMMUNICATION

DIVISION 62: COMPUTER PROGRAMMING, CONSULTANCY AND RELATED ACTIVITIES

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Occupational Framework
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ABSTRACT

An Occupational Framework (OF) was the outcome of the analysis conducted in identifying the work scope of the occupational areas in terms of competencies. It was used to analyse skilled manpower competency requirements for the industry. The OF aims to provide an overall view of the industry's Occupational Structure (OS) and identified skills gaps, critical job titles and Occupational Descriptions (OD) that would assist in further understanding the job requirements of the various occupations in the industry. Department of Skills Development (DSD) was the custodian of this document, where the OF identified the suitable occupational areas which either require development of skills training programmes or the reviewed and enhancement of existing skills training programmes. The OF for Computer Programming, Consultancy and Related Activities are based on the Malaysian Standards Industrial Classification 2008 (MSIC 2008) under Section J: Information and Communication, Division 62: Computer Programming, Consultancy and Related Activities. This document was divided into several chapters, Chapters 1 included the standard definitions of terminology used in DSD skills training system and documentation, followed by the objectives, scope and justification of the OF development. Chapter 2 included the industry overview highlighting the definition and scope of the industry, stakeholders, legislation, initiatives and market intelligence of the industry. Chapter 3 explained the methodology used in the OF development such as qualitative analysis through brainstorming discussion sessions. Chapter 4 discussed the findings from the focus group discussion conducted that be translated into the OS, OD, jobs in demand, skills in demand and emerging skills. Lastly, Chapter 5 concluded the total number of job area identified was 14 with 43 job titles and 21 job titles identified as critical job titles and 6 job titles identified related to Industrial Revolution 4.0 (IR4.0) which was recommended by the National Occupational Skills Standard (NOSS) or National Competency Standard (NCS) that was develop based on the jobs in demand identified in this OF and the skills in demand plus emerging skills that should had included in the NOSS and skills training curriculum under DSD.

ABSTRAK

Kerangka Pekerjaan (OF – *Occupational Framework*) adalah hasil analisis yang dijalankan dalam mengenalpasti skop kerja bidang kerja dari segi kompetensi. Ia digunakan untuk menganalisis keperluan kecekapan tenaga kerja mahir untuk industri. OF bertujuan memberikan pandangan keseluruhan mengenai Struktur Pekerjaan (OS – *Occupational Structure*) industri dan mengenalpasti jurang kemahiran, jawatan pekerjaan kritikal dan Deskripsi Kerja (OD – *Occupational Description*) yang akan membantu dalam memahami lagi keperluan kerja pelbagai pekerjaan dalam industri. Jabatan Pembangunan Kemahiran ialah jabatan yang bertanggungjawab dalam membangunkan dokumen ini, yang OF mengenal pasti bidang pekerjaan yang sesuai sama ada memerlukan pembangunan program latihan kemahiran atau kajian semula dan peningkatan program latihan kemahiran yang sedia ada. Pemrograman Komputer, Perundingan dan Aktiviti Berkaitan adalah berdasarkan Klasifikasi Perindustrian Piawaian Malaysia 2008 (MSIC 2008 – *Malaysia Standard Industrial Classification 2008*) di bawah Seksyen J - Maklumat dan Komunikasi, Bahagian 62 - Pengaturcaraan Komputer, Perundingan dan Aktiviti Berkaitan. Dokumen ini dibahagikan kepada beberapa bab iaitu, Bab 1 merangkumi takrifan istilah yang digunakan dalam sistem latihan kemahiran Jabatan Pembangunan Kemahiran dan dokumentasi, diikuti oleh objektif, skop dan justifikasi Pembangunan Kerangka Pekerjaan. Bab 2 merangkumi gambaran industri yang menonjolkan definisi dan skop industri, pihak berkepentingan, perundangan, inisiatif dan kecerdasan pasaran. Bab 3 menjelaskan metodologi yang digunakan dalam pembangunan seperti analisis kualitatif melalui sesi perbincangan berkumpulan. Bab 4 membincangkan penemuan daripada perbincangan kumpulan fokus yang diterjemahkan ke dalam Struktur Pekerjaan, Deskripsi Kerja, Pekerjaan yang Diperlukan, Kemahiran yang Diperlukan dan Kemahiran Baru Muncul. Akhirnya, Bab 5 menyimpulkan jumlah bidang kerja yang dikenalpasti adalah 14 bidang dengan 43 jawatan pekerjaan dan 21 jawatan pekerjaan yang dikenalpasti sebagai jawatan pekerjaan kritikal dan 6 jawatan pekerjaan yang dikenalpasti sebagai Revolusi Industri (IR – *Industrial Revolution* 4.0) dan juga mengesyorkan Standard Kemahiran Pekerjaan Kebangsaan (SKPK) atau Standard Keterampilan Kebangsaan (SKK) yang perlu dibangunkan berdasarkan pekerjaan yang diminta yang dikenal pasti dalam ini dan yang kemahiran dalam permintaan serta kemahiran baru yang perlu dimasukkan dalam kurikulum latihan SKPK dan kemahiran di bawah JPK.

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LIST OF ABBREVIATION

AI	Artificial Intelligence
BDA	Big Data Analytics
BEA	Bureau of Economic Analysis
CBT	Competency Based Training
CNII	Critical National Information Infrastructure
DDIs	Domestic Direct Investment
DOSM	Department of Statistic Malaysia
DSD	Department of Skills Development
EU	European Union
FDIs	Foreign Direct Investment
FinTech	Financial Technology
GDP	Gross Domestic Product
ICT	Information Communication Technology
IDC	International Data Corporation
IoT	Internet of Things
IP	Internet Protocol
IR4.0	Industrial Revolution 4.0
ISIC	International Standard Industrial Classification
IT	Information Technology
IT-BPM	Information Technology and Business Process Management
IKKM	*Institut Koperasi Malaysia*
LS	Low Skilled Worker
MAMPU	Malaysian Administrative Modernisation and Management Planning Unit
MASCO	Malaysia Standard Classification of Occupation
MCMC	Malaysian Communications and Multimedia Commissions
MDEC	Malaysian Digital Economy Corporation
MIDA	Malaysian Investment Development Authority
MIMOS	Malaysian National Applied Research and Development Centre
MITI	Ministry of International Trade and Industry
MQA	Malaysia Qualifications Agency

LIST OF ABBREVIATION

MQF	Malaysian Qualification Framework
MSC	Multimedia Super Corridor
MSIC	Malaysia Standard Industrial Classification
MSAP	Mandatory Standard for Access Pricing
MyIPO	Intellectual Property Corporation of Malaysia
NASSCOM	National Association of Software and Services Companies
NACSA	National Cyber Security Agency
NCS	National Competency Standard
NOSS	National Occupational Skills Standard
OA	Occupational Analysis
OECD	Organization for Economic Co-operation and Development
OF	Occupational Framework
OD	Occupational Description
ODI	Overseas Development Institute
OS	Occupational Structure
PIKOM	*Persatuan Industri Komputer dan Multimedia Malaysia*
PSISP	Public Sector ICT Strategic Plan
S	Skilled Workers
SS	Semi-Skilled Workers
SIRIM	Standard and Industrial Research Institute
SJPP	Business Loan Guarantee Scheme (*Syarikat Jaminan Pembiayaan Perniagaan*)
SME	Small Medium Enterprise
SSM	*Suruhanjaya Syarikat Malaysia*
TVET	Technical and Vocational Education and Training
US	United States
11th MP	Eleventh Malaysia Plan

GLOSSARY

3R	3Rs refers to three terms often used when talking about waste: Reduce, Reuse, and Recycle. Reducing is cutting back on the amount of trash we make, reusing is finding a new way to use trash so that we do not have to throw it out, and recycling is using trash to remake new goods that can be sold again.
Application	A computer program or a suite of computer programs that performs a particular function for the user, such as a word-processor
Artificial Intelligence	The ability of a computer to mimic human attributes in finding a solution to a problem.
Copyright	New technologies have raised all kinds of new issues relating to copyright, mainly because it has become so easy to copy materials from a variety of digital sources.
Data	An information in a form which can be processed by a computer. It can be text or sets of figures on which a computer program operates
Database	A structured collection of data that can be used for a variety of purposes. Databases are usually stored on a Hard Disc inside your computer, on a CD-ROM, or at a website
Operating System	A suite of programs that starts up when you switch on your computer and manages and runs all the other programs installed on the computer
Programming Language	A formal, structured, English-like language in which computer programs are written. The instructions, known as code, are converted into binary machine instructions via a compiler or an interpreter
Server	A computer which provides services to other computers, which are known as clients
Software	A generic term describing all kinds of computer programs, applications and operating systems

CHAPTER 1: INTRODUCTION

1.1 Introduction

This chapter explained the problem statement, objectives, scope and justification of MSIC 2008 section selection for the development of the Occupational Framework (OF) for the Section J: Information and Communication. Section J was divided into six division namely publishing activities (Division 58), motion picture, video and television programme production, sound recording and music publishing activities (Division 59), programming and broadcasting activities (Division 60), telecommunications (Division 61), computer programming, consultancy and related activities (Division 62) and information service activities (Division 63)[1]. This OF only focused on 2-digits MSIC 2008 Division 62: Computer programming, consultancy and related activities. This division included the following activities of providing expertise in the field of information technologies such as writing, modifying, testing and supporting software to meet the needs of a particular customer; planning and designing computer systems that integrate computer hardware, software and communication technologies; on-site management and operation of clients' computer systems and/or data processing facilities; providing infrastructure for hosting or data processing services; and other professional and technical computer-related activities. There were 4102 companies registered with Companies Commission of Malaysia (SSM - *Suruhanjaya Syarikat Malaysia*) related to these division with more than 225,665 persons were under the employment of this industry[2,3]. The concept of the OF and its function in skills training and curriculum development was also elaborated in this chapter.

[1] Department of Statistics Malaysia. 2008. The Malaysia Standard Industrial Classification, MSIC (2008)
[2] Department of Statistics Malaysia. 2016. Economic Census 2016- Information and Communication. Page 56
[3] Department of Statistics Malaysia. 2019. Annual Economic Survey 2018- Information and Communication. Page 22

1.2 Problem Statement

The demand on the computer programming, consultancy and related activities were increasing throughout years. The insufficient numbers of skilled worker in this industry caused drawback such as slow progress in the industry, unable to progress in term of development of the industry and also caused huge difference in technology advancement compared to other develop country. The identification of Occupational Structure (OS) is a must in order to identify the critical jobs in the industry. There have been various National Occupational Skills Standard (NOSS) documents were developed under OF for the Information and Communication of Computer programming, consultancy and related activities. However, a complete analysis on the OS of the Computer programming, consultancy and related activities was not undertaken before this. Therefore, research and study were important in order to identify the overall structure and available career paths in the industry.

1.3 Objectives of Study

The objectives of the study conducted on the computer programming, consultancy and related activities were to:

a) Produced OS for the computer programming, consultancy and related activities based on Malaysia Standard Industrial Classification 2008 (MSIC 2008);
b) Investigated competencies in demand in the Computer programming, consultancy and related activities;
c) Determined critical jobs for the industry of the Computer programming, consultancy and related activities;
d) Determined the relevant jobs title that were in line with IR4.0; and
e) Produced the Occupational Description (OD) for each job title based on the industry OS.

1.4 Scope of Study

The scope of work for the study conducted on the Computer programming, consultancy and related activities were as the following:

a) The study consisted of literature review on the current industry;
b) The study had covered expert input from relevant sector representatives for determined industry;
c) The study was focused on the development, dissemination and analysed data from industries via industry representatives;
d) The study was focused on job in demand which was in line with emerging technology requirement;
e) The focus group discussion was conducted with the sector representatives, and/or any other methods in order to achieve the study outcome;
f) The outcome of the research were the OS, OD, jobs in demand and skills in demand; and
g) The study was focused on reviews of 339 companies which were distributed throughout Selangor, Wilayah Persekutuan Kuala Lumpur and Penang. This specific location is selected because in 2017, the total value added from these 3 locations contribute to 98.2% of the total value added of information and communication services[4].

The scope of this research was based on MSIC 2008 under Section J: Information and Communication, and only focused on Division 62: Computer programming, consultancy and related activities; Group 620: Computer programming, consultancy and related activities.

[4] Annual Economic Survey 2018. Department of Statistics Malaysia

1.5 Justification for Malaysia Standard Industrial Classification 2008 (MSIC 2008) Section Selection

The scope of the Computer programming, consultancy and related activities followed the description of 2-digits MSIC 2008 Division 62 under Section J which were to provides information from expertise in the field of information technologies. For instance, writing, modifying, testing and supporting software to meet the needs of a particular customer; planning and designing computer systems that integrated computer hardware, software and communication technologies; on-site management and operation of client's computer systems and/or data processing facilities; providing infrastructure for hosting or data processing services; and other professional and technical computer-related activities.

1.6 Structure of Chapter

This section consists of an overview of the entire study which includes:

a) Chapter 1

   This chapter consist of introduction to the research, problem statement, research objective, research scope and justification based on 2-digits MSIC 2008 Division 62: Computer programming, consultancy and related activities.

b) Chapter 2

   This chapter consist of the review from the research were explained in this chapter to give further clarification about the research. The information were gained from different sources such as Department of Statistics Malaysia (DOSM).

c) Chapter 3

   This chapter consist of the research approach and method deployed to achieve the objective of the research such as the focus group discussion with expert from the industry, survey from the company related to the industry and document analysis based on published information were explained in this chapter.

d) Chapter 4

This chapter consist of the results and finding on the research based on the approach and method deployed were listed in this chapter.

e) Chapter 5

This chapter explained about the discussion, summary and conclusion on the research done. Recommendation from the expert in the industry were also listed.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter provided a brief overview of the computer programming, consultancy and related activities in Malaysia, stakeholders, related legislations, key government initiatives and policies for the industry and industry intelligence. Findings in this chapter were obtained primarily through literature review and further subsequently were confirmed by the industry experts to obtain insight on the matters at hand from a practitioner's perspective.

2.1.1 National Skills Development Act 2006 (Act 652)

Act 652 came into effect on 1st September 2006 after it was officially gazetted on 29th June 2006, with the mandate of promoting, through skills training, the development and improvement of a person's abilities, which are needed for vocation, and to provide for other matters connected therewith. The Act 652 is significant because for the first time in the history of skills training in Malaysia, a national legislation has been enacted solely and exclusively for skills training and development. In addition, the meaning and scope of skills training have been clarified and given a statutory interpretation that can be used to distinguish it from other components of the country's national education and training system.

The Act 652 also provides for the implementation of a Malaysia Skills Certification System, leading to the award of five levels of national skills qualification, namely Malaysia Skills Certificate Levels 1, 2 and 3; Malaysia Skills Diploma; and Malaysia Skills Advanced Diploma[5].

[5] Malaysia. 2006. National Skills Development Act (Act 652)

2.1.2 Malaysia Qualification Framework (MQF)

Act 679 was adopted on the 29th August 2007, establishes the Malaysian Qualifications Agency, sets out its composition, functions and responsibilities. This act repeals the National Accreditation Board Act 1996 (Act 556) and dissolves the National Accreditation Board. The MQF refers to the policy framework that satisfies both the national and international recognized qualifications. It consists of titles and guidelines, together with principles and protocols covering articulation and issuance of qualifications and statements of attainment. Elements of the qualification's framework indicate the achievement for each qualification title. It also provided progression routes for all the graduates in the respective occupational fields[6].

The MQF has eight levels of qualifications in three sectors and it was supported by lifelong education pathways as shown in Table 2.1. Department of Skills Development (DSD) governs the skills sector, in which there are five levels of skills qualification. The definition for each level of skills qualification was specified in the Malaysia Occupational Skills Qualification Framework (MOSQF) that can be referred to Annex 1.

[6] Malaysia 2007. Malaysia Qualification Act 2007 (Act 679)

Table 2.1: Malaysian Qualification Framework (MQF) Chart

(Source: Malaysian Qualifications Framework 2nd Edition)

MQF Level	Minimum Graduating Credit	Academic Sector	Technical and Vocational Education and Training (TVET) Sector	Lifelong Learning/APEL Criteria for APEL(A)
Level 8	No credit rating	PhD by Research		Admission criteria: 35 years old Bachelor's degree in relevant field/equivalent 5 years' work experience Passed APEL assessment
	80	Doctoral Degree by Mixed Mode & Coursework		
Level 7	No credit rating	Master's by Research		Admission criteria: 30 years old STPM/Diploma/equivalent Relevant work experience Passed APEL assessment
	40	Master's by Mixed Mode & Coursework		
	30	Postgraduate Diploma		
	20	Postgraduate Certificate		
Level 6	120	Bachelor's degree		Admission criteria: 21 years old Relevant work experience Passes APEL assessment
	66	Graduate Diploma		
	36	Graduate Certificate		
Level 5	40	Advanced Diploma	5	
Level 4	90	Diploma	4	Admission criteria:

MQF Level	Minimum Graduating Credit	Academic Sector	Technical and Vocational Education and Training (TVET) Sector	Lifelong Learning/APEL Criteria for APEL(A)
				20 years old Relevant work experience Passes APEL assessment
Level 3	60	Certificate	3	Admission criteria: 19 years old Relevant work experience Passed APEL assessment
Level 2	30	Certificate	2	3R
Level 1	15	Certificate	1	3R

2.1.3 Occupational Framework (OF)

The Occupational Framework (OF) was described as the outcome of the occupational analysis process to identify the occupational structure of an industry. The OF which was previously known as Occupational Analysis (OA) consists of Occupational Structure (OS), Occupational Descriptions (OD) and skills in demand. The development of the OF was a preliminary process in developing relevant National Occupational Skills Standard (NOSS). Once developed, the NOSS can be used as the basis to conduct skills training and skills certification of competent personnel.

2.1.4 National Occupational Skills Standard (NOSS) and National Competency Standard (NCS)

National Occupational Skills Standard (NOSS) is defined as a specification of the competencies expected of a skilled worker who is gainfully employed in Malaysia for an occupational area, level and pathway to achieve the competencies and was gazetted in Part IV of Act 652. NOSS is developed by industry experts based on the needs of the

industry and is utilised as the main tool in the implementation of Malaysia Skills Certification System in which the performance of existing industry workers and trainees are assessed based on the NOSS to award the Malaysia Skills Certificate[7]. Meanwhile, National Competency Standard (NCS) described the knowledge, skills and attitudes needed to perform in a particular occupation but also do not directly relate to any particular job classification. Standards were developed by the industry experts based on the needs of the industry and is utilised as the main tool in the implementation of Malaysian Skills Certification System in which the performance of existing industry workers and trainees were assessed based on Standards for awarding of Malaysian Skills Certificate.

2.1.5 Competency Based Training (CBT)

Competency Based Training (CBT) is an approach to vocational training which emphasises what a person can do in a work place as a result of education and training obtained. CBT is based on performance standards which are set by the industry with the main focus on measuring the performance while taking-into-account knowledge and attitude rather than the duration taken to complete the course. CBT is a learner-centric, outcome-based approach to training which allows each individual to develop skills at their own pace for a similar outcome. Thus, training practices were customised for each individual to achieve a similar outcome. CBT concept is the basis of Malaysia Skills Certification system which is coordinated by DSD[8].

2.2 Scope of Occupational Framework Based on Malaysia Standard Industrial Classification 2008 (MSIC 2008)

This section provides detail of MSIC 2008, scope on Computer programming, consultancy and related activities. The definition of MSIC 2008 and title selection criteria are explained in this section.

[7] Department of Skills Development. (2019, September 15). Retrieved from https://www.dsd.gov.my/jpkv4/index.php/my/perkhidmatan/noss
[8] Centre for Professional Development. (2019. September 15) Retrieved from https://www.fmm.edu.my

2.2.1 Malaysia Standard Industrial Classification 2008 (MSIC 2008) Definition

The MSIC 2008 is intended to be a standard classification of productive economic activities. Its main purpose is to provide a set of activity categories that can be utilised for the collection and presentation of statistics according to such activities. Therefore, MSIC aims to present these set of activity categories in such a way that entities can be classified according to the economic activity that they carry out. For purposes of international comparability, the MSIC 2008 Version 1.0 conforms closely to the International Standard Industrial Classification (ISIC) of all economic activities Revision 4, published by the United Nations Statistics Division, with some modifications to suit national requirements. The objective of an industrial classification system was to classify data in respect of the economy according to categories of activities and the characteristics of which has been similar. The MSIC is a classification of all types of economic activities and is not a classification of goods and services nor it is a classification of occupations[9].

2.2.2 Title Selection Criteria

In order to review that the scope of the computer programming, consultancy and related activities was comprehensively covered in this OF research, the definition of computer programming, consultancy and related activities was spelt out clearly. Under the MSIC, the area has been researched falls under the Section and Division listed below in Table 2.2:

Table 2.2: Summary of MSIC 2008 by Section, Division and Group
(Source: MSIC 2008)

Section	**J**	**Information and Communication**
Division	**62**	**Computer programming, consultancy and related activities**
Group	**620**	**Computer programming, consultancy and related activities**

[9] Department of Statistic Malaysia. (2008). Malaysia Standard Industrial Classification 2008 Ver. 1.0

To further understand the scope of this particular OF based on MSIC 2008, the following Table 2.3 can be referred to.

Table 2.3: Description of MSIC 2008 by Section, Division, Group, Class and Item (Source: MSIC 2008)

CLASSIFICATION	CODE	DESCRIPTION
Section	**J**	**Information and Communication**
Division	**62**	**Computer programming, consultancy and related activities** This division includes the following activities of providing expertise in the field of information technologies such as writing, modifying, testing and supporting software to meet the needs of a particular customer, planning and designing computer systems that integrate computer hardware, software and communication technologies; on-site management and operation of clients' computer systems and/or data processing facilities; providing infrastructure for hosting or data processing services; and other professional and technical computer-related activities.
Group	**620**	**Computer Programming, Consultancy and Related Activities** This group includes the following activities of providing expertise in the field of information technologies such as writing, modifying, testing and supporting software to meet the needs of a particular customer; planning and designing computer systems that integrate computer hardware, software and

CLASSIFICATION	CODE	DESCRIPTION
		communication technologies; on-site management and operation of clients' computer systems and/or data processing facilities; providing infrastructure for hosting or data processing services; and other professional and technical computer-related activities.
Class	**6201**	**Computer Programming Activities** Includes: a) Designing the structure and content of and/or writing the computer code necessary to create and implement such as systems software (including updates and patches), software applications (including updates and patches), databases and web pages. b) Customizing of software (e.g. modifying and configuring an existing application so that it is functional within the clients' information system environment). Excludes: a) Publishing packaged software, see 5820. b) Planning and designing computer systems that integrate computer hardware, software and communication technologies, even though providing software might be an integral part, see 62021.

CLASSIFICATION	CODE	DESCRIPTION
Item	**62010**	**Computer Programming Activities** Includes: a) Activities of writing, modifying, testing, and supporting software to meet the needs of a particular client (customize computer programming). b) Production of software not associated with publishing. c) Writing of software for video game consoles. d) Design and programming of web pages.
Class	**6202**	**Computer Consultancy and Computer Facilities Management Activities** Excludes: a) Separate sale of computer hardware or software, see 46510, 4741. b) Separate installation of mainframe and similar computers, see 33200. c) Separate installation (setting-up) of personal computers, see 62099. d) Separate software installation, see 62099.
Item	**62021**	**Computer Consultancy** Includes: a) Planning and designing of computer systems that integrated computer hardware, software and communication technologies.

CLASSIFICATION	CODE	DESCRIPTION
		b) Software design or consultancy as part of designing a complete computer system solution for a user.
Item	**62022**	**Computer Facilities Management Activities** Includes: Provision of onsite management and operation of a client's computer systems and/or data processing facilities, as well as related support services.
Class	**6209**	**Other Information Technology and Computer Service Activities** Excludes: a) Installation of mainframe and similar computers, see 33200. b) Computer programming, see 62010. c) Computer consultancy, see 62021. d) Computer facilities management, see 62022. e) Data processing and hosting, see 6311.
Item	**62091**	**Information Communication Technology (ICT) System Security**
Item	**62099**	**Other Information Technology Service Activities n.e.c.** Includes: a) Computer disaster recovery.

CLASSIFICATION	CODE	DESCRIPTION
		b) Installation (setting-up) of personal computers. c) Software installation.

2.3 Key Stakeholders

The key stakeholders for the computer programming, consultancy and related activities in Malaysia comprises government agencies, regulatory bodies, industry associations professional bodies of Computer programming, consultancy and related activities industry. Stakeholders defines as a person, group or organisation that has interest or concern in an organisation. Stakeholders can affect or be affected by the organisation's actions, objectives and policies.

2.3.1 Government Agencies and Regulatory Bodies

These are the regulatory bodies and relevant government agencies that are empowered by the legislations according to the scope and powers given in the related acts that directly regulates the computer programming, consultancy and related activities industry can be referred in Table 2.4 below.

Table 2.4: List of Government Agencies and Regulatory Bodies for Computer Programming, Consultancy and Related Activities Industry

NO	ORGANISATIONS	OVERVIEWS, ROLES, FUNCTION AND RESPONSIBILITIES
1	Malaysian Communications and Multimedia Commission (MCMC)	a) Implement and enforce the provisions of the communications and multimedia law. b) Regulate all matters relating to communications and multimedia activities not provided for in the communications and multimedia law.

NO	ORGANISATIONS	OVERVIEWS, ROLES, FUNCTION AND RESPONSIBILITIES
		c) Consider and recommend reforms to the communications and multimedia law. d) Supervise and monitor communications and multimedia activities. e) Encourage and promote the development of the communications and multimedia industry. f) Encourage and promote self-regulation in the communications and multimedia industry. g) Promote and maintain the integrity of all persons licenced or otherwise authorised under the communications and multimedia industry. h) Render assistance in any form to, and to promote cooperation and coordination amongst, persons engaged in communications and multimedia activities[10].
2	CyberSecurity Malaysia	a) CyberSecurity Malaysia is committed to providing a broad range of cybersecurity innovation-led services, programmes and initiatives to help reduce the vulnerability of digital systems, and at the same time strengthen

[10] Malaysian Communications and Multimedia Commission (MCMC). (2019, August 29). Retrieved from https://www.mcmc.gov.my/about-us/our-responsibility

NO	ORGANISATIONS	OVERVIEWS, ROLES, FUNCTION AND RESPONSIBILITIES
		Malaysia's self-reliance in cyberspace. b) Provides specialised cyber security services, as follows: i) Cyber security responsive services. ii) Cyber security proactive services. iii) Outreach and capacity building. iv) Strategic study and engagement. v) Industry and research development[11].
3	National Cyber Security Agency (NACSA)	a) NASCA is responsible of securing and strengthening Malaysia's resilience in facing the threats of cyberattacks, by co-ordinating and consolidating the nation's best experts and resources in the field of cyber security. b) NACSA is also committed to developing and implementing national-level cyber security policies and strategies, protecting Critical National Information Infrastructures (CNII), undertaking strategic measures in countering cyber threats,

[11] CyberSecurity Malaysia. (2019, August 29). Retrieved from https://www.cybersecurity.my/en/index.html

NO	ORGANISATIONS	OVERVIEWS, ROLES, FUNCTION AND RESPONSIBILITIES
		spearheading cyber security awareness, acculturation and capacity-building programmes, formulating strategic approach towards combatting cyber-crimes, advising on organisational cyber risk management, developing and optimising shared resources among agencies, and fostering constructive regional and global networks among entities with shared interests in cyber security[12].
4	Intellectual Property Corporation of Malaysia (MyIPO)	MyIPO's provide registration of patents, trademarks, industrial designs, geographical indications and copyright voluntary notification; advisory services on internet Protocol (IP); provide IP information/statistics; IP training; patent agent examination; online search, filing and application status; outreach programmes and helpdesk[13].
5	Malaysia's National Applied Research and Development Centre (MIMOS)	MIMOS is Malaysia's national Applied Research and Development Centre. A strategic agency under the Ministry of International Trade and Industry (MITI), MIMOS contributes to transforming

[12] National Cyber Security Agency (NACSA). (2019, August 29). Retrieved from https://www.nacsa.gov.my

[13] Intellectual Property Corporation of Malaysia, MyIPO. (2019, September 15). Retrieved from http://www.myipo.gov.my

NO	ORGANISATIONS	OVERVIEWS, ROLES, FUNCTION AND RESPONSIBILITIES
		Malaysia's industry through patentable technology platforms, products and solutions. Over the past 12 years, MIMOS has filed more than 2,000 Intellectual Properties in various technology domains and across key socio-economic areas. Serving a central role in Malaysia's digital transformation journey. MIMOS endeavours to create a culture of innovation by nurturing relationships with internal and external stakeholders, in the spirit of smart partnerships and inclusive growth models and strategies. MIMOS research and development has evolved from fundamental discoveries in microelectronics and ICT at the year of 1985 to 2005 to cutting edge applied frontier technology which is in line with the changing models and key trends in global industry. Currently, MIMOS focuses on Big Data and Internet of Things, apart from pursuing advanced electrical and electronics engineering technologies[14].
6	Standard and Industrial Research Institute (SIRIM)	SIRIM is a premier industrial research and technology organisation in Malaysia, wholly-owned by the Ministry of Finance

[14] MIMOS Berhad – National Applied R&D Centre. (2019, September 15). Retrieved from http://www.mimos.my

NO	ORGANISATIONS	OVERVIEWS, ROLES, FUNCTION AND RESPONSIBILITIES
		incorporated. with over 40 years of experience and expertise, SIRIM is mandated as the machinery for research and technology development, and the national champion of quality. SIRIM has always played a major role in the development of the country's private sector. By tapping into expertise and knowledge base, SIRIM focus on developing new technologies and improvements in the manufacturing, technology and services sectors[15].
7	Malaysian Administrative Modernisation and Management Planning Unit (MAMPU)	MAMPU is a central agency for the modernisation and transformation of Public Service Administration, MAMPU carries out the following six major roles as: i) A catalyst for change in administrative and management services in the public sector. ii) The leader in developing ICT for the public service sector. iii) Consultants in management organisation and ICT for the public service sector. iv) Facilitator in the implementation of modernisation and

[15] SIRIM QAS International SD.BHD. (2019, September 15). Retrieved from http://www.sirim-qas.com.my

NO	ORGANISATIONS	OVERVIEWS, ROLES, FUNCTION AND RESPONSIBILITIES
		transformation programmes in the public sector delivery system. v) Researcher in administrative modernisation and management planning for the public sector. vi) Promoter of government services to the public[16].

2.3.2 Industry Associations and Professional Bodies

These are the industry associations and professional bodies that will add value to the industry and to the whole economy for the Computer programming, consultancy and related activities industry can be referred to the following Table 2.5.

Table 2.5: List of Related Industry Associations and Professional Bodies for Computer Programming, Consultancy and Related Activities Industry

NO	ORGANISATIONS	ROLES, FUNCTION AND RESPONSIBILITIES
1	The National Tech Association of Malaysia (PIKOM – *Persatuan Industi Komputer dan Multimedia Malaysia*)	a) PIKOM works to improves the business climate in the interests of all its member companies and to promote industry growth in line with national aspirations. b) PIKOM objectives are to: i) Spearhead, promote and encourage development of resources, professional skills and programs in the local ICT industry.

[16] Malaysian Administrative Modernisation and Management Planning Unit (MAMPU). (2019, September 16). Retrieved from https://www.mampu.gov.my/en/

NO	ORGANISATIONS	ROLES, FUNCTION AND RESPONSIBILITIES
		ii) Represent the local ICT industry to the government and private sector both local and overseas. iii) Maintain a balance view between industry and regulatory on ICT-related issues. iv) Provide a platform for ICT players and users to meet, network, learn and share ideas in order to bring the industry to the next level. v) Foster high standards of conduct, service and performance throughout the ICT industry. vi) Promote and market local ICT services to the region and overseas[17].
2	Malaysia Digital Economy Corporation (MDEC)	a) MDEC was established to strategically advise the Malaysian government on legislation, policies and standards for ICT and multimedia operations. b) Entrusted to oversee the development of the Multimedia Super Corridor (MSC) Malaysia initiative, the platform to nurture the growth of local tech companies whilst attracting foreign direct investments (FDIs) and domestic direct investments (DDIs) from global multinational companies to invest and develop cutting-edge digital and creative solutions in Malaysia. c) Plays a catalytic role in driving Malaysia's transition towards a developed digital economy by 2020. In 2012, Digital Malaysia was official

[17] The National Tech Association of Malaysia, PIKOM. (2019. September 15) Retrieved from http://www.pikom.org.my/about-us/

NO	ORGANISATIONS	ROLES, FUNCTION AND RESPONSIBILITIES
		unveiled as the nation's transformational programme to achieve this objective. Digital Malaysia is a national agenda that is fully developed with a sustainable digital economy built upon a vibrant domestic ICT industry, transformative adoption of digital solutions by government, businesses and citizens, as well as a robust enabling ecosystem.[18].

2.3.3 Training Centre

These are the training centre that build custom training material that documents its best practices and procedures for the computer programming, consultancy and related activities industry can be referred to in the following Table 2.6.

Table 2.6: List of Training Centre for Computer Programming, Consultancy and Related Activities Industry

NO	ORGANISATIONS	OVERVIEWS, ROLES, FUNCTION AND RESPONSIBILITIES
1	Malaysia Co-operative Institute (MCI)	a) Provide courses related to information technology and communication (ICT) and the appropriate courses. b) Conducting research and provide advice to cooperatives related to ICT. c) Contributed articles to scientific publications *Institut Kemahiran Malaysia* (MKM)[19].

[18] Malaysia Digital Economy Corporation (MDEC). (2019, August 29). Retrieved from https://mdec.my
[19] Malaysia Co-operative Institute (MCI). (2019, August 29). Retrieved from http://www.ikkm.edu.my/en/

NO	ORGANISATIONS	OVERVIEWS, ROLES, FUNCTION AND RESPONSIBILITIES
2	International Malaysian Training Centre (IMTC)	IMTC was established to provides training and development which ensure trainee to adopt up-to-date skills to work in today's modern, diversified economies across the widest range of Industrial and Service sectors. IMTC is committed to improve training standards and practices through cooperation with distinguished local, regional and international universities in addition to achieving more foreign accreditation by internationally qualified bodies[20].
3	Institute of Broadcasting and Information Tun Abdul Razak (IPPTAR)	a) Plan and prepare training programmes for staff of ministries, departments and agencies under ICT. b) Implement quality training programmes in line with the current needs of customers. c) Evaluation of training programmes to assess and improve the quality of training. d) Cooperate with other agencies inside and outside the country in the field of broadcasting, filming training and corporate communication. a) Provide infrastructure and support services in accordance with the requirements of training[21].

[20] International Malaysia Training Centre, IMTC. (201.9. September 2019) Retrieved from https://imtc.my

[21] *Institut Penyiaran dan Penerangan Tun Abdul Razak,* IPPTAR. (2019, September 15) Retrieved from http://www.ipptar.gov.my

2.4 Government Legislations, Policies and Initiatives

It was imperative that, this research had referred to legislation, by-laws and policies that were directly related to computer programming, consultancy and related activities industry.

2.4.1 Government Legislations

The following Table 2.7 indicates the relevant legislations to the overall Information and Communication Industry which includes the Computer programming, consultancy and related activities industry.

Table 2.7: List of Relevant Legislations for Computer Programming, Consultancy and Related Activities Industry

NO	LEGISLATIONS	DESCRIPTION
1	Computer Crimes Act 1997 (Act 563)	a) Act 563 deals with unauthorised access to computer material, unauthorised access with intent to commit other offenses and unauthorised modification of computer contents. It also makes provisions to facilitate investigations for the enforcement of the Act. Offences that are listed from Act 563 are: i) Unauthorised access to computer material. ii) Unauthorised access with intent to commit or facilitate commission of further offense. iii) Unauthorised modification of the contents of any computer[22].
2	Copyright (Amendment) Act 1987 (Act 332)	a) Make unauthorised transmission of copyright works over the Internet an infringement of copyright. b) Infringement of copyright to circumvent any effective technological measures aimed at restricting access to

[22] Malaysia 1997. Computer Crimes Act 1997 (Act 563)

		copyright works. c) Ensuring adequate protection of intellectual property rights for companies involved in content creation in the ICT and multimedia environment[23].

2.4.2 Government Policies and Initiatives

This section provides information regarding government policies and initiatives for computer programming, consultancy and related activities industry.

a) Public Sector ICT Strategic Plan (PSISP)

Public Sector ICT Strategic Plan (PSISP) outlines the strategic direction of ICT implementation in the Malaysian Public Sector for the years of 2016 to 2020. PSISP direction is in line with the Government Transformation Plan to be a developed nation by year 2020 with PSISP scope includes all ministries and public sector agencies. PSISP objective are as follow:

i) Supports the achievement of Vision 2020.
ii) Aligns the use of technology with the business direction of the Public Sector.
iii) Aligns the ICT implementation with ICT agenda of the Public Sector.
iv) Ensures return of investment through exploitation of technology and a structured and well-planned ICT implementation.
v) Focuses on productivity and innovation

[23] National Cyber Security Agency (NACSA). (2019, August 27). Retrieved from https://www.nacsa.gov.my/legal.php

b) Mid-Term Review Eleventh Malaysia Plan (11th MP)

Mid-term review of the 11th Malaysia Plan aims to reform existing policies and outline the revised socioeconomic targets for 2018 to 2020. The mid-term review has taken into consideration the aspirations of the new government, current economic challenges and global trends. Efforts are focus on stimulating economic growth, while ensuring greater benefits for all segments of the society.[24] Mid-term review assesses the performance of the first two years of the 11th MP, 2016 to 2017, under the previous government which was launched on 21 May 2015 with the theme 'Anchoring Growth on People'[25]. In this regard, mid-term review of 11th MP new priorities and emphases based on six pillars which will focus on reforming governance and improving public service delivery, enhancing inclusive development and wellbeing, pursuing balanced regional development, empowering human capital, ensuring environmental sustainability and strengthening economic growth.

To achieve this goal, the mid-term review of 11th MP plan a sustainable growth through six pillars and six change drivers that will realise Malaysia's goal of achieving advanced and inclusive nation status by the year 2020. Six pillars are as the following:

i) Reforming governance towards greater transparency and enhancing efficiency of public service.
ii) Enhancing inclusive development and wellbeing.
iii) Pursuing balanced regional development.
iv) Empowering human capital.
v) Enhancing environmental sustainability through green growth.
vi) Strengthening economic growth.

Under the six strategic pillars listed, one of the pillars which is strengthening economic growth is to accelerate the momentum of economic

[24] Mid-term Review of the Eleventh Malaysia Plan 2016 – 2020. (2019, September 16). Retrieved from https://www.talentcorp.com.my/resources/publications
[25] Eleventh Malaysia Plan 2016 – 2020. (2019, September 16). Retrieved from https://www.talentcorp.com.my/resources/publications

growth in the remaining plan period by stimulating activities to move up the value chain and promote private investment. Focus was given on strengthening the foundation of the economy to propel Malaysia into a developed and inclusive nation premised on innovation, creativity and high value-added activities to drive productivity.

Focus was given to transform the industry from supply- to demand-driven, user to producer as well as low to high knowledge intensive and value-added activities. This will enable the services sector to move up the value chain and provide strong linkages with other sectors. Initiatives toward development of ICT services are listed as below under the pillar of strengthening economic growth:

i) Adopt emerging technologies such as artificial intelligence (AI), big data analytics (BDA), financial technology (FinTech) and Internet of Things (IoT).
ii) Strengthen self-reliance in cyber security and develop home-grown products and services as well as nurture start-ups companies to be competitive.
iii) Improve ICT research, development, commercialisation and innovation by strengthening partnership between public research institutes, institutions of higher education and industries to deliver commercial solutions.

In the remaining plan period, initiatives to enhance capacity building include strengthening skills training programmes as well as enhancing collaboration between training institutions and industry. Efforts focus on enhancing capacity building to increase the quality as well as the number of skilled workforces to support innovation, modernisation and adoption of new technology associated with 4 IR. Greater collaboration among stakeholders through various initiatives such as internship programmes and skills training for workers will be continued to meet the industry specific talent requirements. The industries are encouraged to invest in human capital development through reskilling and upskilling programmes in the areas of ICT services, software outsourcing, logistics, finance and insurance as well as tourism to embrace and adopt the technological advancement. Initiatives are continued to attract foreign direct

investment in knowledge-intensive industries and adopt best practices, aligned with the development of the 4 IR.

c) Malaysia's Budget 2019

The Malaysia's Budget 2019, themed "A Resurgent Malaysia, A Dynamic Economy, A Prosperous Society" has three focus areas, namely: to implement institutional reforms; to ensure the socio-economic well-being of Malaysians; and to foster an entrepreneurial economy. The following are the allocation for the ICT sector:

i) Enforcement of the Mandatory Standards for Access Pricing (MSAP) to fix and reduce broadband prices by 25 percent by the end of 2018.
ii) Matching grants specific to Industry 4.0 initiatives through the Malaysia Investment Development Authority (MIDA) high impact fund.
iii) RM 3 billion industry digitalisation transformation fund with a subsidised two per cent interest rate under Bank Pembangunan Malaysia Berhad to accelerate the adoption of smart technology.
iv) RM 2 billion under the Business Loan Guarantee Scheme (SJPP) with Government guarantees of up to 70, to incentivize small medium enterprise (SME) investment in automation and modernisation.
v) RM 210 million allocated from 2019 to 2021, to support the transition and migration to Industry 4.0.
vi) RM 1 billion allocated to develop the national broadband infrastructure through the launch of the National Fibre Connectivity Plan[26].

2.5 Industry and Market Intelligence

Industry and market intelligence are the collection and analysis of data of an industry by various sources of data to be utilise by the industry to make business decisions, manpower developments and training requirements. Industry intelligence is critical for developing

[26] Official Portal of Ministry of Finance Malaysia. Retrieved from https://www.treasury.gov.my/index.php/en/

strategies in the development of the industry, areas of manpower development and the impact of those developments. This section focused on discussion regarding current growth of the industry and employment statistics of computer programming, consultancy and related activities industry.

2.5.1 Growth of Computer Programming, Consultancy and Related Activities Industry

Based on National Account Gross Domestic Product 2015 to 2018, Malaysia gross domestic product (GDP) recorded RM 1,361.5 billion in 2018, which see 4.7 per cent growth compared to 2017 with 5.7 per cent[27]. Services sector is the main contributor in Malaysia GDP with 55.6 per cent followed by manufacturing with 21.6 per cent while for main expenditure, private final consumption was the main influencer.

Other than that, for this research, it will focus on computer and information service activities under the information and communication sector. For information and communication sector growth on Malaysia GDP, information and communication recorded 5.6 per cent contribution to Malaysia GDP 2018 compared to 5.4 per cent in both 2016 and 2017, and 5.3 per cent in 2015. From the growth, it can be seen that, information and communication sector recorded an increase in percentage share to Malaysia GDP compare to 2017. More than that, for computer and information service activities percentage share to Malaysia GDP, for 2018, it contributed 1.3 per cent, 1.2 per cent in 2017 and 1.3 per cent in 2016 and 1.3 per cent in 2015[28].

More than that, for annual percentage share of computer and information service activities in 2016 to 2018, it can be seen that there are slightly increasing in term of per cent by year. In 2018, annual percentage share for computer and information service activities is 7.9 per cent and increasing throughout the year with 7.1 per cent in 2017 and 6.1 per cent in 2016[29].

[27] Department of Statistics Malaysia. 2019. National Account Gross Domestic Product 2018. Page 1
[28] Department of Statistics Malaysia. 2019. National Account Gross Domestic Product 2018. Page 43
[29] Department of Statistics Malaysia. 2019. National Account Gross Domestic Product 2018. Page 35

2.5.2 Employment Statistics

This section provides an overview regarding labour force, labour demand in Malaysia and employment statistics of computer programming, consultancy and related activities industry.

a) Labour Force in Malaysia

Labour force can be defined as the sum of persons in employment plus persons in unemployment. Together these two groups of the population represent the current supply of labour for the production of goods and services taking place in a country through market transactions in exchange for remuneration[30]. The concept and definition of labour force in Malaysia are stated in Figure 2.1 follows.

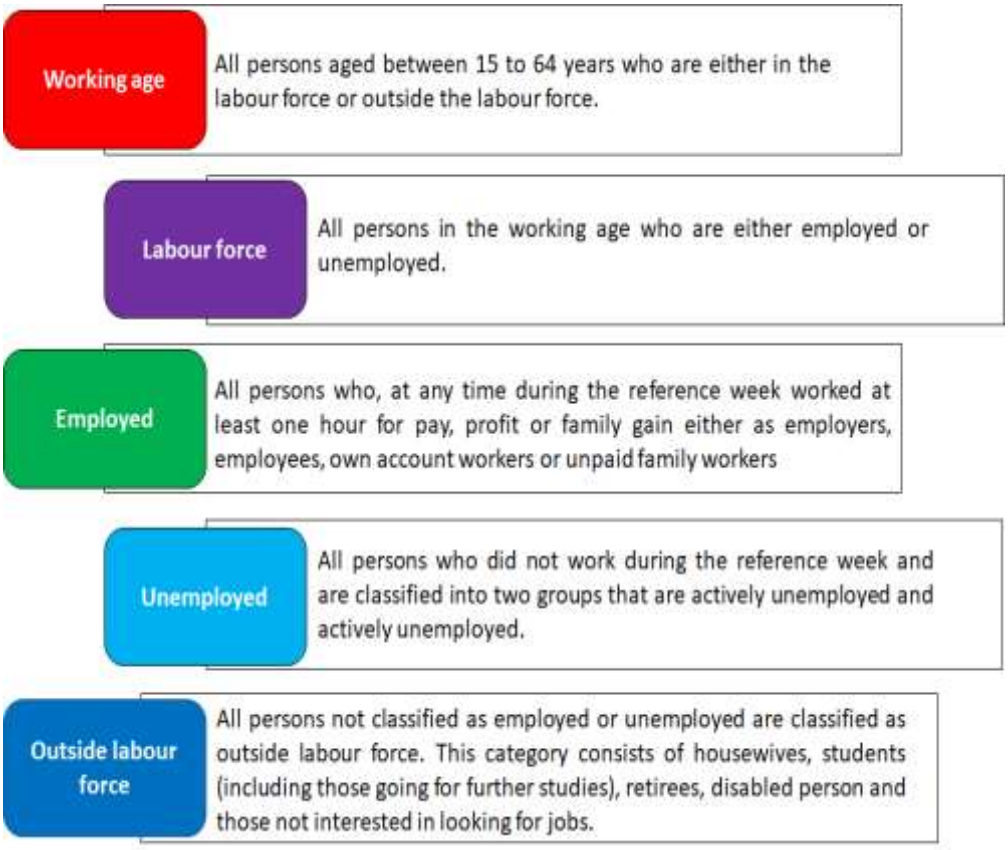


Figure 2.1: Concepts and Definitions of Term Relating to Labour Force in Malaysia (Source: Department of Statistics Malaysia, 2019)

[30] International Labour Organization. 2018. Labour force (2019, 30 September) Retrieved from https://www.ilo.org/global/statistics-and-databases/statistics-overview-and-topics/WCMS_470304/lang--en/index.htm

Labour force in Malaysia increased 2.0 per cent to nearly 15.3 million persons in 2018 as compared to 15.0 million persons in 2017. The increase in labour force was contributed by 299,200 employed persons. Labour force participation rate (LFPR) in 2018 increased 0.3 percentage points to 68.3 per cent as compared to 68.0 per cent in 2017[31]. Hence, the remaining 31.7 per cent of the working age population was outside the labour force. The unemployment rate in 2018, on the other hand improved to 3.3 per cent as compared to 3.4 percent in 2017. This shows that the country's economy is still operating at full employment that is unemployment rate below 4.0 per cent.

b) Overview of Service Sector Labour Demand

Labour demand indicates the total labour that the economy is willing to employ at any given point of time. At the microeconomic level, labour demand by firm refers to positions in the company; and through the process of hires and separations, the information of filled positions and vacancies can be estimated. The concepts and definitions of the statistics on labour demand in this publication shown in Figure 2.2:

[31] Department of Statistics Malaysia. 2019. The Labour Force Survey Report 2018. Page 12

Figure 2.2: Concepts and Definitions of Term Relating to Labour Demand
(Source: Department of Statistics Malaysia, 2019)

For positions and skill in services sector by percentage share, for 2018, 46.8 per cent was recorded for semi-skilled worker, 32.6 per cent for skilled worker and 20.6 per cent for low-skilled worker[32]. As compared to 2017, the numbers of semi-skilled worker position are same with 2018, while for skilled worker and low-skilled worker are 32.2 per cent and 21.0 per cent recorded for each part. The details of the information can be referred to Figure 2.3.

[32] Department of Statistics Malaysia. 2019. Employment Statistics Second Quarter 2019. Page 33

Figure 2.3: Positions and Skills in Services Sector by Percentage Share

(Source: Department of Statistics Malaysia, 2019)

Other than that, for filled position and skill in services sector by percentage share, for 2018, 47.1 per cent was recorded for semi-skilled worker, 32.8 per cent for skilled worker and 20.1 per cent for low skilled-worker[33]. The comparison with 2017 can be referred to Figure 2.4.

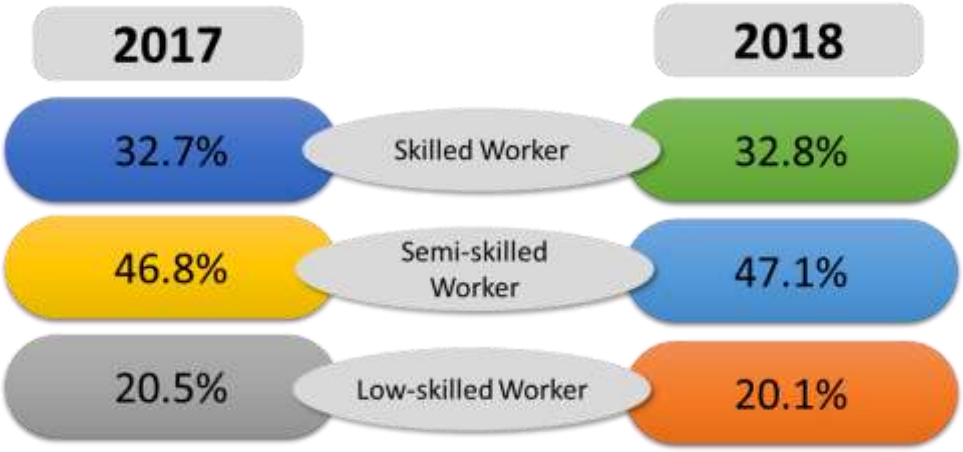


Figure 2.4: Filled Position and Skills in Services Sector by Percentage Share

(Source: Department of Statistics Malaysia, 2019)

45.0 per cent was recorded for semi-skilled worker, 27.0 per cent for skilled worker and 28.0 per cent for low-skilled worker[34]. The comparison with

[33] Department of Statistics Malaysia. 2019. Employment Statistics Second Quarter 2019. Page 39
[34] Department of Statistics Malaysia. 2019. Employment Statistics Second Quarter 2019. Page 45

2018 can be referred to Figure 2.5. More than that, for vacancies and skill in services sector by percentage share, for 2018, 45.0

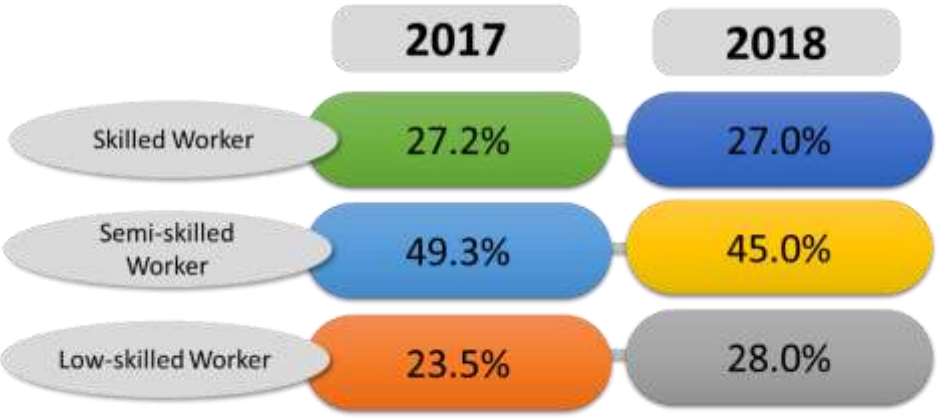


Figure 2.5: Vacancies and Skills in Services Sector by Percentage Share
(Source: Department of Statistics Malaysia, 2019)

Last but not least, for jobs created and skill in services sector by percentage share for 2018, 54.9 per cent was recorded for skilled worker, 38.0 per cent for skilled worker and 7.1 per cent for low-skilled worker[35]. The comparison with 2017 can be referred in Figure 2.6.

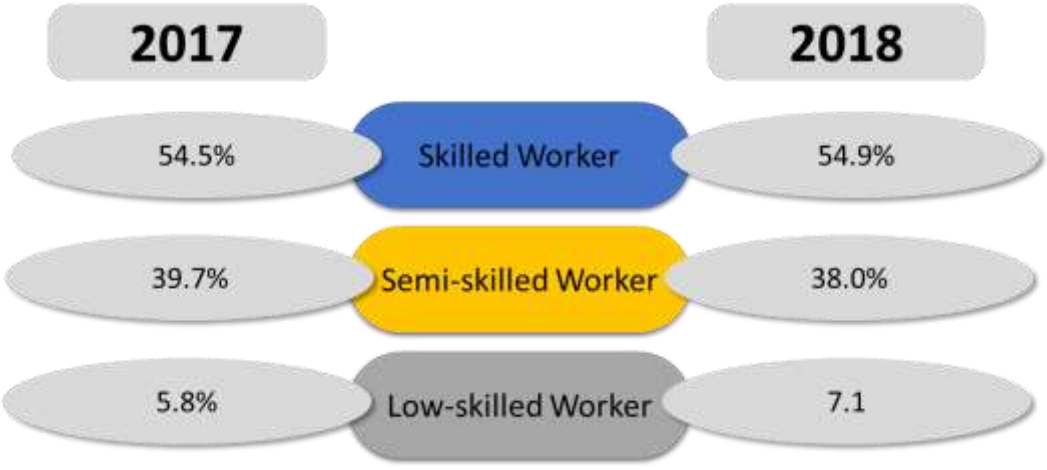


Figure 2.6: Jobs Created and Skills in Services Sector by Percentage Share
(Source: Department of Statistics Malaysia, 2019)

[35] Department of Statistics Malaysia. 2019. Employment Statistics Second Quarter 2019. Page 51

c) Employment Growth of Computer Programming, Consultancy and Related Activities Industry

For 2017, computer programming, consultancy and related activities registered the highest number of persons engaged of 111,896 persons or 49.6 per cent (2015: 48.4%). The second highest contributor was telecommunications services with 58,163 persons or 25.8 per cent (2015: 25.4%) followed by publishing activity with 17,293 persons or 7.7 per cent (2015: 8.1%)[36] as shown in Figure 2.7. These three activities contributed more than half (82.8%) of the total number of persons engaged in the information and communication services in 2017.

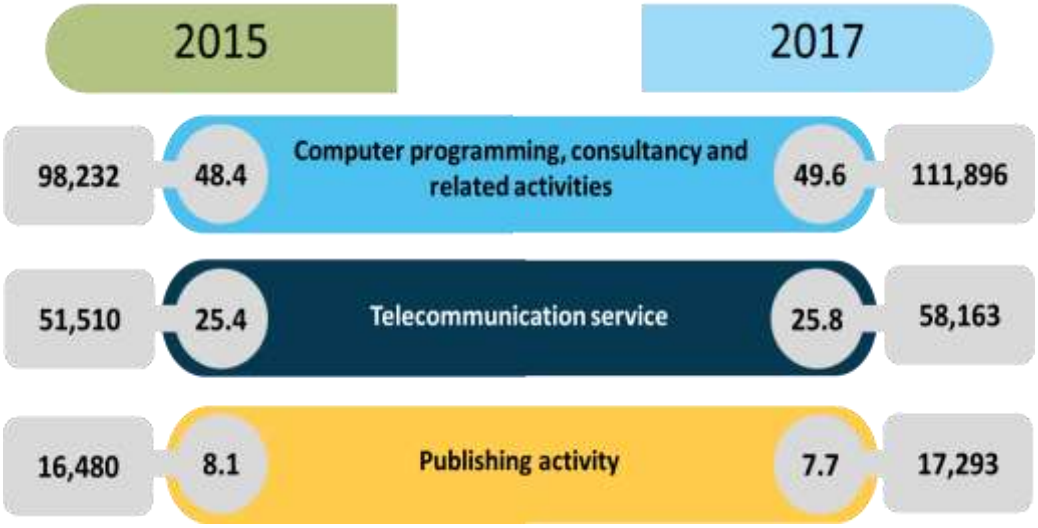


Figure 2.7: Number of Persons Engaged in Information and Communication Services (Source: Department of Statistics Malaysia, 2019)

2.5.3 Conclusion

In conclusion, for computer programming, consultancy and related activities industry, from 2015 to 2018, the contribution of this industry toward Malaysia GDP are increasing by year with 7.9 per cent in 2018 are the second highest contributor toward information and communications sector.

[36] Department of Statistics Malaysia. 2019. Annual Economic Statistics 2018- Information and Communications. Page 14

More than that, for employment statistics, computer programming, consultancy and related activities are the largest contributor for number of persons engaged with the industry with 111,896 persons. The growth of this industry clearly shows that computer programming, consultancy and related activities industry is one of potential industry for enhance country development in the future.

2.6 Existing NOSS Relevant to MSIC 2008 Section J, Division 62

Currently there are 29 NOSS developed by DSD that are relevant to the sub-sectors and areas in the Computer programming, consultancy and related activities industry. The details of the existing NOSS relevant to the Computer programming, consultancy and related activities industry are in the tables below.

Table 2.8: Summary of NOSS Developed under the Division 62
(Source: NOSS Registry January 2019)

MSIC GROUP	CORRESPONDING NOSS/ LEVEL		
620 Computer programming, consultancy and related activities	BT-010-2 (2008)	Bioinformatics Assistant Programmer	Level 2
	BT-010-3 (2008)	Bioinformatics Programmer	Level 3
	J620-001-5:2019	Cyber Security Penetration Testing & Assessment	Level 5
	IT-020-5:2013	Computer Systems Management	Level 5
	IT-090-5 (2009)	ICT System Security Technologist	Level 5
	IT-030-5:2013	Computer Network Management	Level 5
	IT-020-4:2013	Computer Systems Administration	Level 4

MSIC GROUP	CORRESPONDING NOSS/ LEVEL		
	IT-030-4:2013	Computer Network Administration	Level 4
	IT-020-3:2013	Computer System Operation	Level 3
	IT-030-3:2013	Computer Network Services	Level 3
	IT-035-5:2014	IT Infrastructure Development	Level 5
	IT-035-4:2014	IT Support & Maintenance	Level 4
	IT-010-5 :2013	Application Systems Implementation & Integration	Level 5
	IT-120-5:2011	Multimedia Programming	Level 5
	IT-121-5:2011	Database Programming	Level 5
	IT-010-4 :2013	Systems Module Development	Level 4
	IT-120-4:2011	Multimedia Programming	Level 4
	IT-121-4:2011	Database Programming	Level 4
	IT-010-3:2016	Application Development	Level 3
	IT-122-5:2011	Server Application Development and Management	Level 5
	IT-122-4:2011	Server Application Development and Management	Level 4
	IT-010-3:2016	Application Development	Level 3
	IT-052-5:2013	Web Development	Level 5
	IT-052-4:2013	Web Development	Level 4
	IT-081-5 (2010)	Geospatial Manager	Level 5
	IT-081-4 (2010)	Geospatial Executive	Level 4
	IT-081-3 (2010)	Geospatial Technician	Level 3
	IT-082-5:2016	Data Mining Management & Analysis	Level 5
	IT-082-4:2016	Data Mining Operation	Level 4
	IT-082-3:2016	Data Collection	Level 3

2.7 Overview of Computer Programming, Consultancy and Related Activities in Developed Countries

Computer programming, consultancy and related activities industry is projected to grow much faster than any other industries over the next decades. The evolution in technology in all industries and the rise of industrial revolution 4.0 (IR4.0) gives a boost to the computer programming industry. Currently, there were 23 million software developers in the world in 2018 and it is expected to reach 26.4 million by the end of 2019. In 2023, it is estimated that there will be 27.7 million software developers in the world[37]. Three country are selected as overview for the computer programming, consultancy and related activities industry are:

a) United States of America (US)

   US are selected as presently US has the largest population of software developers compared to the rest of the world which is about 3.6 million workers.[38]

b) India

   India are selected as estimated that the population of software developers of India will overtake the US by 2023.[39]

c) China

   China are selected as China currently held the title of top nation for growth of the number of software developers. Leading up to year 2023, China's software market growth rate is between 6 to 8 % annually.[40]

2.8 Relation of Industry and Industrial Revolution 4.0 (IR4.0)

Industrial revolution 4.0 was founded by Klaus Schwab, founder and executive chairman of the world economic forum and author of a book titled The Fourth Industrial

[37] Evans Data Corporation. (2019, September 16). Retrieved from https://www.daxx.com/blog/development-trends/number-software-developers-world
[38] Evans Data Corporation. (2019, September 16). Retrieved from https://www.computerworld.com/article/2483690/india-to-overtake-u-s--on-number-of-developers-by-2017.html
[39] Statista. (2019, September 16). Retrieved from https://www.statista.com/topics/2256/it-industry-in-india/
[40] China Market Insights. (2019, September 16) Retrieved from https://www.dragonsocial.net/blog/china-software-market-2018/

Revolution[41]. The 4th IR is used to describe the emergence of the digital economy and use of automation and data exchange in industrial technologies. In a simple manner, the 4th IR can best describe as the blurring of boundaries between the physical, digital, and biological worlds. It's a fusion of advances in artificial intelligence, robotics, the IoT, 3D printing, genetic engineering, quantum computing, and other technologies. It is the collective force behind many products and services that are fast becoming indispensable to modern life.

Technology experts are already speaking about the coming industrial revolution as one that has the potential to disrupt every industry in every country due to the exponential pace that is the nature of digital revolution which is at the heart of IR4.0. This is already happening in businesses and industries as robotics and artificial intelligence can take over jobs traditionally manned by human labour, in particular technical processes that can easily be computerized. Figure below depicts the progression of the industry revolutions:

[41] Schwab, K. 2016. *The Fourth Industrial Revolution*. World Economic Forum

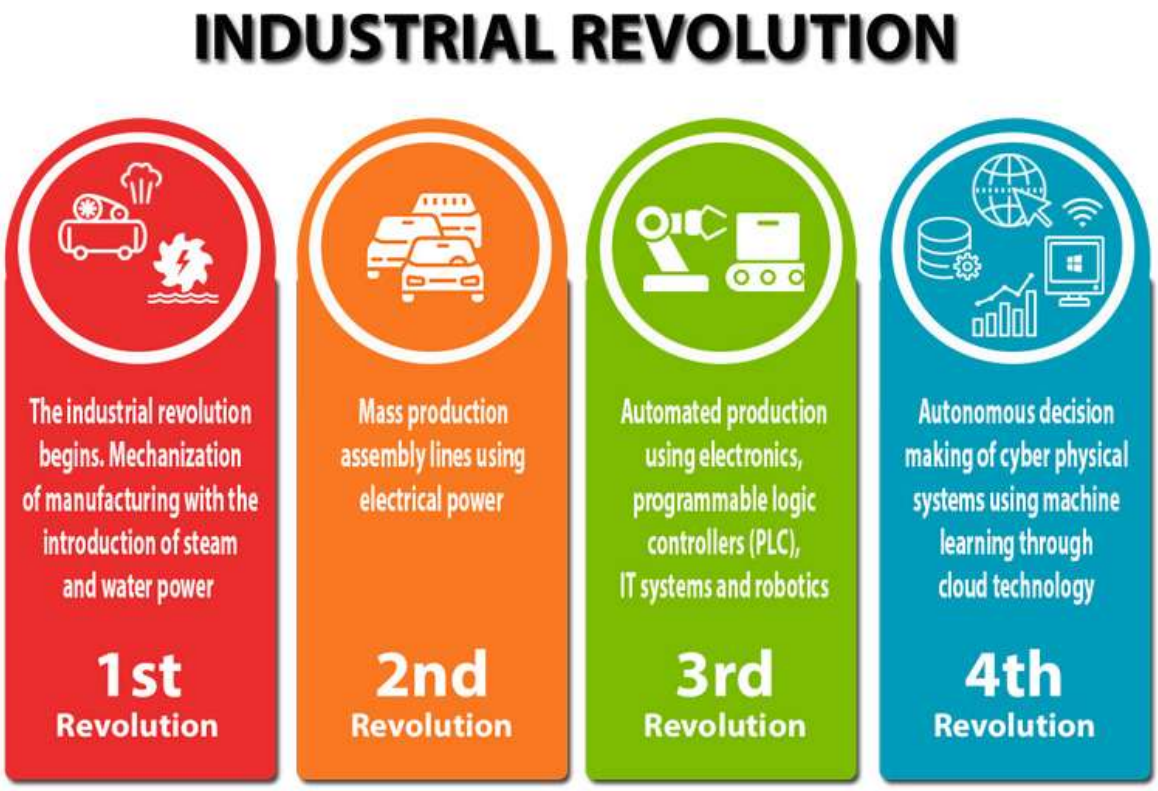


Figure 2.8: Industrial Revolution 4.0
(Source: https://studymalaysia.com)[42]

IR4.0 is a technological revolution, which starts from the first industrial revolution to third industrial revolution. The first industrial revolution was a "mechanization revolution" which began with the development of steam engines in Britain during the 18th century. It led to a huge breakthrough in productivity, shifting from manual production to mechanical production. The second industrial revolution was a "mass production revolution" based on the use of electricity. The mass production system was established through the introduction of conveyor belts in manufacturing assembly lines powered by electricity from 19th century to early 20th century. The third industrial revolution, known as the "knowledge and information revolution", occurred thanks to the advent of computers and the internet during the latter half of the 20th century. The establishment of high-speed internet networks and the popularization of high-performance personal computer enabled information exchange that exceeded physical limits.

[42] StudyMalaysia.com. (2019, September 17). Retrieved from https://studymalaysia.com

The Ministry of International Trade and Industry (MITI) has identified the main pillars[43] of Industry Revolution 4.0 and the description[44] of each is given as in the Table 2.7.

Table 2.9: The 9 Pillars of Industry Revolution 4.0's Pillars Acknowledged by MITI

(Source: Ministry of International Trade and Industry (MITI))

NO.	I.R4.0 PILLARS	BRIEF DESCRIPTION
1.	Autonomous Robots	Coordinated and automated actions of robots to complete tasks intelligently, with minimal human input.
2.	Big Data Analytics	The analysis of ever larger volumes of data. Circulation, collection, and analysis of information is a necessity because it supports productivity growth based on a real-time decision-making process.
3.	Cloud Computing	Storing and accessing data and programs over the Internet instead of your computer's hard drive.
4.	Internet of Things (IOT)	All machines and systems connected to the production plant (as well as other systems) must be able to collect, exchange and save these massive volumes of information, in a completely autonomous way and without the need of human intervention.
5.	Additive Manufacturing (3D printing)	Use in prototyping, design iteration and small-scale production and often described as "rapid prototyping" - produce the desired components

[43] MITI. Industry 4.0. FAQ. www.miti.gov.my
[44] Vaidyaa, S., Ambadb, P., Bhoslec, S. (2018). Industry 4.0 – A Glimpse. 2nd International Conference on Materials Manufacturing and Design Engineering. Elsevier B.V.

		faster, more flexibly and more precisely than ever before.
6.	System Integration	The process of linking together different computing systems and software applications physically or functionally to act as a coordinated whole via Internet of Things-IoT.
7.	Cyber-security	With the increased connectivity and use of standard communications protocols, the need to protect critical industrial systems and manufacturing lines from cybersecurity threats is increasing.
8.	Augmented Reality	Augmented-reality-based systems support a variety of services, such as selecting parts in a warehouse and sending repair instructions over mobile devices - provide workers with real-time information to improve decision making and work procedures.
9.	Simulation	Simulations will leverage real-time data to mirror the physical world in a virtual model, which can include machines, products, and humans. This allows operators to test and optimize the machine settings for the next product in line in the virtual world before the physical changeover, thereby driving down machine setup times and increasing quality.

Malaysia aspires to be a developed nation by 2025. The ICT sector has been identified as a conduit in achieving this. During the 2015-2016 period, the key drivers identified to lead the ICT industry were: big data, the IoT and cloud computing. For 2017-2018, this has transitioned into the 4 IR, fintech and block chain. Moving forward, the keys areas identified by International Data Corporation (IDC) Malaysia as best prospects are: big data in the cloud, enterprise mobility and device deployment, IoT, cognitive cybersecurity, data centre vision and fintech opportunities.

The Government has taken special interest in developing the IoT sub-sector, which has resulted in several market partnerships. The commercialization of 'smart city' infrastructure, applications and services – such as smart highways, intelligent traffic management systems and advanced energy management systems – is expected to drive IoT adoption across key social and economic sectors.

Over the last five years, the data centre industry has grown rapidly to support 26 data centre service companies and nearly 200 specialized service providers capable of providing affordable, scalable and high-quality remote data storage and retrieval services to the growing numbers of multinational corporations looking to establish regional headquarters in the country.

Cloud computing is experiencing investment in data centres and ICT infrastructure in Malaysia. MSC Malaysia has named cloud computing as the most important of its top 10 strategic technology priorities. The government hopes that adoption of cloud computing and building on the National Broadband Initiative, could accelerate Malaysia's development into an advanced economy. Software-as-a-Service (SaaS) has the highest adoption in cloud computing followed by Infrastructure-as-a-Service (IaaS) and Platform-as-a-Service (PaaS). Hybrid Clouds remain the dominant form of deployment by enterprises and this model has been recognized by service providers as a key growth market. While the adoption of cloud computing offers multiple potential benefits, there are also concerns regarding bandwidth consumption, lack of maturity of cloud environments, latency, data security and privacy guarantees from service providers. US industry has expressed concerns increased interest in data localization requirements in Malaysia.

2.9 Conclusion

Based on the literature review findings, the area of computer programming, consultancy and related activities is seen as one of the main contributors to the economic performance and foreign investment. Currently there are several stakeholders in the industry comprising of government agencies (i.e. MCMC, NACSA, MDEC, etc.) involved in the development and monitoring of the industry in terms of compliance to the relevant acts and regulations.

In order to increase employment mobility for the workforce, it is imperative that the occupational areas are redefined in the OS. This is to allow scalability of skills and to accommodate the emerging skills required in the current industrial revolution, which is the IR4.0. Segmentation of the industry based on the MSIC is also taken into consideration in order to be in sync with data from the Department of Statistics on labour demographics. This industry in particular falls under Section J: Information and Communication, Division 62: Computer programming, consultancy and related activities under MSIC 2008.

CHAPTER 3: METHODOLOGY

3.1 Introduction

The focus of this study is on computer programming, consultancy and related activities industry. Hence, this section provides a detailed description of the research methodology utilized for the study. It encompasses the overall review of the research design, overall research approach and summary.

In developing a better understanding regarding current development of computer programming, consultancy and related activities industry in Malaysia, a combination of research methods or the mixed methods (triangulation method) were utilized in the study in order to ensure the data collection and findings are relevant to the research investigation.

In order to get the depth understanding on the results from the quantitative data, the qualitative approach was deployed. Document analysis and focus group discussion with industry experts are a key part of the methodology as it facilitates understanding of key factors that would influence the industry. This qualitative approach, therefore, is an attractive technique to provide rich descriptions of the research data in natural settings (Miles & Huberman, 1994). Therefore, the semi-structured interviews seem to be a very practical way to reflect the realities of the industry under study.

In the quantitative and cross-sectional approaches, the method of data collection was mainly on survey. The scale was developed to contribute to the study industry. The questionnaires are directly administered to all the selected respondents in the Computer programming, consultancy and related activities industry. The phases of this research approach are shown in Figure 3.1.

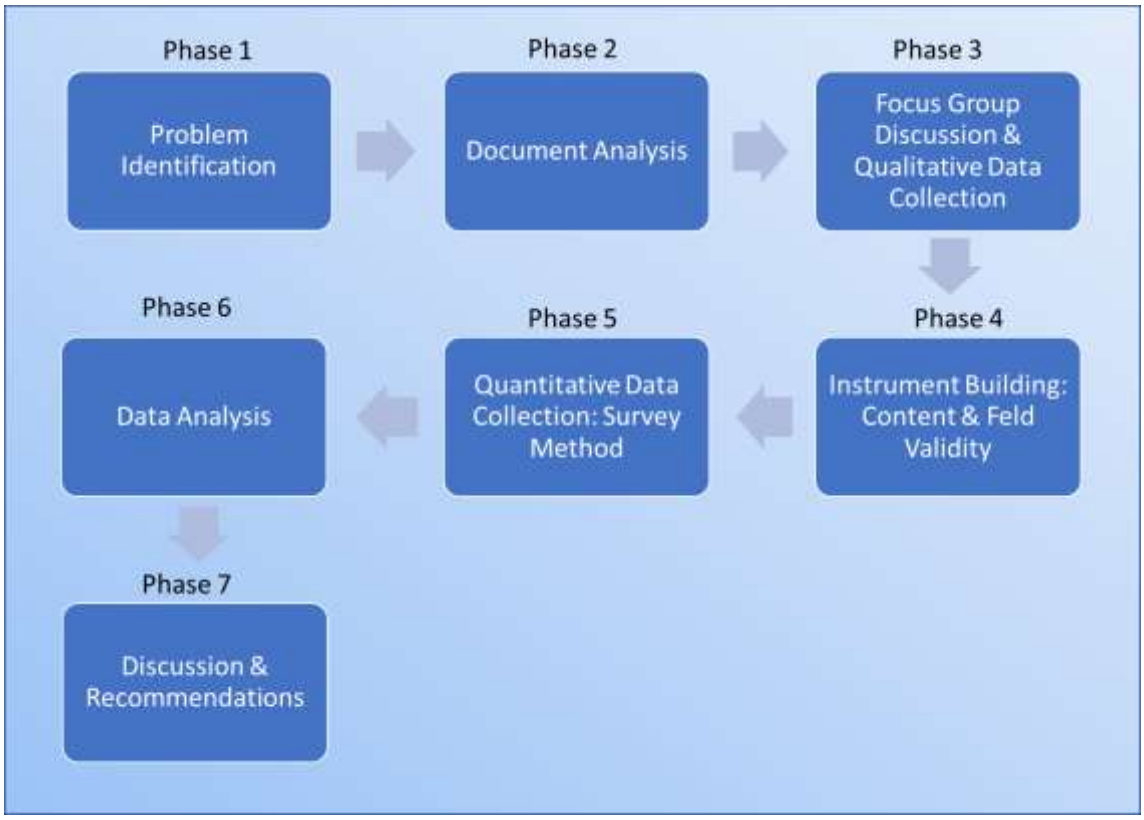


Figure 3.1: Phases of Research Methodology for Computer Programming, Consultancy and Related Activities in Industry.

Phase 1:

Identification of research problem: Broad problem area was identified through preliminary information gathering which was from secondary data and literature review.

Phase 2:

Document analysis: Perform actual secondary data collection by reviewing published information available from sources such as websites, archives and other written reports.

Phase 3:

Preparation of qualitative data procedure: The interview protocol was in the form of semi structure questionnaire that was prepared in line with the objective of this study. The interview protocol was developed by the researchers themselves. The

validity for this study was verified by employing triangulation strategy. In this approach, the researchers will triangulate different data sources of information to build a coherent justification of the different themes in close relation to the aim of the study. Focus group will then be conducted where respondent was from industry experts and practitioners.

Phase 4:

Quantitative instrument building: From the focus group discussion a reliable instrument was verified to be used in the actual field survey.

Phase 5:

Quantitative data collection: Actual data collection was carried out. Both self-administered and internet survey was carried out at nationwide for generalisation purposes. Sample from the population was collected at random to be representative.

Phase 6:

Data analysis for the quantitative data approach: Descriptive analysis was utilised to describe issues related to demand for the skills, jobs title, and critical tasks skills level for the computer programming, consultancy and related activities industry.

Phase 7:

Discussion and recommendation: Final discussion on the study was established with recommendations.

3.2 Overall Approach

Current study decided to fully employ three major approaches for data collection as following.

a) Document analysis;
b) Focus group discussion; and
c) Survey

3.2.1 Document Analysis

This approach requires rigorous review of existing literature that addresses a clearly formulated question. The review systematically searches, identifies, selects, appraises, and synthesises document research evidence found in the trade journal, academic paper and related journals. The collected data from this approach addresses the overview of the industry relevant to the requirement of Industrial Revolution (IR4.0) and industrial need.

a) Data Collection Strategy

Basically, document analysis involves two main sources of data and information:

i) Economic database

ii) Official reports and databases from relevant public and private agencies (Such as DOSM and DSD)

i) Economic Database

The information related to Malaysia's labour markets or demand is highly relevant to this study. Thus, the information from the Department of Statistic Malaysia (DOSM), Malaysia Standard Industrial Classification (MSIC) and critical occupation list by TalentCorp Malaysia, 11th Malaysia Plan, National Budget and Talent Corporation must be gathered, analyse and reported. Information from the Economic Census serves two purposes:

— To provide a snapshot of the computer programming, consultancy and related activities industry landscape and outlook.

— To serve as control figures and baselining database when assessing data obtained from the online survey.

ii) Official Reports and Databases from Relevant Public and Private Agencies (RMK 11, DSD and others)

In addition to the Economic Census reports, database from other government agencies (local and international agencies) that are relevant to computer programming, consultancy and related activities industry were gathered and analysed. Based on initial observation, the following databases contain relevant information for the industry.

- Local database – Department of Skills Development (DSD), Ministry of international Trade and Industry (MITI), and Malaysian investment Development Authority (MIDA).
- International database – Organization for Economic Co-operation and Development (OECD), World Bank, and European Union (EU).

Additionally, data and information published by local and international agencies in the form of online resources was collected.

b) Data Analysis Procedure

Based on the two sources of data and information, the following data analysis procedures are expected to be carried out.

i) Examined the economic performances of the industry by looking at several macroeconomic indicators (such as Gross Domestic product (GDP), employment and output)
ii) Analysed the industry outlook in relation to regional and global perspectives.
iii) Determined the profile of the current and future workforce (such as occupations, and salaries and wages).
iv) Reviewed technological development in the industry (such as robotic & automation as well as element of IR4.0).

3.2.2 Focus Group Discussion

A series of industry engagement based on focus group discussion were conducted to enable in-depth discussions on the issues of the industry workforce status. The focus group discussion involves the discussion on the occupational structure, job description, demand for the skills, jobs title, and critical tasks; assessment of curriculum and training programs; accreditation and qualification based on National Occupational Skills Standard (NOSS) and Malaysia Qualifications Agency (MQA) framework; potential workforce challenges; future outlook and strategic recommendations to be proposed.

For focus group discussion, about 6 industry experts were selected and appointed. The focus group discussion was conducted by an experience facilitator to encourage dialogue among the panels and at the same time controlling the discussion. Facilitators must be commissioned by the DSD to develop occupational standards according to the guidelines that have been set.

The functions of the facilitator are to elicit and gather information and develop occupational standards in accordance with the format and formulas prescribed by the DSD. While the industry experts must be a person who had at least 7 years' industry experience and working with a company registered with companies' *Suruhanjaya Syarikat Malaysia* (SSM).

The semi structured questions developed for focus group discussion was based on occupational structure, job description, demand for the skills, jobs title, critical tasks, and other related issues.

Five main semi-structured questions were constructed as follows:

a) What will be the industry Occupational Structure (OS) looks like?
b) What will be the job descriptions for each job title?
c) How to determine the demand for the industry skills?
d) How to determine the relevant jobs title that is in line with IR4.0?
e) How to determine the critical jobs for the industry?

a) Data Collection Strategy

In the process of gathering the input, brainstorming technique was adopted and attended by industrial expert who discussed the different sub-sectors and areas. Facts obtained during the document's analysis were also discussed and presented to the industrial experts. The information gathered was then used as input to the Occupational Framework (OF) of the said sub-sector. Workshops and interviews were conducted during the development of the Computer programming, consultancy and related activities industry OF. Output from surveys also underwent verification from the industrial experts from the focus group discussion. Follow up discussions with the industrial experts were done in smaller groups to verify the findings of the OF. See Figure 3.2 Focus group discussion flow chart.

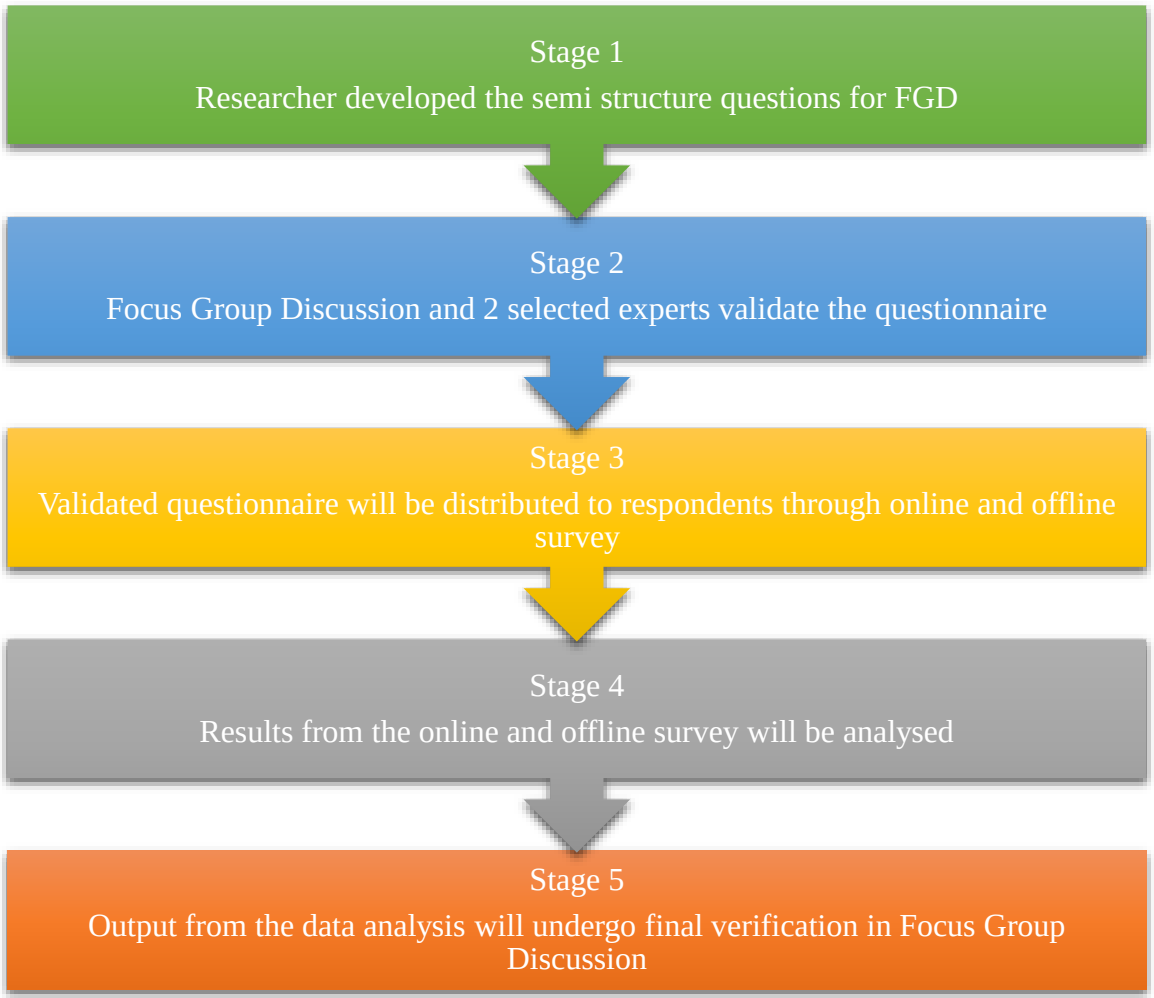


Figure 3.2: Focus Group Discussions Flow Chart

b) Data Analysis Procedure

The following analyses are expected to be carried-out for focus group discussion sessions.

i) Reviewed initial findings obtained from the online survey.
ii) Assessed the potential workforce challenges faced by the industry
iii) Highlighted any important sub-sectors of the industry
iv) Examined the demand and supply of talent in the computer programming, consultancy and related activities industry according to NOSS and MQA standards.
v) Reviewed the curriculum and training program relevant for the computer programming, consultancy and related activities industry workforce occupations in coordination with accreditation (MQA and DSD) and training providers, comprising local academic institutions (universities or colleges), vocational and other training entities.
vi) Analysed of future trend of the occupational demand by various skill categories including Technical and Vocational Education and Training (TVET) related occupations.

3.2.3 Survey

This study also employed online survey to achieve the four keys critical information which is competency in demand, jobs in demand, emerging skills and related issues. Google form was used as a platform for the survey. The survey will specifically be distributed to the related organisation base on organisational level. The survey form was divided into 4 sections as follows:

Section 1: Competency in demand

This section explores the competency that is required by the industry. Another objective of this section is trying to figure out the skills gap and how to overcome the gap.

Section 2: Jobs in demand

This section is aimed to determine which category of workers that is in shortage supply or over supply. The category is such as skilled workers, semi-skilled workers and low-skilled workers.

Section 3: Emerging skills

This section is trying to determine the readiness of industry players and the workers in the advent of IR4.0. The technology drives or pillars of IR4.0 are listed and the respondents have to decide the relevancy of each element in their line of duty.

Section 4: Related issues

This section explores the common issues surrounding the industry. The respondents are asked to choose related issues for the industry.

a) Establishment and Sampling Procedure

The establishment of this study consists of companies in Malaysia. According to the MSIC group there are 4,102 companies as refer to Economic Census 2016 from DOSM in Malaysia (See Table 3.2). This constitutes the establishment of this study.

The unit of analysis should be in consistent with the research problems, questions and objectives. This study used organisation as a unit of analysis and the respondents were owners/managers of the companies in Malaysia. Owner/managers are chosen because they are usually involved in day-to-day running of the businesses, and therefore they are in a better position to provide the needed, available and accurate information about their companies[45,46].

[45] Brush, C.G., Vanderwerf, P.A. (1992). A comparison of methods and sources for obtaining estimates of new venture performance. 157-170

[46] Chandler, G.N., Hanks, S.H. (1994). Market attractiveness, resource-based capabilities, venture strategies, and venture performance. 331-349

According to Roscoe (1975), sample size of 30 and less than 500 are appropriate for most research. Based on the total establishment of about 4,102 companies from the sampling frame the appropriate sample size at 10 percent margin of error should be 67 (See Table 3.1). Therefore, since the total establishment is 4102, the number of sample establishment is 67 and number of targeted respondents are 35. However, to minimize errors in sampling and to take care issues of non-response, the number of targeted respondents were doubled and a total of 70 questionnaires were distributed to selected companies or organisations. For respondent's response rate, based on Brauch, Y & Holtom, B.C (2008), the average level of response rate is 52.7 per cent. After data collected exercise was conducted, there are 40 totals of questionnaire collected. The targeted respondents were among the managerial levels in the related company and association in the industry or human resources director.

Simple random sampling was used in selecting the sample. This sampling technique only requires that the researcher has a list of all members of the establishment which allows him to get access to any member who might be chosen. Being simple it poses the least bias and offers the most generalizability, and thus it is the best single way to obtain a representative sample.

Table 3.1**:** Number of Targeted Respondents According to MSIC 2008 by Group

SECTION	**J**	**INFORMATION AND COMMUNICATION**	**ESTABLISHMENT**	**NUMBER OF SAMPLE ESTABLISHMENT**	**NUMBER OF TARGETED RESPONDENTS**	**NUMBER OF ACTUAL RESPONDENT**
DIVISION	**62**	Computer programming, consultancy and related activities				
GROUP	**620**	Computer programming, consultancy and related activities	**4,102**	**67**	**35**	**40**

b) Questionnaire Design

For this study, the questionnaires are design based on the feedback from focus group discussion. Which are based on the four keys critical information which is competency in demand, jobs in demand, emerging skills and related issues.

To increase the response rate and consistent responses, the questionnaire was designed based on close-ended questions on interval scale appropriate to the instrument. Content validity and face validity were employed. Content validity were performed in the pre-test stage by two experts from academic and industry sectors. They were expected to identify the content, grammar, phrasing of sentences and comprehend of the items used. After the pre-testing stage is completed, a pilot test was conducted to pre-test the instruments for this study. 10 respondents were chosen and none of the items required modification.

c) Measures and Instrumentation

Establishing the validity and reliability of the survey questionnaire before it could be used is important because it can determine the accuracy of the results as well as increases the credibility of the research findings. For this study, there were measures used in the section in the questionnaire. The questionnaire is divided into four sections namely: Section 1, Section 2, Section 3, and Section 4.

For Section 1, it will discuss regarding competency in demand and will use 4 interval scale ranging from 4 (High in demand), 3 (Moderate in Demand), 2 (Low in demand) and 1 (Not in demand) measuring the intensity of low-skilled workers, semi-skilled workers and skilled workers.

For Section 2, it will discuss on jobs in demand and will use three interval scale ranging from low demand, mid demand and high demand measuring the intensity of low-skilled workers, semi-skilled workers and skilled workers in computer programming, consultancy and related activities.

For Section 3, Emerging skills were discussed in this section. It contains close ended question measuring the important prerequisite and skills for IR4.0 in computer programming, consultancy and related activities.

For Section 4, related issues regarding the industry were discuss and three interval scale ranging from strongly agree, agree and disagree measuring the key issues in computer programming, consultancy and related activities.

d) Data Collection Strategy

Costing is an important consideration that influences the determination of sampling size for a primary survey. The population of the industry is large and will require a significant financial budget if a nationally representative survey is the primary target. The consultation with related associations concluded that a nationally representative survey will not be feasible. Instead of aiming for a nationally representative sample, our survey aims to increase participation rates from industries. There are three approaches for the data collection.

i) Approached the related associations' members. The secretariat of each association has agreed to distribute the questionnaire.
ii) Industry engagements/interviews/visits were scheduled to seek their assistance to distribute the online survey to the members of respective associations.
iii) Assistance from MITI & MCMC may also be required to provide the institutional support when engaging the selected respondents.

e) Data Analysis Procedure

The following analyses are expected to be performed for the online survey.

i) Descriptive analysis of employment profiles and other variables those are included in the questionnaire.
ii) Analysis of critical occupations identified by the industry
iii) Analysis of future trend of the occupational demand by various skills category including TVET related occupations.

iv) Analysis of talent gaps between supply and demand according to NOSS and MQA standards
v) Analysis of training provided by industries to employees

3.3 Conclusion

In this section, the justification of each selected research methodology is discussed. The selected research methodologies are document analysis, survey and questionnaire and focus group discussion.

Document analysis is chosen due to it efficient and effective way of gathering data because documents are manageable and practical resources. Documents are commonplace and come in a variety of forms, making documents a very accessible and reliable source of data. Obtaining and analysing documents is often far more cost efficient and time efficient than conducting the research and experiment. Document analysis is suitable method for this research because of this research required more information such as current statistics for related industry and the growth of the industry.

In addition, the survey and questionnaire were deployed in this research because questionnaires may be taken anonymously or in private, this method may be more effective for gathering sensitive information or when you want statistical data about what the majority of a certain group of people think. The shorter and more concise the questionnaire and the more specific the group of respondents, the more effective the results were.

Finally, focus group discussion is deploy in this research due to free and open discussion among the respondents results in generation of new ideas that can be very useful for decision-making. It is also a fast way to gain the needed information regarding job title in the related industry. This approach is time saving and effective way to gather information from many sources.

CHAPTER 4: FINDINGS

4.1 Introduction

This chapter elaborates the findings from the research works on 2 digits Malaysia Standard Industrial Classification 2008 (MSIC 2008) Division 62. The findings revolve around the objectives set for the study namely; to produce Occupational Structure (OS) for Computer programming, consultancy and related activities based on MSIC 2008, to highlight the competency in demand in the computer programming, consultancy and related activities, to determine critical jobs in computer programming, consultancy and related activities industry, to identify job titles related to Industrial Revolution (IR4.0) and to determine Occupational Descriptions (OD) for each job title on latest industry OS. This chapter therefore highlights the findings gathered on these key areas.

4.2 Findings Analysis

This section provides the analysis of data derived from focus group discussion and survey findings. Analysis result were discussed on job in demand and competency in demand. Emerging skills that will developed in this industry also discussed in details. Besides that, related issues are also discussed at which identification of key issues and solution to the issues. Result analysis from focus group discussion and survey are analyse and compared to find whether the standard of job identification are standardize within the job market.

4.2.1 Discussion of Results

The findings of this research were obtained by document analysis, focus group discussion with the industry representative during the development workshops and survey, the OS and OD of the industry is produced. The discussions also have identified the jobs in

demand, competency in demand, emerging skills and related issues for computer programming, consultancy and related activities industry. From the total survey distributed, 40 data from respondent are collected. Base on sample size the sample size is appropriate as the range of respondent is between 30 and 500[47].

4.2.2 Jobs in Demand

In summary, job in demand or critical job means job titles that are hard to fill, job titles that are strategic to the industry and job titles that require specific skill and experience. This section comprises of focus group discussion and survey findings. The jobs in demand as referred from the Table 4.1 were obtained from discussion in development workshops. The job area / job title was divided into three categories of worker skills which is low-skilled worker (LS), semi-skilled worker (SS) and skilled worker (S) which based on focus group discussion. Based on Department of Skills Development (DSD), eight levels of qualification are identified which is level 1 (low skilled worker), level 2 and 3 (semi-skilled worker) and 4 until 8 (skilled worker).

a) Focus Group Discussion

Based on the data from focus group discussion in table above, most of the development panels are agreed that there is high in demand for semi-skilled and skilled worker such as application developer, application programmer, data processing and data entry to increase their industry's productivity. These data are supported by distributed surveys which showed that there is high demand in semi-skilled and skilled worker. Figure below showed the similar pattern of job in demand for three categories of worker which are low skilled worker, semi-skilled worker and skilled worker according to their job area.

[47] Roscoe, J.T. (1975). *Fundamental research statistics for the behavioral sciences*

Table 4.1: Jobs in Demand

NO.	CATEGORY OF WORKERS (JOB TITLES)	FACTOR(S) CONTRIBUTING TO THE DEMAND	SPECIFIC REQUIREMENTS AND SKILLS
1	Low Skilled Worker (General Worker)	a) Certifies workforce to execute and operate front-end work activities	a) Analytical skills with independent in delivering results
2	Semi-Skilled Worker (Data Processing, Data Entry, Application Programmer)	a) Mismatch of qualification, knowledge and required skills to perform the job function b) High salary expectation c) Limited requirement for personnel in the sector	a) Qualification which is relevant to the job function b) Knowledge which is required to perform the job function c) Skills which is required to execute the task
3	Skilled Workers (System Analyst, Application Developer)	a) Mismatch of qualification, knowledge and required skills to perform the job function b) High salary expectation c) Limited requirement for personnel in the sector	a) Qualification which is relevant to the job function b) Knowledge which is required to perform the job function c) Skills which is required to execute the task d) Operation and management skills e) Knowledge on current or latest technology f) Team work, leadership skills and communication skills g) Analytical skills

b) Survey

Figure 4.1 shows based from the 40 respondents, for semi-skilled workers there are high demand and mid demand for semi-skilled workers in web programming.

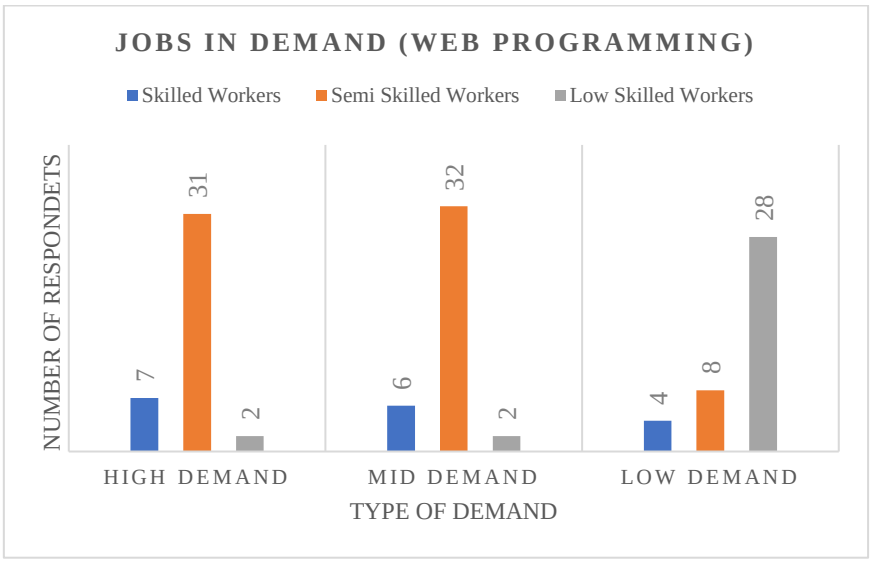


Figure 4.1 Jobs in Demand (Web Programming)

Figure 4.2 shows based from the 40 respondents, for semi-skilled workers and skilled workers there are high demand and mid demand for semi-skilled workers in mobile programming.

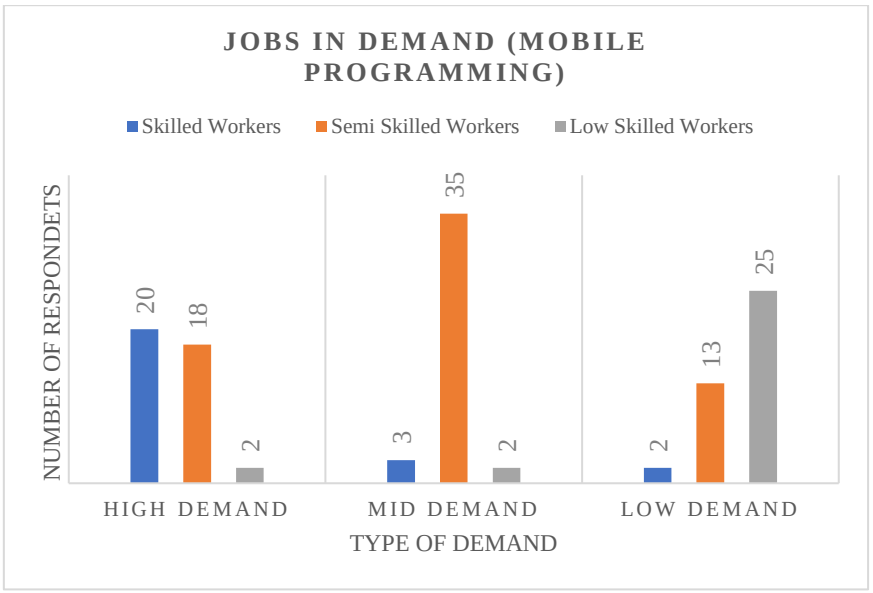


Figure 4.2 Jobs in Demand (Mobile Programming)

Figure 4.3 shows based from the 40 respondents, semi-skilled and skilled workers there are high demand and mid demand for semi-skilled workers in games programming.

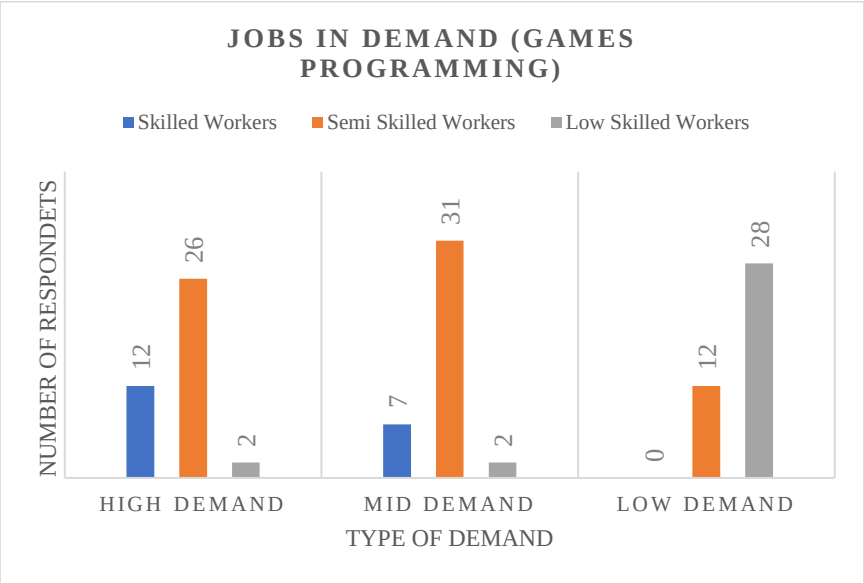


Figure 4.3 Jobs in Demand (Games Programming)

Figure 4.4 shows based from the 40 respondents, for skilled workers there are high demand and mid demand for semi-skilled and skilled workers in VR Software Application programming.

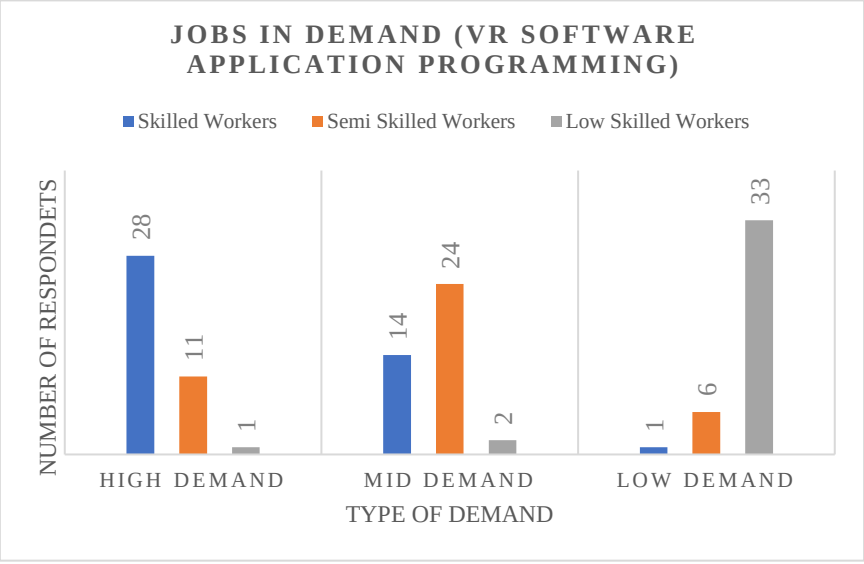


Figure 4.4 Jobs in Demand (VR Software Application Programming)

Figure 4.5 shows based from the 40 respondents, for semi-skilled and skilled workers there are high demand and mid demand for semi-skilled and skilled workers in enterprise application programming.

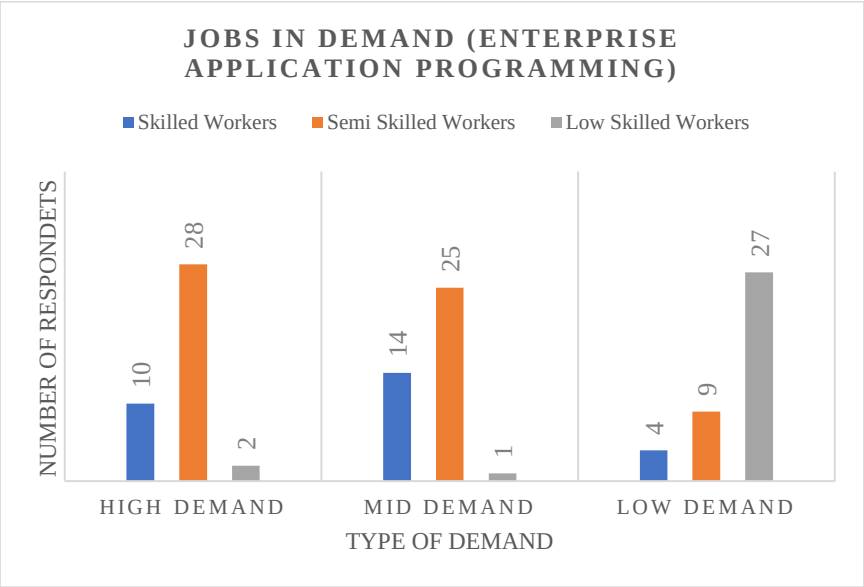


Figure 4.5 Jobs in Demand (Enterprise Application Programming)

Figure 4.6 shows based from the 40 respondents, for semi-skilled workers there is high demand and mid demand for semi-skilled workers in Wearable Device programming.

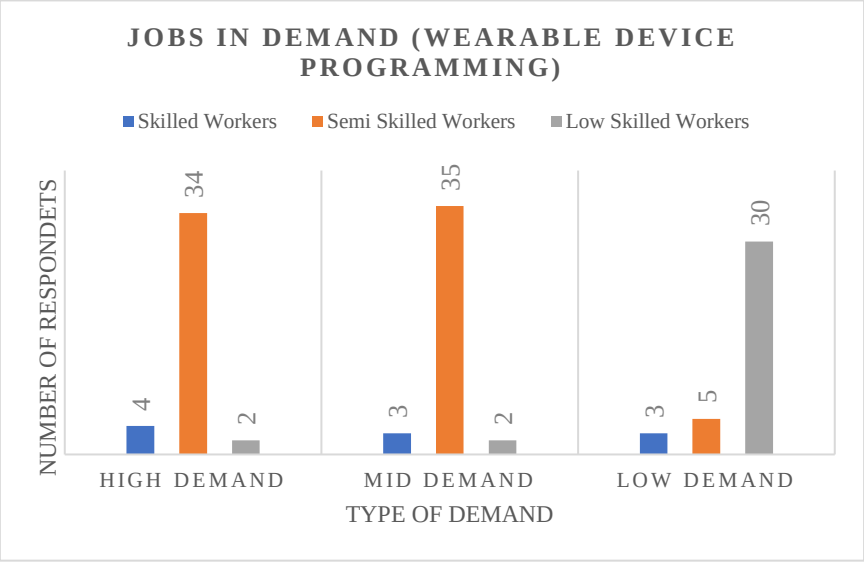


Figure 4.6 Jobs in Demand (Wearable Device Programming)

Figure 4.7 shows based from the 40 respondents, for semi-skilled workers there are high demand while mid demand for semi-skilled workers in Drone programming.

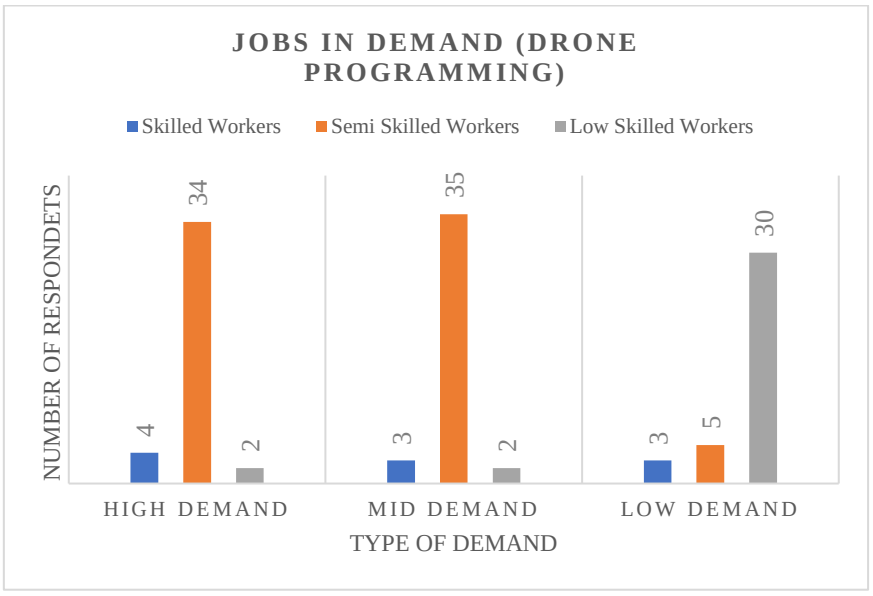


Figure 4.7 Jobs in Demand (Drone Programming)

Figure 4.8 shows based from the 40 respondents, for skilled workers there are high demand and while mid demand for semi-skilled and skilled workers in IoT programming.

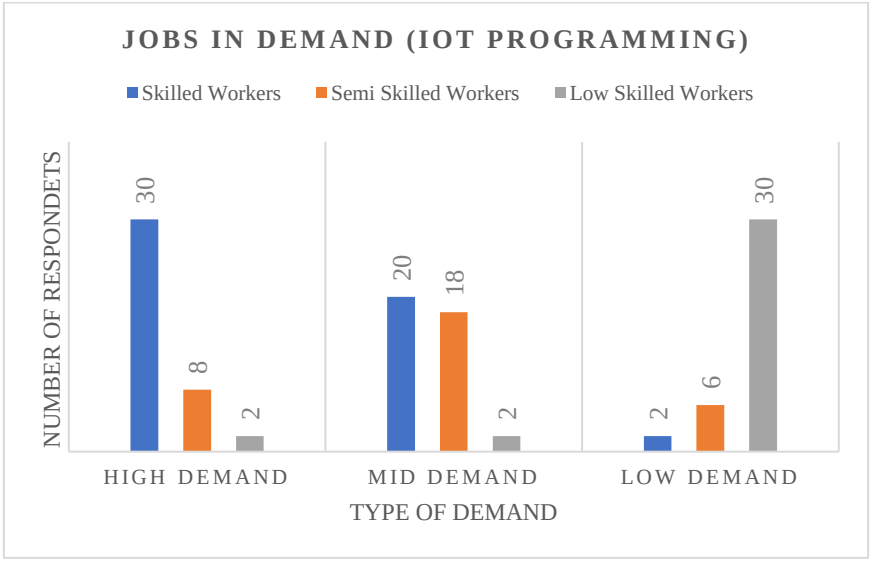


Figure 4.8 Jobs in Demand (IoT Programming)

Figure 4.9 shows based from the 40 respondents, for semi-skilled and skilled workers there are high demand and while mid demand for low-skilled and semi-skilled workers in big data programming. There are also low demand for low skilled, semi-skilled and skilled workers.

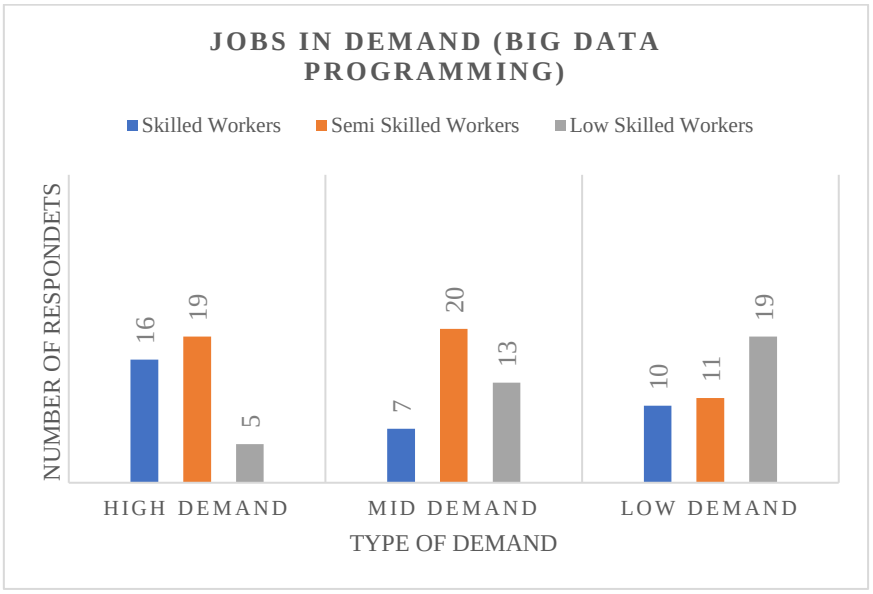


Figure 4.9 Jobs in Demand (Big Data Programming)

Figure 4.10. shows based from the 40 respondents, for semi-skilled and skilled workers there are high demand while mid demand for low-skilled and semi-skilled workers in database programming. There is low demand for low-skilled and semi-skilled workers.

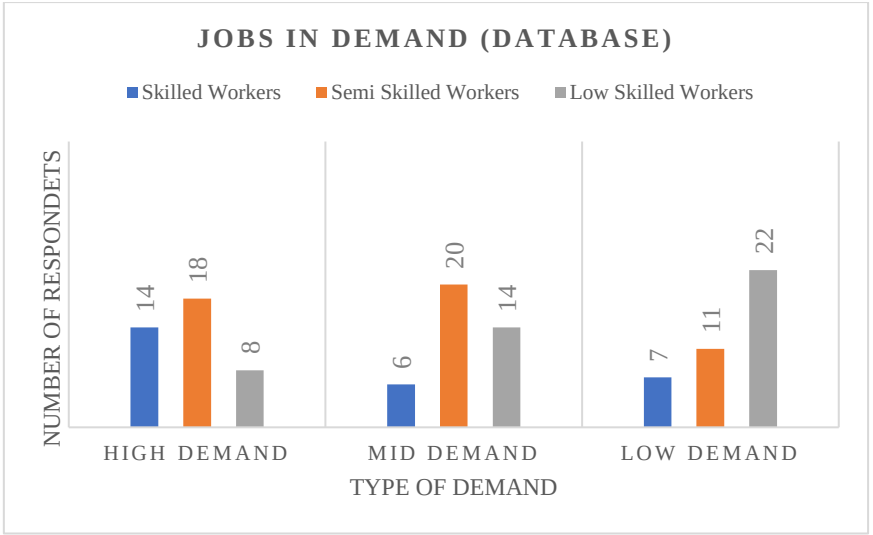


Figure 4.10 Jobs in Demand (Database)

Figure 4.11 shows based from the 40 respondents, for semi-skilled and skilled workers there are high demand while mid demand for semi-skilled workers in UX. There are also low demand for low-skilled workers.

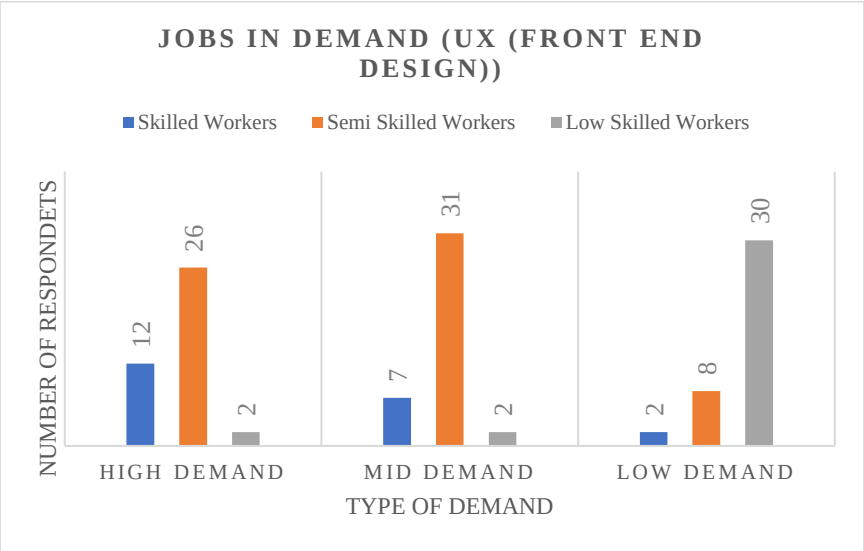


Figure 4.11 Jobs in Demand (UX (Front End Design))

Figure 4.12. shows based from the 40 respondents, for low-skilled, semi-skilled and skilled workers there are high demand while mid demand for low-skilled and semi-skilled workers in quality assurance/ quality controls. There are low demand for low-skilled and semi-skilled workers.

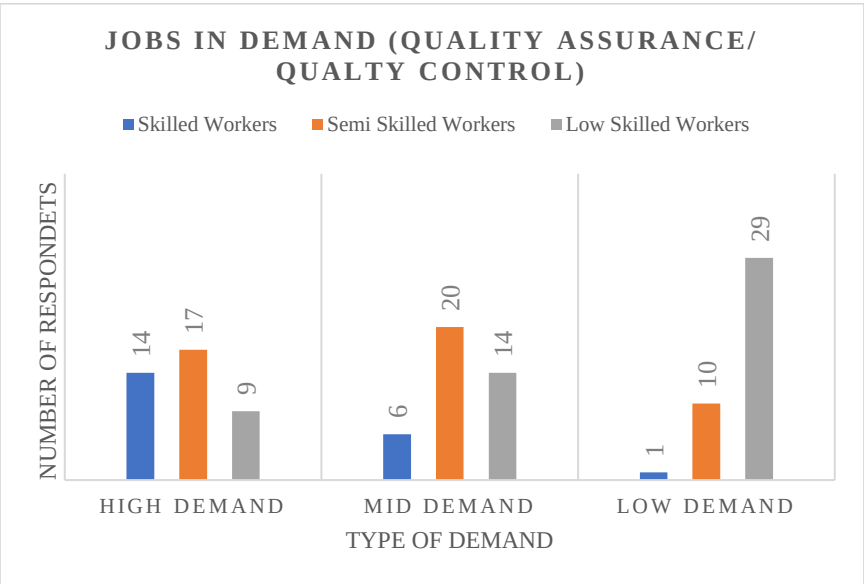


Figure 4.12 Jobs in Demand (Quality Assurance/ Quality Controls)

Figure 4.13. shows based from the 40 respondents, low-skilled, semi-skilled and skilled workers there is high demand and while mid demand for low-skilled and semi-skilled workers in infrastructure. There is low demand for low-skilled and semi-skilled workers.

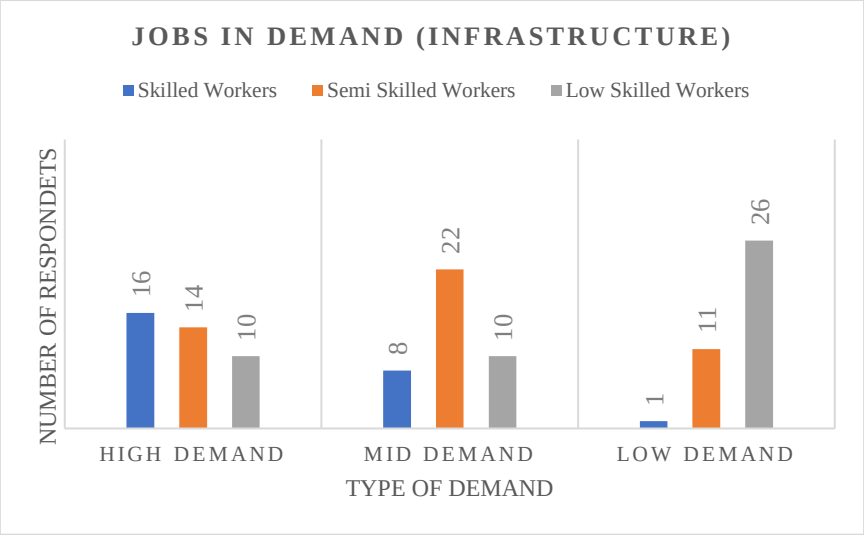


Figure 4.13 Jobs in Demand (Infrastructure)

Figure 4.14 shows based from the 40 respondents, for semi-skilled and skilled workers there are high demand while mid demand for low-skilled and semi-skilled workers in consultancy. There are low demand for low-skilled and semi-skilled workers.

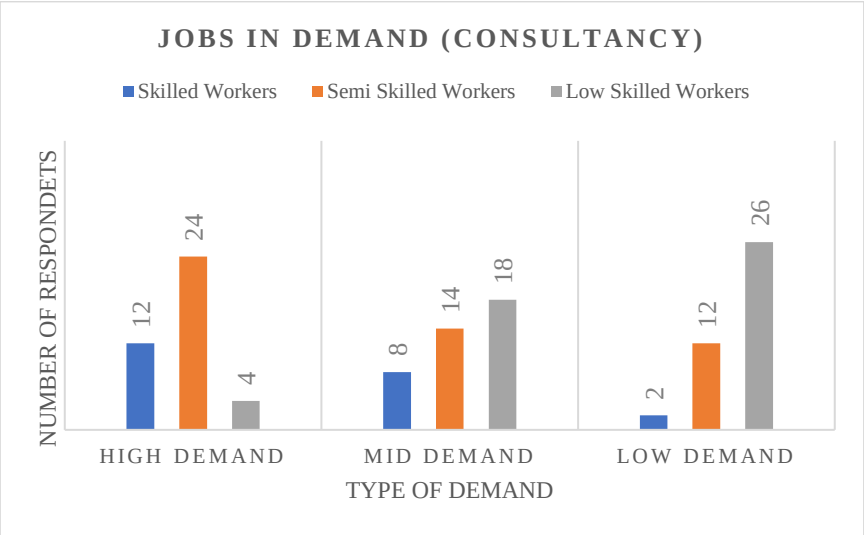


Figure 4.14 Jobs in Demand (Consultancy)

Table 4.2: Occupational Structure vs E-Masco vs Critical Occupational List

Job Titles	Occupational Structure	e-Masco	COL
System Analyst	√	√	√
Application Developer	√	√	√
Application Programmer	√	√	**X**
Data Processing	√	√	**X**
Data Entry	√	√	**X**

Based on focus group discussion and survey conducted, the jobs in demand in computer programming, consultancy and related activities are highlighted for low-skilled workers, semi-skilled worker and skilled worker and specifically for system analyst, application developer, application programmer, data processing and data entry which relates to each area of discussion. From the survey, most of the result obtain from the respondent are there is high and mid demand for semi-skilled workers as positions of programmer and developer are the platform to create program while certain job are being state by the respondent that there are high demand for low-skilled workers such as data entry and data processing as this positions is important for big data and database area. This survey results corresponds with the FGD as one of the critical jobs are data entry and data processing. Table 4.2 shows the mapping between OS produced, E-Masco and COL.

4.2.3 Competency in Demand

The current workers employed require other training programs/schemes such as management, supervisory and social skills beside the skills that they possess in order to enhance their knowledge and skills can be refer from the Table 4.3.

a) Focus Group Discussion

Based on FGD data, managerial skills, social skills, troubleshooting/ problem solving skills, competent in using latest technology and programming language competency are example set of skill and competency in demand for the computer programming, consultancy and related activities industry. These competency skills are mostly demanded for semi-skilled and skilled worker such as system architect, system analyst, application developer and application programmer. These data are supported by distributed surveys show in Figure 4.4

Table 4.3: Competency in Demand

No.	Competency in Demand	Factors Contributing to The Demand	Specific Requirements and Skills
1	a) Managerial skills b) Social skills (interpersonal, communication, language, etc)	a) No structured system to transfer skill to new successor b) Lack of exposure on process c) Lack of hands on experience on process	a) Training on related or similar areas b) Review of training syllabus at training centre/ provider c) Joint venture with industry player to provide facilities and exposure d) Invite industry player to jointly carry out R&D programs
2	a) Troubleshooting / problem solving skills b) Competent in using latest technology c) Programming language competency	a) No established written procedure on handling such product b) No established written material on latest technology for reference c) Expensive Equipment and software licenses	a) Training on related or similar areas b) Review of training syllabus at training centre/ provider c) Joint venture with industry player to provide facilities and exposure d) Invite industry player to jointly carry out R&D programs.

b) Survey

Figure 4.15 shows skills in demand for low-skilled workers. There are high demand competency criterion especially in data collection and sorting skills, general attitude toward works and communication skills. There are in demand for administration skills, product knowledge and communication skills, and low in demand for all competency especially for leadership, competent in using latest technology, programming language competency and training and coaching.

Figure 4.16 shows skills in demand for semi-skilled workers. There are high demand for all competency criteria especially in diagnostic skills, planning and forecasting abilities, general attitude toward work, competent in using latest technology, programming language competency, training and coaching and regulatory knowledge. There are in demand for all competency criteria especially in planning and forecasting abilities and English language competency. There are low in demand for administration skills, leadership and English language competency.

Figure 4.17 shows skills in demand for skilled workers. There are high demand for all competency criteria especially in diagnostic skills, leadership, planning and forecasting abilities, general attitude towards work, product knowledge, English language competency, programming language competency and communication skills. There is only high demand for communication skills. There are in demand for all especially for training and coaching. There are low in demand in data collection and sorting skills and not competent in using latest technology

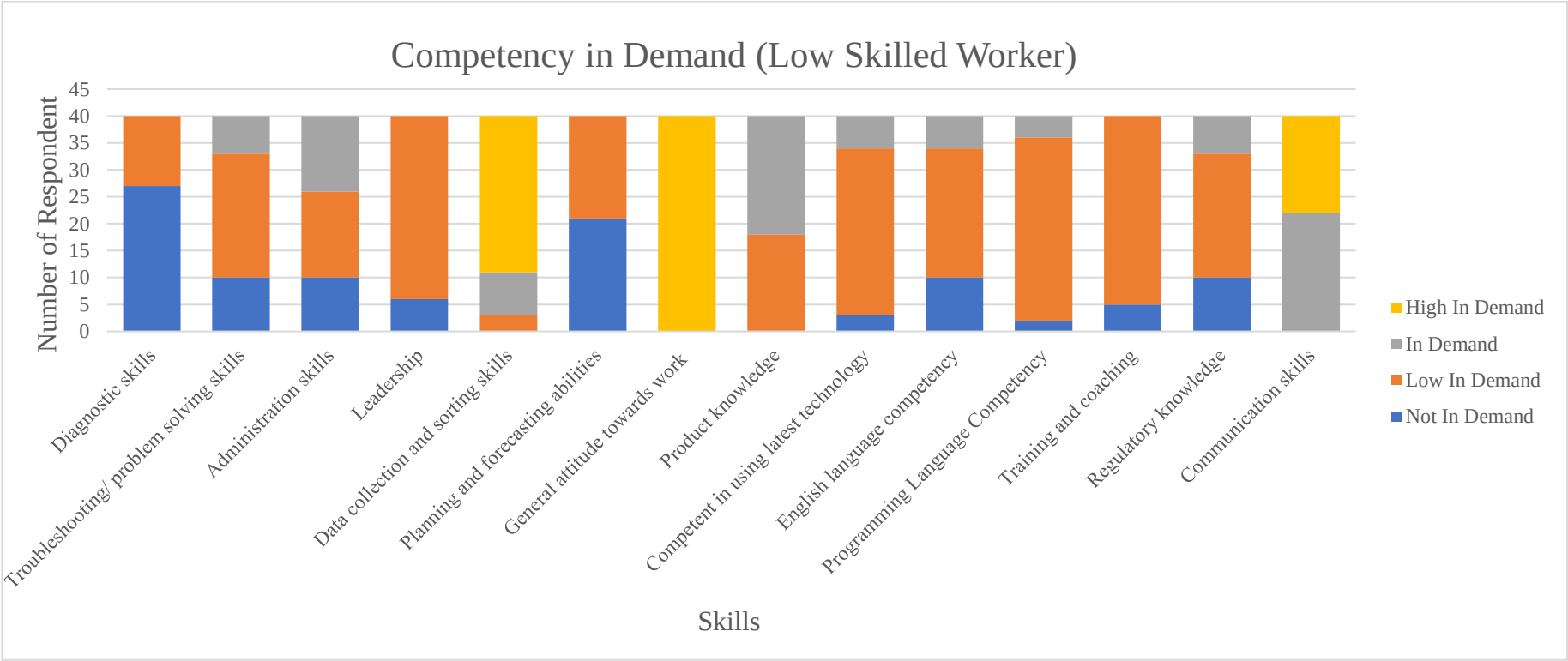


Figure 4.15 Skills in Demand (Low-Skilled Worker)

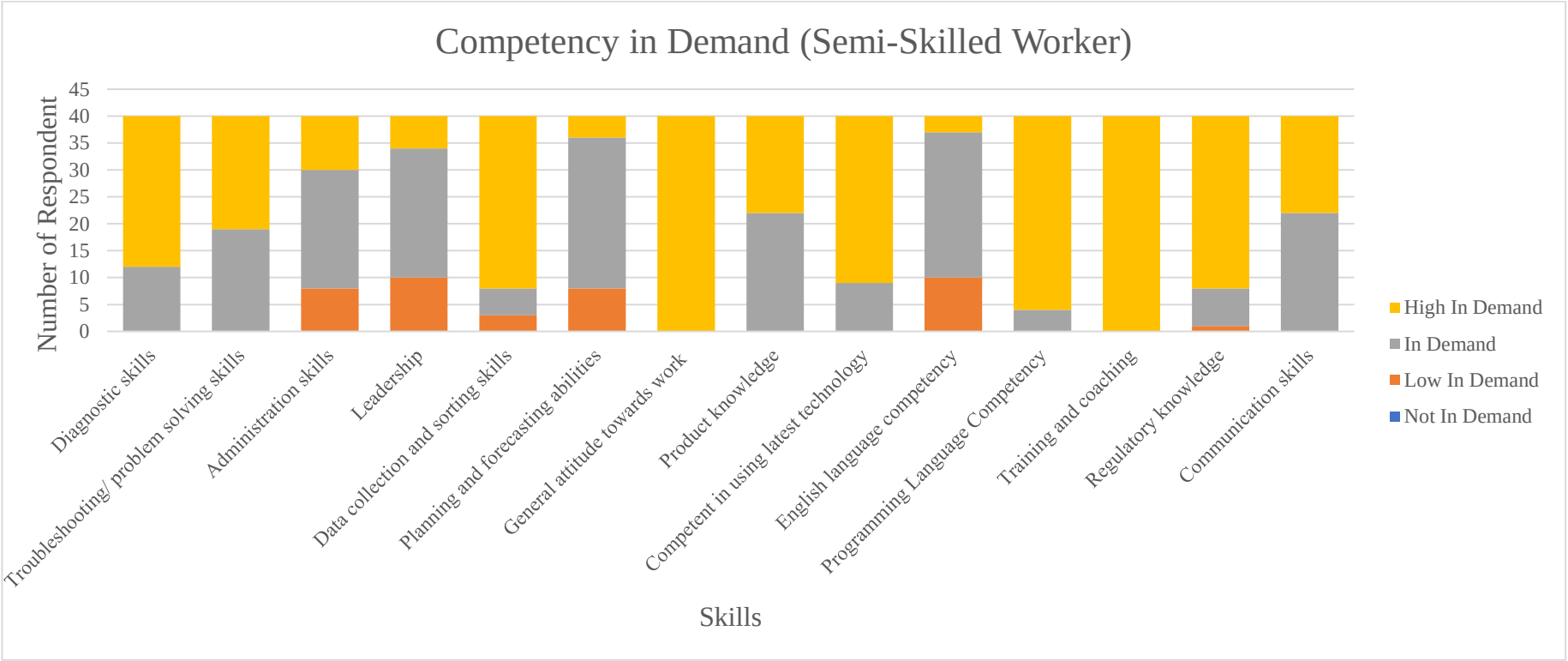


Figure 4.16 Skills in Demand (Semi-Skilled Worker)

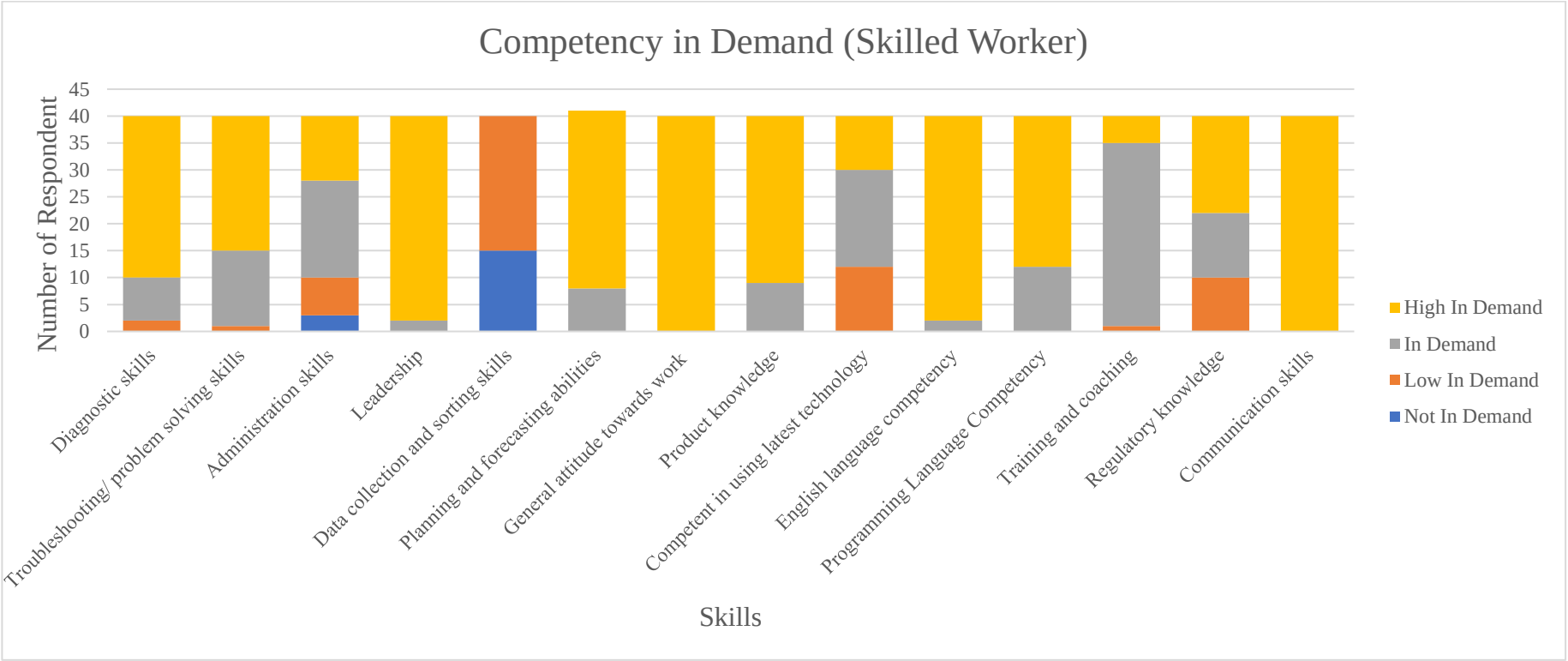


Figure 4.17 Skills in Demand (Skilled Worker)

Table 4.4 Competency Skills Description

(Source: Merriam-Webster Dictionary)[48]

Competency	Description
Diagnostic skills	Diagnostic skills refer to an individual's ability to identify a particular problem and define it.
Troubleshooting/ problem solving skills	Problem solving skills refers to an individual's ability to solve problems in an effective and timely manner without any impediments. It involves being able to identify and define the problem, generating alternative solutions, evaluating and selecting the best alternative, and implementing the selected solution.
Administration skills	Administration skills refers to an individual's ability to plan, organize, staffing, scheduling and managing computer software comprehending word processing, spreadsheets, databases, and telecommunications.
Leadership	Leadership refers to an individual's ability to motivate a group of people to act towards achieving a common goal.
Data collection and sorting skills	Data collection and sorting skills refers to an individual's ability to gather, measure and sort information from a variety of sources to get a complete and accurate picture of an area of interest.
Planning and forecasting abilities	Planning and forecasting abilities refer to an individual's ability to look in the future and plan course of actions accordingly on the basis of its performance in past and present.

[48] Merriam-Webster Dictionary. (11, October 2019). Retrieved from https://www.merriam-webster.com/

General attitude towards work	General attitude towards work refers to an individual's ability to give commitment toward work, being resourcefulness to an organization and perform as a team.
Product knowledge	Product knowledge refers to an individual's ability to communicate information and answer questions about a product or service.
Competent in using latest technology	Competent in using latest technology refers to an individual's ability to always update self-skills with the over changing technology.
English language competency	English language competency refers to an individual's ability of an individual to speak or perform in english language.
Programming Language Competency	Programming Language Competency refers to an individual's ability to communicate information and answer questions about a product or service.
Training and coaching	Training and coaching refer to an individual's ability to transfer knowledge and enhance knowledge/skills.
Regulatory knowledge	Regulatory knowledge refers to an individual's ability to have a solid grasp on changing work environment.
Communication skills	Communication skills refers to an individual's ability to convey or share ideas effectively.

Based on Figure 4.15, the respondents highlighted the top 5 skills demands for semi-skilled worker are programming language competency, English language competency, competent in using latest technology, communication skills and general attitude towards work (commitment, resourcefulness, teamwork, etc.)). While for skilled worker, based on Figure 4.17, the top 5 skills in demands are programming language competency, training and coaching, English language competency, regulatory knowledge and communication skills.

4.2.4 Emerging Skills

Emerging skills can be defined as the new set of skills that have potential for the industry such as IR4.0 related skills. The following are emerging skills as highlighted by the industry and can be refer from Table 4.5

a) Focus Group Discussion

According to the data from FGD, the emerging skills for computer programming, consultancy and related activities are listed in Table 4.5, the job related to these emerging skills are system architect, system analyst, application developer, application programmer, data processing and data entry. Based on the survey distributed, it is observed that not all from 11 pillars of the IR4.0 affected the computer programming, consultancy and related activities. The respondent agrees that the pillar that gives the highest impact are big data analytics, cloud computing, internet of things, system integration, cybersecurity, augmented reality and simulation and artificial intelligence.

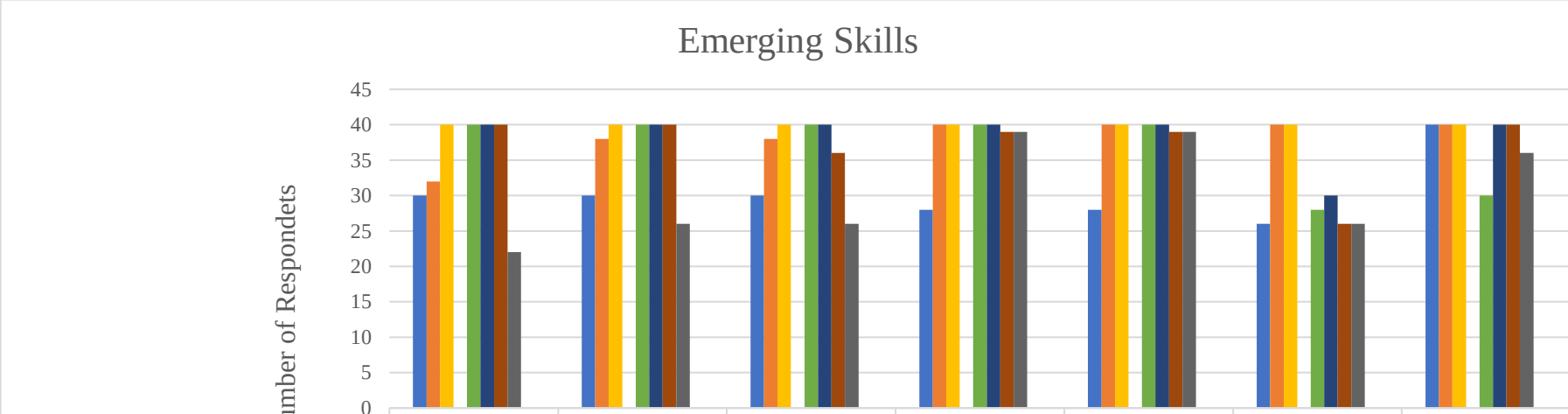
Table 4.5: Emerging Skills for Computer Programming, Consultancy and Related Activities in Industry

No.	EMERGING SKILLS	AREA/ JOB TITLES	REASON OF REQUIRED EMERGING SKILLS
1	Big Data Analytics	a) Big Data/ Data Processing b) Big Data/ Data Entry c) Database/ Data Processing d) Database/ Data Entry	a) Increase productivity, reduce cost and improve efficiency b) Minimize human error c) Fast decision making
2	Cloud Computing		
3	Internet of Things (IoT)		
4	System Integration		
5	Cybersecurity		
6	Augmented Reality & Simulation		
7	Artificial Intelligence		

		e) UX (Front End Design)/ UX Developer f) UX (Front End Design)/ UX Programmer	d) Increase process effectiveness

b) Survey

Figure 4.18 shows emerging skills in computer programming, consultancy and related activities industry. Survey result shows that big data analytics, cloud computing, internet of things, system integration, cybersecurity, augmented reality and simulation and artificial intelligence are emerging skills that are closely related to this industry. It is in line with FGD which concludes the same results.



	Web Programming	Mobile Programming	Game Programming	VR Software Application Programming	Enterprise Application Programming	Wearable Device Programming	Drone
Autonomous Robots	0	0	0	0	0	0	0
Big Data Analytics	30	30	30	28	28	26	40
Cloud Computing	32	38	38	40	40	40	40
Internet of Things (IoT)	40	40	40	40	40	40	40
Additive Manufacturing (3D Printing)	0	0	0	0	0	0	0
System Integration	40	40	40	40	40	28	30
Cybersecurity	40	40	40	40	40	30	40
Augmented Reality & Simulation	40	40	36	39	39	26	40
Artificial Intellegence	22	26	26	39	39	26	36
Supply Chain	0	0	0	0	0	0	0
New Bussiness Model	0	0	0	0	0	0	0

Figure 4.18 Emerging Skills for Computer Programming, Consultancy and Related Activities Industry

4.2.5 Related Issues in Computer Programming, Consultancy and Related Activities Industry

The industry's common issues are explored in this section. The respondents suggest that ways to overcome these problems by survey that have been distributed. Furthermore, related issues for the computer programming, consultancy and related activities industry also have been identified during focus group discussion and listed in the Table 4.6 below.

a) Focus Group Discussion

According to the data from FGD, the related issues for Computer programming, consultancy and related activities are listed in table 4.6, the issues related for Computer Programming, Consultancy and Related Activities Industry are insufficient manpower, low skilled and low performance workforce, underpayment of wages, low quality control and technology change.

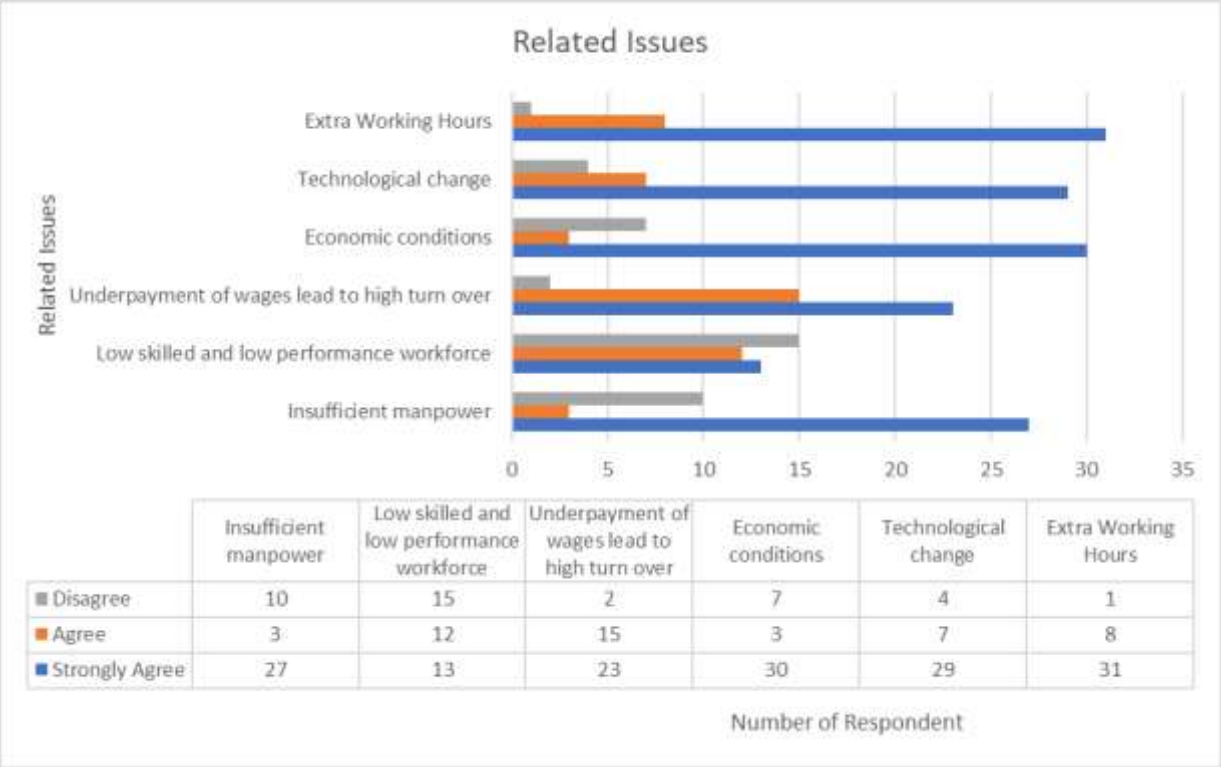
Table 4.6: Related Issues

No.	Key Issues	Discussion	Suggestion
1.	Insufficient manpower	a) Unattractive wages and fringe benefits b) Negative perception by community	a) Minimum wage policy b) Review wages scheme on productivity based
2.	Low skilled and low performance workforce	a) Lack of training facilities and talent management from the employees b) Low motivation and rewards	a) Government Incentives and Intervention
3.	Underpayment of wages lead to high turn over	a) Salary wages does not match with productivity and job requirements.	a) Profit sharing – changing the mindset of the managerial to create harmonise salary scheme.

No.	Key Issues	Discussion	Suggestion
4.	Low- Quality Control	a) Low productivity and quality	a) Quality enhancement by upgrading more skilful workers. b) SOP enforcement by private sector.
5.	Technological change	a) Slow technological innovation and adoption b) Lack of capital investment	a) Financial facilities by public fund with incentives.

b) Survey

Figure 4.20 shows that based on the 40 respondents, related issues for computer programming, consultancy and related activities industry are insufficient manpower, low skilled and low performance workforce, underpayment of wages leads to high turnover, economic conditions, technological change, and extra working hours. Most of them strongly agree with all these issues especially on extra working hours and economic condition.



	Insufficient manpower	Low skilled and low performance workforce	Underpayment of wages lead to high turn over	Economic conditions	Technological change	Extra Working Hours
Disagree	10	15	2	7	4	1
Agree	3	12	15	3	7	8
Strongly Agree	27	13	23	30	29	31

Figure 4.19 Related Issues for Computer Programming, Consultancy and Related Activities Industry

4.3 Comparative Study Analysis

This section provides comparison between Malaysia, United States, India and China regarding information and communication industry.

a) United States (US)

Figure 4.20 shows the digital economy and industry share of total gross domestic product in 2017. US constant GDP for the year 2018 grew with the total value of USD $ 18.219 trillion compared to 2015 with the total value of USD $ 20.494 trillion. Currently, US has the largest population of software developers compared to the rest of the world which is about 3.6 million workers[49]. Due to the large increase in the demand for computer software's, it is expected that the increase of

[49] Evans Data Corporation. (2019, September 16). Retrieved from https://www.computerworld.com/article/2483690/india-to-overtake-u-s--on-number-of-developers-by-2017.html

employment of application developers and software developers from 2018 to 2029 are 21% and 26%, respectively[50].

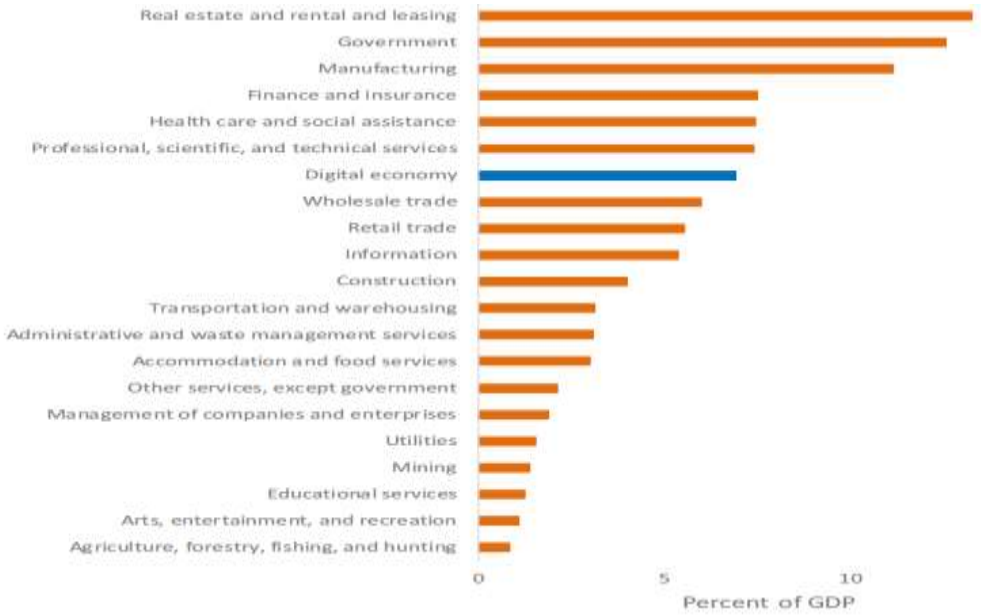


Figure 4.20: Digital Economy and Industry Share of Total Gross Domestic Product, 2017 Percent

(Source: Bureau of Economic Analysis, 2017)

Figure 4.22 shows the total employment US economy in 2017. Digital economy has been a bright spot in the US economy. Digital economy real value added grew at an average annual rate of 9.9% per year from 1998 to 2017, compared to 2.3% growth in the overall economy. The GDP digital economy value is at USD $19,485.4 billion in 2017, up from 5.9% in 1997. When compared with traditional US industries or sectors, the digital economy ranked just below professional, scientific, and technical services, which accounted for 7.4% ($1,450.0 billion) of current-dollar GDP, and just above wholesale trade, which accounted for 6.0% ($1,174.1 billion) of current-dollar GDP. In 2017, the digital economy supported 5.1 million jobs, which accounted for 3.3% in total US employment (152.1 million jobs), comparable to the transportation and warehousing industry. Employees working in the digital economy earned USD

[50] U.S. Bureau of Labor Statistics. (2019, September 16). Retrieved from https://www.bls.gov/ooh/computer-and-information-technology/software-developers.htm#tab-6

$132,223 in average annual compensation compared to USD $ 68,506 average annual compensation per worker for the total US economy.

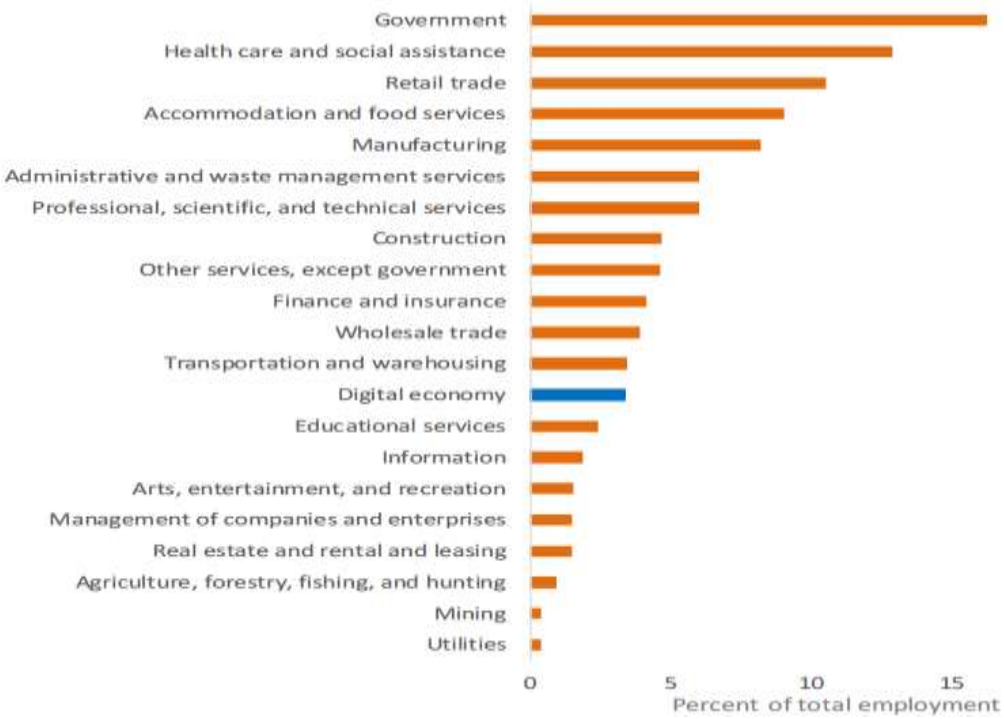


Figure 4.21: Total Employment US Economy, 2017

(Source: Bureau of Economic Analysis)

Among the main contributors to the digital economy, the largest components are support services and telecommunications, which together accounted for more than half of total digital value added in 2016. Digital goods such as computer hardware and software accounted for only 11% and 21%, respectively. The share of ecommerce has increased from 7.6% in 2006 to 11.6% in 2016, consistent with the growing importance of e-commerce retail sales such as Amazon and other online retailers.

b) **India**

It is estimated that the population of software developers of India will overtake the US by 2023. In the middle of the year of 2018, India has approximately 2.75 million software developers[51]. India constant GDP for the year 2018 grew with

[51] The Week. (2019, September 16). Retrieved from https://www.theweek.in/news/biz-tech/2018/04/18/india-fastest-growing-software-developer-base-globally.html

total value of USD $ 2.716 trillion compared to 2015 with total value of USD $ 2.103 trillion. In the year of 2018, almost 8% of the India overall GDP is represented by information technology and its various subsectors which is at the value of USD $ 217.28 billion. This industry generated an annual revenue close to USD $180 billion in the financial year 2019, which is a significant increase from the generated revenue of the year 2009. Only a total of less than USD $50 billion were for domestic revenue which shows that the majority of this revenue was generated in exports[52].

India core digital sectors can be divided to three which are undergoing transitions for the future. In addition to analysing past growth trends, extensive stakeholder consultations are run to develop a perspective on potential growth and develop scenarios. The approach used to develop the scenario are listed below:

i) Information Technology and Business Process Management (IT-BPM) (USD $205 billion to USD $250 billion potential value added in 2025)
The revenue and value-added scenarios for IT-BPM were constructed with two fundamental trends in mind: scenarios related to global technology spending and India's ability to capture a part of that. Global ICT spending grew by 2 percent per year between 2015 and 2017, as opposed to 3.4 percent per year forecast in the National Association of Software and Services Companies (NASSCOM) - McKinsey 2015 perspective. As a result, we developed two scenarios, one assuming that technology spending could continue to grow at a moderate rate of 2.5% annually to year 2025, and the other assuming that it could accelerate pace and grow at a 3.4% rate. The second component of our scenario is alternative perspectives on how fast India's information technology (IT) industry captures share of global spending. In the moderate scenario, India's share rises from 5.6% in 2017 to 8.3% in year 2025; in the optimistic scenario, its share in year 2025 is 9.7% of global ICT spending. Depending on which of these scenarios plays out, India's IT-BPM sector could grow 7.6 to 10.8% per year between 2017 and year 2025.

[52] Statista. (2019, September 16). Retrieved from https://www.statista.com/topics/2256/it-industry-in-india/

ii) Electronics manufacturing (USD $100 billion to USD $130 billion potential value added in year 2025)

The demand for electronics in India in year 2017 to 2018 stood at USD $ 106.1 billion, of which domestic electronics manufacturing fulfilled USD $ 59.6 billion (accounting for about 4% of all manufacturing sector output). The past few years have been encouraging for the sector, especially in the growth of India's mobile handset manufacturing, where production jumped from 60 million handsets valued at USD $2.9 billion in year 2014 to 2015 to 225 million units valued at USD $ 20.3 billion in year 2017 to 2018. Future demand for electronics in India was gauged by analyzing per capita spending on electronics as a function of GDP per capita. Based on the cross-country trend in more than 20 countries, India's per capita spending on electronic goods is expected to rise by 20% to year 2025, should it follow the global curve. We also incorporated a moderate rise in manufacturing share of GDP for India, from a low of around 15% currently to between 18 and 20%. If India is able to take advantage of its increased spending on electronics manufacturing, along with the overall focus on increasing manufacturing share of GDP, electronics manufacturing could rise from its current 4% of manufacturing sector GDP to about 8 to 10% by year 2025, in line with countries such as Germany and Japan.

iii) Digital communication services (USD $ 50 billion to USD $ 55 billion potential value added in year 2025)

India's digital consumption is rising exponentially as data prices fall. Smartphone penetration is also rising rapidly, and the total number of handsets in use is forecasted to exceed 800 million by year 2025. Smartphone owners in India currently consume 8.3 GB of data each month on average, well above the 5.5 GB for the average Chinese mobile user and comparable to South Koreans' consumption, which is in the range of 8.0 to 8.5 GB a month. Between year 2015 and 2025, we anticipate overall data consumption may rise by more than 60 times, which is equivalent to data consumption doubling every 18 months. Estimation incorporate

reasonable data-price assumptions to account for the sector's long-term financial sustainability[53].

c) **China**

China constant GDP for the year 2018 grew with the total value of USD $ 11.226 trillion compared to year 2015 with the total value of USD $ 13.407 trillion. China currently held the title of top nation for growth of the number of software developers. Leading up to year 2023, China's software market growth rate is between 6 to 8 %. A profit of USD $ 687.5 billion is already achieved by China's IT services and software industry in year 2017 which shows the thriving market of China in this selected industry. Furthermore, there is an increase in the numbers of employee by 3.4% from year 2016, making the total employees working under China's software industry to be over 6,000,000 in year 2017[54]. In comparison to the year 2017, the value added of information transmission, software and information technology services was up by 30.7% the year 2018 which account to USD $ 458.9 billion.

China has become a global leader in some key digital industries such as on e-commerce and fintech. On e-commerce, China accounts for over 40% of global transactions, and the penetration of e-commerce stands now at 15%, compared to 10% in the US On fintech, China companies account for more than 70% of the total global valuations. The value of China's consumption-related mobile payments by individuals totaled USD $ 790 billion in 2016, 11 times that of the US related to the growth of this sizable market, the processing capacity of one of China's largest mobile payments providers is roughly 3 times faster than of US counterparts. While still at an early stage, China's leading industries have started to have global reach spanning a range of sectors, particularly in fintech.

i) Payments

[53] Gnanasambandam, C., Madgavkar, A., Kaka, N., Manyika, James., Chui, M., Bughin, J. & Gomes, M. 2015. *Online and upcoming: The internet's impact on India*. McKinsey & Company.
[54] China Market Insights. (2019, September 16) Retrieved from https://www.dragonsocial.net/blog/china-software-market-2018/

China's tech giants have been rapidly expanding in overseas markets. Most notably, in the payment industry, Alipay and WeChat Pay, the two popular third-party payment applications in China, are available at physical retailers in 28 countries and regions outside of China for tourists.

ii) E-commerce

Alibaba has set up a global platform connecting sellers and buyers from more than 200 countries, with its total revenue growing by more than 200%. China companies have also promoted the development of e-commerce and third-party payments in other countries by investing in local companies, such as Pay TM in India, Airwallex in Australia, and Lazada in South East Asia.

iii) Cloud computing,

Alibaba cloud computing has set up 14 data centers globally, with overseas cloud computing revenues growing at 400%.

iv) ICT exports

Overall, China accounts for 32% of global ICT goods exports and 6% in ICT services exports. In year 2017, 11% of China's Overseas Development Institute (ODI) was in the ICT sector. Dajiang, a leading China drone company, now accounts for 50% of the drone market share in North America.

China is also a leading global investor in key digital technologies. The venture capital industry in China has grown rapidly, and increasingly focused on the digital sector. Based on McKinsey estimates, total venture capital in China has surged from USD $12 billion in year 2011-2013 to USD $ 77 billion in 2014-2016. The main sectors that attract venture capital investment include big data, artificial intelligence, and Fintech. Currently, China is in the global top three of venture capital investors in key digital technologies, including virtual reality, autonomous driving, 3D printings, robotics, drones, and artificial intelligence. Figure 4.22 shows the comparative analysis between Malaysia, United States, India and China.

COUNTRY	GDP Percentage Share (Information and Communication Sector)	Number of Establishment	Employment Statistics
 **Malaysia**	**5.8%**	**8008**	**223,122**
 **United States**	**7.4%**	**525,000**[55]	**5.1 million**
 **India**	**8%**	**18,000**[56]	**2.75 Million**
 **China**	**8%**	**35,774**[57]	**6 Million**

Figure 4.22 Comparative Analysis between Malaysia, United States, India and China

[55] Information Technology (IT) Industry & Association, Comp TIA. (2019, October 6). Retrieved from https://www.comptia.org/
[56] National Association of Software and Services Companies, NASSCOM. (2019, October 6). Retrieved from https://www.nasscom.in/
[57] Statista. (2019, October 6). Retrieved from https://www.statista.com/statistics/276633/companies-in-the-software-industry-in-china/

4.4 Occupational Structure (OS)

Occupational structure can be described as aggregate distribution of occupations in society, classified according to skill level or economic function. Classification of Not Available means the current job whether are not available in Malaysia or will soon be created while No Level means there no current position presence. Classification of critical job are defined as job that are required for improvement in term of workforce and labour skilled.

Based on the focus group discussion with the expert development panel from the computer programming, consultancy and related activities successfully come out with the total number achieved of 14 total job areas, 43 job titles, 21 critical job titles and 6 jobs related to IR4.0. The result listed from the Table 4.6 until Table 4.8. The summary of the finding including with the critical job title and job title related to IR4.0 also are listed in Table 4.9.

Table 4.7: Group 620 Occupational Structure (1 of 3)

SECTION	**(J) INFORMATION AND COMMUNICATION**				
DIVISION	**(62) COMPUTER PROGRAMMING, CONSULTANCY AND RELATED ACTIVITIES**				
GROUP	**(620) COMPUTER PROGRAMMING, CONSULTANCY AND RELATED ACTIVITIES**				
AREA	**Programming (Web)**	**Programming (Mobile)**	**Programming (Game)**	**Programming (VR Software Application)**	**Programming (Enterprise Application)**
LEVEL 8	Not Available	Not Available	Not Available	Not Available	Not Available
LEVEL 7	Not Available	Not Available	Not Available	Not Available	Not Available
LEVEL 6	Not Available	Not Available	Not Available	Not Available	Not Available
LEVEL 5	System Analyst*	System Analyst*	System Analyst*	System Analyst*	System Analyst
LEVEL 4	Web Developer*	Mobile App Developer*	Game Developer*	VR Software Developer*	Enterprise Application Developer
LEVEL 3	Web Programmer	Mobile App Programmer	Game Programmer*	VR Software Programmer*	Enterprise Application Programmer
LEVEL 2	No Level	No Level	No Level	No Level	No Level
LEVEL 1	No Level	No Level	No Level	No Level	No Level

Note: *Critical Job Titles

Table 4.8: Group 620 Occupational Structure (2 of 3)

SECTION	**(J) INFORMATION AND COMMUNICATION**			
DIVISION	**(62) COMPUTER PROGRAMMING, CONSULTANCY AND RELATED ACTIVITIES**			
GROUP	**(620) COMPUTER PROGRAMMING, CONSULTANCY AND RELATED ACTIVITIES**			
AREA	**Programming (Wearable Device)**	**Programming (Drone)**	**Programming (IoT)**	**Programming (Big Data)**
LEVEL 8	Not Available	Not Available	Not Available	Not Available
LEVEL 7	Not Available	Not Available	Not Available	Data Scientist
LEVEL 6	Not Available	Not Available	Not Available	Big Data Architect
LEVEL 5	System Analyst*	System Analyst*	System Analyst*	Big Data Analyst
LEVEL 4	Wearable Device Developer*	Drone Application Developer*	IoT Developer*	Data Visualization Developer
LEVEL 3	Wearable Device Programmer*	Drone Application Programmer*	IoT Programmer*	Data Processing***
LEVEL 2	No Level	No Level	No Level	Data Entry***
LEVEL 1	No Level	No Level	No Level	No Level

Note: *Critical Job Titles

*** Critical Job Titles and Job Titles Related to IR4.0

Table 4.9: Group 620 Occupational Structure (3 of 3)

SECTION	**(J) INFORMATION AND COMMUNICATION**				
DIVISION	**(62) COMPUTER PROGRAMMING, CONSULTANCY AND RELATED ACTIVITIES**				
GROUP	**(620) COMPUTER PROGRAMMING, CONSULTANCY AND RELATED ACTIVITIES**				
AREA	**Consultancy**	**Related Activities (Database)**	**Related Activities - UX (Front End Design)**	**Related Activities (Quality Assurance/ Quality Control)**	**Related Activities (Infrastructure)**
LEVEL 8	Not Available	Not Available	Not Available	Not Available	Not Available
LEVEL 7	Not Available	Not Available	Not Available	Not Available	Not Available
LEVEL 6	Project Manager/ Consultant	Not Available	Not Available	Not Available	Not Available
LEVEL 5	Programming Analyst	Database Administrator	UX Analyst	QA Executive	Solution Architect
LEVEL 4	No Level	SQL/ NOSQL Programmer	UX Developer**	Application Tester	SysOps Administrator
LEVEL 3	No Level	Data Processing**	UX Programmer**	No Level	No Level
LEVEL 2	No Level	Data Entry**	No Level	No Level	No Level
LEVEL 1	No Level	No Level	No Level	No Level	No Level

Note: **Job Titles Related to IR4.0

Table 4.10: Summary of Job Titles

No	Job Area	Level								Total Identified Job Titles	Total Critical Job Titles	Total Job Titles relevant to IR4.0
		1	2	3	4	5	6	7	8			
620 – Computer Programming, Consultancy and Related Activities												
1	Programming (Web)	NL	NL	1	1	1	NA	NA	NA	3	2	-
2	Programming (Mobile)	NL	NL	1	1	1	NA	NA	NA	3	2	-
3	Programming (Game)	NL	NL	1	1	1	NA	NA	NA	3	3	-
4	Programming (VR Software Application)	NL	NL	1	1	1	NA	NA	NA	3	3	-
5	Programming (Enterprise Application)	NL	NL	1	1	1	NA	NA	NA	3	-	-
6	Programming (Wearable Device)	NL	NL	1	1	1	NA	NA	NA	3	3	-
7	Programming (Drone)	NL	NL	1	1	1	NA	NA	NA	3	3	-
8	Programming - IoT (Internet of Things)	NL	NL	1	1	1	NA	NA	NA	3	3	-
9	Programming (Big Data)	NL	1	1	1	1	1	1	NA	6	2	2

No	Job Area	Level								Total Identified Job Titles	Total Critical Job Titles	Total Job Titles relevant to IR4.0
		1	2	3	4	5	6	7	8			
10	Consultancy	NL	NL	NL	NL	1	1	NA	NA	2	-	-
11	Related Activities (Database)	NL	1	1	1	1	NA	NA	NA	4	-	2
12	Related Activities - UX (Front End Design)	NL	NL	1	1	1	NA	NA	NA	3	-	2
13	Related Activities (Quality Assurance/ Quality Control)	NL	NL	NL	1	1	NA	NA	NA	2	-	-
14	Related Activities (Infrastructure)	NL	NL	NL	1	1	NA	NA	NA	2	-	-
Grand Total of Identified Job Titles										**43**	**21**	**6**

NL – No level

NA- Not Available

4.5 Occupational Responsibilities

This section provides occupational responsibilities for every job title identified in FGD. The occupational responsibilities listed in this section may include but not limited to the list. These occupational responsibilities were purposely for NOSS development in the future for this industry.

DIVISION: J62-COMPUTER PROGRAMMING, CONSULTANCY AND RELATED ACTIVITIES

GROUP: 620-COMPUTER PROGRAMMING, CONSULTANCY AND RELATED ACTIVITIES

Table 4.11: List of Occupational Responsibilities for Group 620 Based on Table 4.6 (1 of 5)

AREA	Programming (Web)	Programming (Mobile)	Programming (Games)
LEVEL 8	Not Available	Not Available	Not Available
LEVEL 7	Not Available	Not Available	Not Available
LEVEL 6	Not Available	Not Available	Not Available
LEVEL 5	**System Analyst** 1) Identify user system requirement. 2) Propose and suggest solution based on requirement. 3) Translate user requirement into technical solution specification/ design.	**System Analyst** 1) Identify user system requirement. 2) Propose and suggest solution based on requirement. 3) Translate user requirement into technical solution specification/ design. 4) Consolidate all specification into written document (solution design).	**System Analyst** 1) Identify user system requirement. 2) Propose and suggest solution based on requirement. 3) Translate user requirement into technical solution specification/ design. 4) Consolidate all specification into written document (solution design).

AREA	Programming (Web)	Programming (Mobile)	Programming (Games)
	4) Consolidate all specification into written document (solution design). 5) Coordinate with application developer on projects. 6) Analyse system solution design. 7) Conduct application functional test. 8) Ensure completion of development within timeline. 9) Ensure continuous improvement of projects. 10) Maintain project and technical documentation.	5) Coordinate with application developer on projects. 6) Analyse system solution design. 7) Conduct application functional test. 8) Ensure completion of development within timeline. 9) Ensure continuous improvement of projects. 10) Maintain project and technical documentation.	5) Coordinate with application developer on projects. 6) Analyse system solution design. 7) Conduct application functional test. 8) Ensure completion of development within timeline. 9) Ensure continuous improvement of projects. 10) Maintain project and technical documentation.
LEVEL 4	**Web Developer** 1) Establish coding standard and design. 2) Handle complex area of application. 3) Coordinate application programmers. 4) Design application structure. 5) Modify application structure. 6) Develop software solutions.	**Mobile App Developer** 1) Establish coding standard and design. 2) Handle complex area of application. 3) Coordinate application programmers. 4) Design application structure. 5) Modify application structure. 6) Develop software solutions.	**Game Developer** 1) Establish coding standard and design. 2) Handle complex area of application. 3) Coordinate application programmers. 4) Design application structure. 5) Modify application structure. 6) Develop software solutions.

AREA	Programming (Web)	Programming (Mobile)	Programming (Games)
	7) Follow the software development lifecycle. 8) Conduct system integration testing (SIT).	7) Follow the software development lifecycle. 8) Conduct system integration testing (SIT).	7) Follow the software development lifecycle. 8) Conduct system integration testing (SIT).
LEVEL 3	**Web Programmer** 1) Interpret user requirement document (solution design). 2) Create source code according to solution document. 3) Comply with data security guideline. 4) Conduct Internal test.	**Mobile App Programmer** 1) Interpret user requirement document (solution design). 2) Create source code according to solution document. 3) Comply with data security guideline 4) Conduct Internal test.	**Game Programmer** 1) Interpret user requirement document (solution design). 2) Create source code according to solution document. 3) Comply with data security guideline. 4) Conduct Internal test.
LEVEL 2	No Level	No Level	No Level
LEVEL 1	No Level	No Level	No Level

Table 4.12: List of Responsibilities for Group 620 Based on Occupational Structure in Table 4.6 and Table 4.7 (2 of 5)

AREA	Programming (VR Software Application)	Programming (Enterprise Application)	Programming (Wearable Device)
LEVEL 8	Not Available	Not Available	Not Available
LEVEL 7	Not Available	Not Available	Not Available
LEVEL 6	Not Available	Not Available	Not Available
LEVEL 5	**System Analyst** 1) Identify user system requirement. 2) Propose and suggest solution based on requirement. 3) Translating user requirement into technical solution specification/ design. 4) Consolidate all specification into written document (solution design). 5) Coordinate with application developer on projects. 6) Analyse system solution design. 7) Conduct application functional test. 8) Ensure completion of development within timeline. 9) Ensure continuous improvement of projects. 10) Maintain project and technical documentation.	**System Analyst** 1) Identify user system requirement. 2) Propose and suggest solution based on requirement. 3) Translating user requirement into technical solution specification/ design. 4) Consolidate all specification into written document (solution design) 5) Coordinate with application developer on projects. 6) Analyse system solution design. 7) Conduct application functional test. 8) Ensure completion of development within timeline. 9) Ensure continuous improvement of projects. 10) Maintain project and technical documentation.	**System Analyst** 1) Identify user system requirement. 2) Propose and suggest solution based on requirement. 3) Translating user requirement into technical solution specification/ design. 4) Consolidate all specification into written document (solution design) 5) Coordinate with application developer on projects. 6) Analyse system solution design. 7) Conduct application functional test. 8) Ensure completion of development within timeline. 9) Ensure continuous improvement of projects. 10) Maintain project and technical documentation.

AREA	Programming (VR Software Application)	Programming (Enterprise Application)	Programming (Wearable Device)
LEVEL 4	**VR Software Developer** 1) Establish coding standard and design. 2) Handle complex area of application. 3) Coordinate application programmers. 4) Design application structure. 5) Modify application structure. 6) Develop software solutions. 7) Follow the software development lifecycle. 8) Conduct system integration testing (SIT).	**Enterprise Application Developer** 1) Establish coding standard and design. 2) Handle complex area of application. 3) Coordinate application programmers. 4) Design application structure. 5) Modify application structure. 6) Develop software solutions. 7) Follow the software development lifecycle. 8) Conduct system integration testing (SIT).	**Wearable Device Developer** 1) Establish coding standard and design. 2) Handle complex area of application. 3) Coordinate application programmers. 4) Design application structure. 5) Modify application structure. 6) Develop software solutions. 7) Follow the software development lifecycle. 8) Conduct system integration testing (SIT).
LEVEL 3	**VR Software Programmer** 1) Interpret user requirement document (solution design). 2) Create source code according to solution document. 3) Comply with data security guideline. 4) Conduct Internal test.	**Enterprise Application Programmer** 1) Interpret user requirement document (solution design). 2) Create source code according to solution document. 3) Comply with data security guideline. 4) Conduct Internal test.	**Wearable Device Programmer** 1) Interpret user requirement document (solution design). 2) Create source code according to solution document. 3) Comply with data security guideline. 4) Conduct Internal test.

AREA	Programming (VR Software Application)	Programming (Enterprise Application)	Programming (Wearable Device)
LEVEL 2	No Level	No Level	No Level
LEVEL 1	No Level	No Level	No Level

Table 4.13: List of Responsibilities for Group 620 Based on Occupational Structure in Table 4.7 (3 of 5)

AREA	Programming (Drone)	Programming - IoT (Internet of Things)	Programming (Big Data)
LEVEL 8	Not Available	Not Available	Not Available
LEVEL 7	Not Available	Not Available	**Data Scientist** 1) Work closely with organization to identify issues and use data to propose solutions for effective decision making. 2) Build algorithms and design experiments to merge, manage, interrogate and extract data to supply tailored reports to colleagues, customers or the wider organisation. 3) Use machine learning tools and statistical techniques to produce solutions to problems. 4) Test data mining models to select the most appropriate ones for use on a project. 5) Maintain clear and coherent communication, both verbal and written, to understand data needs and report results.

AREA	Programming (Drone)	Programming - IoT (Internet of Things)	Programming (Big Data)
			6) Assess the effectiveness of data sources and data-gathering techniques and improve data collection methods. 7) Horizon scan to stay up to date with the latest technology, techniques and methods. 8) Conduct research from which you'll develop prototypes and proof of concepts. 9) Look for opportunities to use insights/datasets/code/models across other functions in the organisation.
LEVEL 6	Not Available	Not Available	**Big Data Architect** 1) Address specific big data problems and requirements. 2) Able to describe the structure and behaviour of a big data solution and how that big data solution can be delivered. 3) Coordinate between needs of organization and the big data scientist and the big data analyst. 4) Monitor and governs the implementation of big data solution

AREA	Programming (Drone)	Programming - IoT (Internet of Things)	Programming (Big Data)
			5) Identify benchmark systems, analyse system bottlenecks and propose solution. 6) Perform detailed analysis of organization problems and technical environments.
LEVEL 5	**System Analyst** 1) Identify user system requirement. 2) Propose and suggest solution based on requirement 3) Translating user requirement into technical solution specification/ design 4) Consolidate all specification into written document (solution design) 5) Coordinate with application developer on projects 6) Analyse system solution design 7) Conduct application functional test 8) Ensure completion of development within timeline	**System Analyst** 1) Identify user system requirement. 2) Propose and suggest solution based on requirement. 3) Translating user requirement into technical solution specification/ design 4) Consolidate all specification into written document (solution design) 5) Coordinate with application developer on projects 6) Analyse system solution design 7) Conduct application functional test 8) Ensure completion of development within timeline 9) Ensure continuous improvement of projects	**Big Data Analyst** 1) Evaluate an organization's technical performance and providing recommendations on system enhancement. 2) Coordinate with data scientist and data architect 3) Ensure streamlined implementation of services 4) Conduct profiling source information and setting characteristics 5) Execute big data processes such as parsing, filtering, text connotation and enrichment 6) Direct cross-functional and design workshops, as well as elicitation sessions

AREA	Programming (Drone)	Programming - IoT (Internet of Things)	Programming (Big Data)
	9) Ensure continuous improvement of projects 10) Maintain project and technical documentation	10) Maintain project and technical documentation	
LEVEL 4	**Drone Application Developer** 1) Establish coding standard and design 2) Handle complex area of application 3) Coordinate application programmers 4) Design application structure 5) Modify application structure 6) Develop software solutions 7) Follow the software development lifecycle 8) Conduct system integration testing (SIT)	**IoT Developer** 1) Establish coding standard and design 2) Handle complex area of application 3) Coordinate application programmers 4) Design application structure 5) Modify application structure 6) Develop software solutions 7) Follow the software development lifecycle 8) Conduct system integration testing (SIT)	**Data Visualization Developer** 1) Convert complex data into more accessible, understandable and usable 2) transforming, improving and integrating data, depending on the business requirements 3) combining the data result sets across multiple sources 4) Create data visualizations, charting designing and interactive graphics 5) Develop and support interactive data visualizations
LEVEL 3	**Drone Application Programmer** 1) Interpret user requirement document (solution design) 2) Create source code according to solution document	**IoT Programmer** 4) Interpret user requirement document (solution design) 5) Create source code according to solution document	**Data Processing** 1) Raw information conversion into specific format 2) Collect data 3) Perform Data validation

AREA	Programming (Drone)	Programming - IoT (Internet of Things)	Programming (Big Data)
	3) Comply with data security guideline Conduct Internal test	6) Comply with data security guideline 7) Conduct Internal test	4) Perform Data preparation and sorting
LEVEL 2	No Level	No Level	**Data Entry** 1) Prepare and sorting documents for data entry 2) Enter data into database software and checking to ensure the accuracy of the data that has been inputted 3) Create data backups as part of a contingency plan 4) Respond to information requests from authorised members
LEVEL 1	No Level	No Level	No Level

Table 4.14: List of Responsibilities for Group 620 Based on Occupational Structure in Table 4.8 (4 of 5)

AREA	Consultancy	Related Activities (Database)	Related Activities - UX (Front End Design)
LEVEL 8	Not Available	Not Available	Not Available
LEVEL 7	Not Available	Not Available	Not Available
LEVEL 6	**Project Manager/Consultant** 1) Establish project scope 2) Design and delivering solutions 3) Lead team members 4) Validate business and technical requirements and parameters 5) Plan project life-cycle deliverables and resource availability 6) Monitor project progress 7) Coordinate and organize user and final acceptance test (UAT/FAT 8) Accomplishes work requirements 9) Follow production, productivity, quality, and customer-service standards 10) Identify work process improvements	Not Available	Not Available

AREA	Consultancy	Related Activities (Database)	Related Activities - UX (Front End Design)
LEVEL 5	**Programming Analyst** 1) Analyse competitive market strategies through analysis of related product, market, or share trends 2) Synthesize current business intelligence or trend data to support recommendations for action 3) Communicate with customers, competitors, suppliers, professional organizations, or others to stay abreast of industry or business trends 4) Manage timely flow of business intelligence information to users 5) Collect business intelligence data from available industry reports, public information, field reports, or purchased sources	**Database Administrator** 1) Propose and suggest database solution based on requirement 2) Ensure and sustain the integrity of the database 3) Perform forecast analysis (database growth) 4) Ensure optimum database performance 5) Creating complex query definition that allow data to be extracted 6) Create data definition language (DDL) 7) Create database design documents 8) Manage patching, backup and recovery plan 9) Comply with data security guideline	**UX Analyst** 1) Gather and evaluate user requirement 2) Interpret product specifications and user psychology 3) Coordinate with UI and graphic designer 4) Simplify navigation structure 5) Identify troubleshoot UX problems 6) Communicate design ideas and prototypes to developers

AREA	Consultancy	Related Activities (Database)	Related Activities - UX (Front End Design)
LEVEL 4	No Level	**SQL/ NOSQL Programmer** 1) Perform data manipulation language (DML) 2) Create function and procedure 3) Create the SQL/NOSQL code according to solution document 4) Maintain and optimize in-application SQL/NOSQL 5) Perform database change request 6) Perform periodically health check 7) Comply with data security guideline	**UX Developer** 1) Meet with clients to find out what they want from their web applications and online projects, especially regarding user interface and experience. 2) Present web design plans and UI layout ideas to clients. 3) Create various web applications using code and visual design skills. They also design and create user interface layouts and web pages aimed at maximizing the user experience. 4) Perform usability tests and analyse the results to gauge the consumer's experience when using web applications and online programs. 5) Analyse user data to evaluate user interfaces for existing applications and web pages and to identify areas needing improvement.

AREA	Consultancy	Related Activities (Database)	Related Activities - UX (Front End Design)
LEVEL 3	No Level	No Level	**<u>UX Programmer</u>** 1) Create images that identify the product or convey a message based on UI requirement 2) Develop graphics of icon and illustration 3) Select colours, images, text style and layout 4) Create layout design 5) Create graphics interface (UI)
LEVEL 2	No Level	No Level	No Level
LEVEL 1	No Level	No Level	No Level

Table 4.15: List of Responsibilities for Group 620 Based on Occupational Structure in Table 4.8 (5 of 5)

AREA	Related Activities (Quality Assurance/ Quality Control)	Related Activities (Infrastructure)
LEVEL 8	Not Available	Not Available
LEVEL 7	Not Available	Not Available
LEVEL 6	Not Available	Not Available
LEVEL 5	**QA Executive** 1) Produce text script 2) Create a test plan 3) Ensure the product is culturally compatible with the target market 4) Guard against incorrect language usage, truncated text and incorrect formatting 5) Look for ways to prevent bugs from occurring in the first place	**Solution Architect** 1) Focus the design on the technology that will help a company meet its unique goals 2) Study new breakthroughs in technology to offer clients updated solutions 3) Build relationships with technology vendors who may offer deals on the newest software and hardware 4) Determine what hardware may need to be updated to handle new software
LEVEL 4	**Application Tester** 1) Run the text script 2) Use the plan to assess functionality, performance, reliability, stability and compatibility with other systems 3) Use the plan to hunt down and fix software bugs	**SysOps Administrator** 1) Follow a consistent approach to the deployment and change of the software. 2) Help out the developer team, SysOps supports the consistent manner do deployment and change of an application. 3) Make changes in an application if required
LEVEL 3	No Level	No Level
LEVEL 2	No Level	No Level
Level 1	No Level	No Level

4.6 Mapping OS vs NOSS Available

This section provides mapping between OS and available NOSS to identified which area and job titles has a developed NOSS. There are 28 existing NOSS identified for Computer programming, consultancy and related activities industry. Table 4.17, Table 4.18 and Table 4.19 shows the mapping of OS with developed NOSS and only 13 existing NOSS are identified from the OS mapping amongst the total of 28 existing NOSS. The rest of the NOSS list that are not identified on the mapping of OS is because the job scope does not suitable with the job area of the OS and can be refer from Table 4.16.

Table 4.16: List of NOSS That are Not Included in Division 62

NO.	CORRESPONDING NOSS/LEVEL
1	BT-010-3 (2008) Bioinformatics Programmer
2	BT-010-2 (2008) Bioinformatics Assistant Programmer
3	J620-001-5 (2019) Cyber Security Penetration Testing & Assessment
4	IT-020-5 (2013) Computer Systems Management
5	IT-090-5 (2009) ICT System Security Technologist
6	IT-030-5 (2013) Computer Network Management
7	IT-020-4 (2013) Computer Systems Administration
8	IT-030-3 (2013) Computer Network Services
9	IT-020-3 (2013) Computer System Operation
10	IT-030-3 (2013) Computer Network Services

11	IT-120-5 (2011) Multimedia Programming
12	IT-010-4 (2013) Systems module Development
13	IT-120-4 (2011) Multimedia Programming
14	IT-010-3 (2016) Application Development
15	IT-010-3 (2016) Application Development

Table 4.17: Mapping OS vs NOSS Available (1 of 3)

SECTION	**(J) INFORMATION AND COMMUNICATION**				
DIVISION	**(62) COMPUTER PROGRAMMING, CONSULTANCY AND RELATED ACTIVITIES**				
GROUP	**(620) COMPUTER PROGRAMMING, CONSULTANCY AND RELATED ACTIVITIES**				
AREA	**Programming (Web)**	**Programming (Mobile)**	**Programming (Game)**	**Programming (VR Software Application)**	**Programming (Enterprise Application)**
LEVEL 8	Not Available	Not Available	Not Available	Not Available	Not Available
LEVEL 7	Not Available	Not Available	Not Available	Not Available	Not Available
LEVEL 6	Not Available	Not Available	Not Available	Not Available	Not Available
LEVEL 5	IT-052-5:2013	System Analyst	System Analyst	IT-010-5 :2013	IT-122-5:2011
LEVEL 4	IT-052-4:2013	Mobile App Developer*	Game Developer*	VR Software Developer*	IT-122-4:2011
LEVEL 3	Web Programmer	Mobile App Programmer	Game Programmer*	VR Software Programmer*	Enterprise Application Programmer
LEVEL 2	No Level	No Level	No Level	No Level	No Level
LEVEL 1	No Level	No Level	No Level	No Level	No Level

Table 4.18: Mapping OS vs NOSS Available (2 of 2)

SECTION	**(J) INFORMATION AND COMMUNICATION**			
DIVISION	**(62) COMPUTER PROGRAMMING, CONSULTANCY AND RELATED ACTIVITIES**			
GROUP	**(620) COMPUTER PROGRAMMING, CONSULTANCY AND RELATED ACTIVITIES**			
AREA	**Programming (Wearable Device)**	**Programming (Drone)**	**Programming (IoT)**	**Programming (Big Data)**
LEVEL 8	Not Available	Not Available	Not Available	Not Available
LEVEL 7	Not Available	Not Available	Not Available	Data Scientist
LEVEL 6	Not Available	Not Available	Not Available	Big Data Architect
LEVEL 5	System Analyst	System Analyst	System Analyst	IT-082-5:2016
LEVEL 4	Application Developer	Application Developer	Application Developer	IT-082-4:2016
LEVEL 3	Application Programmer	Application Programmer	Application Programmer	IT-082-3:2016
LEVEL 2	No Level	No Level	No Level	Data Entry
LEVEL 1	No Level	No Level	No Level	No Level

Table 4.19: Mapping OS vs NOSS Available (3 of 3)

SECTION	**(J) INFORMATION AND COMMUNICATION**				
DIVISION	**(62) COMPUTER PROGRAMMING, CONSULTANCY AND RELATED ACTIVITIES**				
GROUP	**(620) COMPUTER PROGRAMMING, CONSULTANCY AND RELATED ACTIVITIES**				
AREA	**Consultancy**	**Related Activities (Database)**	**Related Activities - UX (Front End Design)**	**Related Activities (Quality Assurance/ Quality Control)**	**Related Activities (Infrastructure)**
LEVEL 8	Not Available	Not Available	Not Available	Not Available	Not Available
LEVEL 7	Not Available	Not Available	Not Available	Not Available	Not Available
LEVEL 6	Project Manager/ Consultant	Not Available	Not Available	Not Available	Not Available
LEVEL 5	Programming Analyst	IT-121-5:2011	UX Analyst	QA Executive	IT-035-5:2014
LEVEL 4	No Level	IT-121-4:2011	UX Developer	Application Tester	IT-035-4:2014
LEVEL 3	No Level	Data Processing	UX Programmer	No Level	No Level
LEVEL 2	No Level	Data Entry	No Level	No Level	No Level
Level 1	No Level	No Level	No Level	No Level	No Level

4.7 Occupational Description

Occupational Description is a broad, general, and written statement of a specific job, based on the findings of a job analysis. It generally includes duties, purpose, responsibilities, scope, and working conditions of a job along with the job's title, and the name or designation of the person to whom the employee reports. The Occupational Description provided in Annex 3 are the job titles that have been identified as critical or hard-to-fill job as suggested by industry representatives from focus group discussion.

4.8 Conclusion

Based on the discussions with panel members during the development workshops, the OS of the industry is produced in this chapter. The OS would provide information of the competency or job areas applicable to the industry, and the skill level of the different job titles, according to the MOSQF Level Descriptors, and the available career paths.

The jobs and skills in demand, and the specific steps proposed to be taken by various parties to bridge the skills gaps are elaborated so that the parties concerned could take the necessary steps to overcome such challenges

CHAPTER 5: DISCUSSION, RECOMMENDATION AND CONCLUSION

5.1 Discussion

Based on the findings obtained throughout the Occupational Analysis (OA) on the industry, job area has been identified and confirmed to be in tandem with MSIC. There are total of 14 job areas, 43 job titles, 21 critical job titles and 6 job titles related to IR4.0 have been identified The job titles identified require a holistic view in development of standard, skills training and also certification for recognition. If the competency requirements documented in NOSS format, the personnel in these areas will obtain a more structured skills training and will also enable personnel who are experienced and skilled to be certified.

5.2 Recommendation

As recommendation, the result of this Occupational Framework (OF) will be used as reference to fulfil the future plans of developing skilled personnel and certifying Malaysians in this sector towards improving the quality of the local sector and thus spurring Malaysia's global competitiveness.

There are several options when addressing or mitigating workforce demand and supply. It may include establishing and maintaining partnerships with other agencies or departments, or educational institutions to increase external talent pools and also through the training of existing staff in line with new skills requirements.

Based on the above comments, specific recommendations are listed below:

a) To continue and streamline efforts in NOSS development for areas under the sector in line with the findings of this analysis. This includes the development of the NOSS for the sectors and sub-sectors that are in demand and have not been developed.
b) To have more industry players to be accredited as training provider for National Dual Training System (NDTS) for the related sub sector and job area.
c) To promote certification of existing and experienced personnel in the sector through Recognition via Prior Achievement (RPA) (*Pengiktirafan Pencapaian Terdahulu* – PPT).
d) Collaboration with higher learning institution to develop academic syllabus that matches the industry requirement.
e) To implement syllabus that are suitable with the industry requirement are important in creating quality graduates. Inefficient education system that cause by too much focus on exam and theory, out dated syllabus and skills, and miss match industry requirement by the student.
f) To Innovate technology and improved industry, this will automatically increase the demand of experts. Lack of cutting-edge tech will limit the creating of opportunities.

5.3 Conclusion

The conclusion is based on the specified objectives of the Occupational Framework as elaborated below:

Objective 1: To establish the OS for MSIC 2008, Section J Division 62: Computer programming, consultancy and related activities

As result of the Sector Occupational Framework conducted together with expert panel members from various organizations, a total of 14 areas, 43 job titles, 21 critical job titles and 6 job titles related to IR4.0 have been identified. By planning and conducting the training and certification of this sector personnel in the near future, it is hoped that there will be a steady flow of local skilled and certified workers.

Objective 2: To examine the competencies in demand in the Computer programming, consultancy and related activites

Based on the focus group discussion, document analysis and survey, the skills in demand are as follows:

a) Communication skills
b) General attitude towards work
c) Diagnostic skills
d) Troubleshooting / problem solving skills
e) Competent in using latest technology
f) Language competency
g) Programming language competency

Objective 3: To list the critical jobs in the Computer programming, consultancy and related activities

The respondents and Focus Group Discussion members have reviewed the list and specified the critical job titles as in the Annex 4. There are 21 critical job titles identified in computer programming, consultancy and related activities.

Objective 4: To identify job titles relevant to Industry Revolution 4.0 in the Computer programming, consultancy and related activities

There were 6 jobs identified to be related to IR4.0 which covers the area of big data, database and UX front end design programming. The job levels are within the level of 2, 3 and 4 which are of lowest part. This is because with the help of automated functions, they could help in increasing the efficiency and quality of work done. The emerging skills which can be developed from IR4.0 of computer programming, consultancy and related activities are big data analytics, cloud computing, IoT, system integration, cybersecurity, augmented reality and simulation, and artificial intelligence. All these could increase productivity, reduce cost and improve efficiency, minimize human error, improve on fast decision making, and increase process effectiveness. The list of job title relevant to IR4.0 can be referred to Annex 5.

Objective 5: To establish the OD for each job title based on the latest industry OS

The Occupational Descriptions for all the different job titles were obtained from Focus Group Discussion and related reports listed in Annex 6. These Occupational Descriptions will also serve as reference of job scope and the required competencies for NOSS development. To ensure these critical occupations are addressed, several essential steps and action should be undertaking by stakeholders from industry, training/academic institutions and the relevant accreditations authorities

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ANNEX 1: MOSQF LEVEL DESCRIPTORS

MALAYSIAN OCCUPATIONAL SKILLS QUALIFICATION FRAMEWORK (MOSQF) LEVEL DESCRIPTOR

(Source: Department of Skills Development)

LEVEL	LEVEL DESCRIPTORS
8	Achievement at this level reflects the ability to develop original understanding and extend a sub-area of knowledge or professional practice. It reflects the ability to address problematic situations that involve many complexes, interacting factors through initiating, designing and undertaking research, development or strategic activities. It involves the exercise of broad autonomy, judgement and leadership in sharing responsibility for the development of a field of work or knowledge, or for creating substantial professional or organisational change. It also reflects a critical understanding of relevant theoretical and methodological perspectives and how they affect the field of knowledge or work.
7	Achievement at this level reflects the ability to reformulate and use relevant understanding, methodologies and approaches to address problematic situations that involve many interacting factors. It includes taking responsibility for planning and developing courses of action that initiate or underpin substantial change or development, as well as exercising broad autonomy and judgment. It also reflects an understanding of theoretical and relevant methodological perspectives, and how they affect their sub-area of study or work.
6	Achievement at this level reflects the ability to refine and use relevant understanding, methods and skills to address complex problems that have limited definition. It includes taking responsibility for planning and developing courses of action that are able to underpin substantial change or development, as well as exercising broad autonomy and judgment. It also reflects an understanding of different perspectives, approaches of schools of thought and the theories that underpin them.

5	Achievement at this level reflects the ability to identify and use relevant understanding, methods and skills to address broadly-defined, complex problems. It includes taking responsibility for planning and developing courses of action as well as exercising autonomy and judgment within broad parameters. It also reflects understanding of different perspectives, approaches or schools of thought and the reasoning behind them.
4	Achievement at this level reflects the ability to identify and use relevant understanding, methods and skills to address problems that are well defined but complex and non-routine. It includes taking responsibility for overall courses of action as well as exercising autonomy and judgment within fairly broad parameters. It also reflects under-standing of different perspective or approaches within a sub-area of study or work.
3	Achievement at this level reflects the ability to identify and use relevant understanding, methods and skills to complete task and address problems that are well defined with a measure of complexity. It includes taking responsibility for initiating and completing tasks and procedures as well as exercising autonomy and judgments within limited parameter. It also reflects awareness of different perspectives or approaches within a sub-area of study or work.
2	Achievement at this level reflects the ability to select and use relevant knowledge, ideas, skills and procedures to complete well-defined tasks and address straightforward problem. It includes taking responsibility for completing tasks and procedures, and exercising autonomy and judgment subject to overall direction or guidance.
1	Achievement at this level reflects the ability to use relevant knowledge, skills and procedures to complete routine and predictable tasks that include responsibility for completing tasks and procedures subject to direction or guidance.

ANNEX 2: LIST OF CONTRIBUTORS

LIST OF SECTOR PANEL MEMBERS FOR THE COMPUTER PROGRAMMING, CONSULTANCY AND RELATED ACTIVITIES FRAMEWORK DEVELOPMENT

NO	NAME	POSITION	ORGANISATION
1	Jalmin Lampisung	It Manager	Wedo Technologies
2	Khalil Zulkifflee	Director	CPX Resources
3	Mohd Fuad Mahadi Bin Ya'akob	Managing Director	Adi Karya Sdn. Bhd.
4	Mohd Hanafi Bin Mahamud	Manager	Kancil Emas Enterprise
5	Shahrizan Shahrudin	Assistant Information Technology Officer	Majlis Perbandaran Ampang Jaya
6	Maizun Mohd Noor	Sr. Software Developer	Heitech Padu Berhad
7	Situah Ariff Zakaria	General Manager	MMSC Ventures Sdn. Bhd.
8	Syed Musa-AlKadzim Albar	Director	Beyond Radar (M) Sdn Bhd

LIST OF DEPARTMENTS OF SKILLS DEVELOPMENT (DSD) OFFICERS INVOLVED IN OCCUPATIONAL FRAMEWORK DEVELOPMENT

NO.	NAME	POSITION	ORGANISATION
1	Siti Fauziah Binti Jumadi	Principal Assistant Director	Department of Skills Development
2	Jefrizan Bin Abdul Rasid	Senior Assistant Director	Department of Skills Development
3	Norazura Binti Adnan	Senior Assistant Director	Department of Skills Development
5	Syazwani Binti Azmi	Assistant Director	Department of Skills Development
6	Nazrul Hilmi Bin Mohammad	Assistant Director	Department of Skills Development
7	Zainal Bin Abdul Jalil	Senior Skills Development Officer	Department of Skills Development
8	Nur Hurriyatul Huda Binti Abdullah Sani	Statistician	Malaysian Bureau of Labour Statistic (MBLS)

LIST OF OCCUPATIONAL FRAMEWORK TECHNICAL EVALUATION COMMUNITEE

NO.	NAME	POSITION	ORGANISATION
1	Mohamed Ibrahim Abdullah	Manager	Kasura Resources
2	Mohamad Fadzli Bin Mohamad Amin	Programmer	G Minds Group Sdn Bhd
3	Nor Ashikin Binti Alias	Project manager	Tripleclique Sdn Bhd
4	Shahrizan Bin Shahrudin	Information Technology Officer	*Majlis Pembandaran Ampang Jaya* (MPAJ)
5	Muhammad Shafiq Harun	Statistician	Department of Statistic Malaysia

LIST OF WORKFORCE TEAM IN OCCUPATIONAL FRAMEWORK DEVELOPMENT

NO.	NAME	POSITION	ORGANISATION
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3	Cristnorish Bin Lianu	Curriculum Development Executive I	Edusure Sdn Bhd
4	Ahmad Ramdan Bin M Yusof	Curriculum Development Executive II	Edusure Sdn Bhd
5	Khairul Alia Binti Mohd Kharudin	Proofreader Team	Edusure Sdn Bhd

6	Dr. Raemah Binti Abdullah Hashim	Research Team	Edusure Sdn Bhd
7	Dr. Azahari Bin Jamaludin	Research Team	Edusure Sdn Bhd
8	Ah Faizal Husni	Facilitator	Edusure Sdn Bhd
9	Muhammad Amirul Nazhif Bin Mohd Nohan	Research Team	Edusure Sdn Bhd

ANNEX 3: QUESTIONNAIRE

Computer Programming, Consultancy and Related Activities Industry
Occupational Framework Survey

The Department of Skills Development (DSD), Ministry of Human Resources is currently conducting an analysis on the Occupational Framework of the Industry. From this analysis, the industry framework, occupational structure, occupational job titles, and job description will be summarised for the use of the government, private sector, investors, employers, employees, educators or any personnel involved either directly or indirectly with the industry.

The main objective of this research is to enhance skills training starting from the entry level position for any job in this industry based on input from the industry. It will also provide a reference competency for skills required by workers to perform as required in the industry.

This survey will be used as field data in order to conduct a comprehensive analysis of the industry's Occupational Framework. The target group for this survey is the organisation's representative either from the Human Resource Department or personnel at Management level.

We would like to extend our heartfelt gratitude upon your cooperation in answering this survey. Please fill in where necessary in the forms provided. Do advise us if you wish to remain anonymous in your survey response. There will be further communication with survey respondents in order to verify our findings. The completed questionnaire can be emailed to:

Muhammad Amirul Nazhif Bin Mohd Nohan: nazhifamirul@gmail.com

Survey Respondent Details

Name :

Position :

Organisation :

Date :

Please answer the questions below in the space provided, additional pages may be added if necessary. There are 4 section in this 9-page survey.

SECTION 1: COMPETENCY IN DEMAND

1.1 Listed below are set of skills related to personnel involve in **Computer Programming, Consultancy and Related Activities Industry**. Rate the level of demand to the set of skills by using the scale below:

Category of Skills	Description
Skilled Workers	Managers, Executive, Specialist, and Professional
Semi-Skilled Workers	Support, Technician, Admin and Machine Operator
Low Skilled Workers	Elementary Workers

1	2	3	4
Not in Demand	**Low in Demand**	**In Demand**	**High in Demand**

No	Competency	Low-Skilled Workers	Semi-Skilled Workers	Skilled Workers
1	Technical skills			
2	Communication skills			
3	Diagnostic skills			
4	Troubleshooting / problem solving skills			
5	Administration skills			
6	Leadership			
7	Data collection and sorting skills			
8	Planning and Forecasting abilities			
9	General attitude towards work (commitment, resourcefulness, teamwork, etc.)			
10	Product knowledge			
11	Competent in using computer / other mechanical devices			

12	English language competency			
13	Training and coaching			
14	Regulatory knowledge			

SECTION 2: JOBS IN DEMAND

2.1 Listed below are job areas and description of category of skills. Based on your observation, which job area is experiencing **shortage of manpower in Computer Programming, Consultancy and Related Activities Industry**?

Tick (√) where applicable.

Category of Skills	**Description**
Skilled Workers	Managers, Executive, Specialist, and Professional
Semi-Skilled Workers	Support, Technician, Admin and Machine Operator
Low Skilled Workers	Elementary Workers

No.	**Job Areas & Category of Skills**	**High Demand**	**Mid Demand**	**Low Demand**
1	**Web Programming**			
	a) Skilled Workers			
	b) Semi-Skilled Workers			
	c) Low Skilled Workers			
2	**Mobile Programming**			
	a) Skilled Workers			
	b) Semi-Skilled Workers			
	c) Low Skilled Workers			
3	**Games Programming**			
	a) Skilled Workers			
	b) Semi-Skilled Workers			

	c) Low Skilled Workers			
4	**VR Software Application Programming**			
	a) Skilled Workers			
	b) Semi-Skilled Workers			
	c) Low Skilled Workers			
5	**Enterprise Application Programming**			
	a) Skilled Workers			
	b) Semi-Skilled Workers			
	c) Low Skilled Workers			
6	**Wearable Device Programming**			
	a) Skilled Workers			
	b) Semi-Skilled Workers			
	c) Low Skilled Workers			
7	**Drone**			
	a) Skilled Workers			
	b) Semi-Skilled Workers			
	c) Low Skilled Workers			
8	**IoT (Internet of Things) Programming**			
	a) Skilled Workers			
	b) Semi-Skilled Workers			
	c) Low Skilled Workers			
9	**Big Data Programming**			
	a) Skilled Workers			

	b) Semi-Skilled Workers			
	c) Low Skilled Workers			
10	**Database**			
	a) Skilled Workers			
	b) Semi-Skilled Workers			
	c) Low Skilled Workers			
11	**UX (Front End Design)**			
	a) Skilled Workers			
	b) Semi-Skilled Workers			
	c) Low Skilled Workers			
12	**Quality Assurance/ Quality Controls**			
	a) Skilled Workers			
	b) Semi-Skilled Workers			
	c) Low Skilled Workers			
13	**Infrastructure**			
	a) Skilled Workers			
	b) Semi-Skilled Workers			
	c) Low Skilled Workers			
14	**Consultancy**			
	a) Skilled Workers			
	b) Semi-Skilled Workers			
	c) Low Skilled Workers			

SECTION 3: EMERGING SKILLS

(Note: Emerging Skills are skills that are predicted to be imperative to the industry in the near future based on recent development, trend or study)

3.1 Do you think Industry Revolution 4.0 (Digitalization) (IR4.0) would give an impact to the economic activities of Computer Programming, Consultancy and Related Activities Industry?

[__] Yes

[__] No

[__] Not sure

3.2 Listed below are the nine (9) technology drives/pillars of IR4.0. Which job area is likely to be affected by these 9 technology drives/pillars of IR4.0?

Tick (√) where applicable, you may tick more than once

No.	TECHNOLOGY DRIVES / PILLARS	JOB AREAS						
		Web Programming	Mobile Programming	Game Programming	VR Software Application	Enterprise Application Programming	Wearable Device Programming	Drone
1	**Autonomous Robots** (coordinated and automated actions of robots to complete tasks intelligently, with minimal human input)							
2	**Big Data Analytics** (the analysis of ever larger volumes of data. Circulation, collection, and analysis of information is a necessity because it supports productivity growth based on a real-time decision-making process)							
3	**Cloud Computing** (storing and accessing data and programs over the Internet instead of your computer's hard drive)							
4	**Internet of Things (IoT)** (all machines and systems connected to the production plant (as well as other systems) must be able to collect, exchange and save these massive volumes of information, in a completely autonomous way and without the need of human intervention)							

5	**Additive Manufacturing (3D Printing)** (use in prototyping, design iteration and small-scale production and often described as “rapid prototyping” - produce the desired components faster, more flexibly and more precisely than ever before)							
6	**System Integration** (the process of linking together different computing systems and software applications physically or functionally to act as a coordinated whole via Internet of Things-IoT)							
7	**Cybersecurity** (with the increased connectivity and use of standard communications protocols, the need to protect critical industrial systems and manufacturing lines from cybersecurity threats is increasing)							

8	**Augmented Reality & Simulation** (Augmented-reality-based systems support a variety of services, such as selecting parts in a warehouse and sending repair instructions over mobile devices - provide workers with real-time information to improve decision making and work procedures). (Simulations will leverage real-time data to mirror the physical world in a virtual model, which can include machines, products, and humans. This allows operators to test and optimize the machine settings for the next product in line in the virtual world before the physical changeover, thereby driving down machine setup times and increasing quality)							
9	**Artificial Intelligence** Artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems. These processes include learning (the acquisition of information and rules for using the information), reasoning (using rules to reach approximate or definite conclusions) and self-correction							

10	**Supply Chain** Supply chain is the network of all the individuals, organizations, resources, activities and technology involved in the creation and sale of a product, from the delivery of source materials from the supplier to the manufacturer, through to its eventual delivery to the end user							
11	**New Business Model** Business model is a combination of two functions: the process of value creation and the process of value captures. The process of value creation refers to creating value for the target customer. The process of value capture refers to converting market opportunities into performance outcomes for the firm, which then justify value creation							

No.	TECHNOLOGY DRIVES / PILLARS	JOB AREAS						
		IoT	Big Data	Database	UX (Front End Design)	Quality Assurance/ Quality Control	Infrastructure	Consultancy
1	**Autonomous Robots** (coordinated and automated actions of robots to complete tasks intelligently, with minimal human input)							
2	**Big Data Analytics** (the analysis of ever larger volumes of data. Circulation, collection, and analysis of information is a necessity because it supports productivity growth based on a real-time decision-making process)							
3	**Cloud Computing** (storing and accessing data and programs over the Internet instead of your computer's hard drive)							
4	**Internet of Things (IoT)** (all machines and systems connected to the production plant (as well as other systems) must be able to collect, exchange and save these massive volumes of information, in a completely autonomous way and without the need of human intervention)							
5	**Additive Manufacturing (3D Printing)** (use in prototyping, design iteration and small-scale production and often described as "rapid prototyping" - produce the desired components faster, more flexibly and more precisely than ever before)							

6	**System Integration** (the process of linking together different computing systems and software applications physically or functionally to act as a coordinated whole via Internet of Things-IoT)							
7	**Cybersecurity** (with the increased connectivity and use of standard communications protocols, the need to protect critical industrial systems and manufacturing lines from cybersecurity threats is increasing)							
8	**Augmented Reality & Simulation** (Augmented-reality-based systems support a variety of services, such as selecting parts in a warehouse and sending repair instructions over mobile devices - provide workers with real-time information to improve decision making and work procedures). (Simulations will leverage real-time data to mirror the physical world in a virtual model, which can include machines, products, and humans. This allows operators to test and optimize the machine settings for the next product in line in the virtual world before the physical changeover, thereby driving down machine setup times and increasing quality)							

9	**Artificial Intelligence** Artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems. These processes include learning (the acquisition of information and rules for using the information), reasoning (using rules to reach approximate or definite conclusions) and self-correction							
10	**Supply Chain** Supply chain is the network of all the individuals, organizations, resources, activities and technology involved in the creation and sale of a product, from the delivery of source materials from the supplier to the manufacturer, through to its eventual delivery to the end user							
11	**New Business Model** Business model is a combination of two functions: the process of value creation and the process of value captures. The process of value creation refers to creating value for the target customer. The process of value capture refers to converting market opportunities into performance outcomes for the firm, which then justify value creation							

3.3 Table 2 is the list of important prerequisite and skills required in order to equip the workforce for IR4.0. Select prerequisite and skills that are relevant to the job area. Tick (√) where applicable, you may tick more than once.

Table 2: The description of important prerequisite and skills for workforce in the age of IR4.0 published in Skill Development for Industry 4.0 Whitepaper by Roland Berger GMBH in 2016

Prerequisite & Skills	Knowledge About ICT	Ability to Work with Data	Technical Know-How	Personal Skills
Details	▪ Basic Information Technology Knowledge ▪ Ability to Use and Interact with Computers And Smart Machines Like Robots, Tablets Etc. ▪ Understanding Machine to Machine Communication, It Security & Data Protection	▪ Ability to Process and Analyse Data and Information Obtained from Machines ▪ Understanding Visual Data Output & Making Decisions ▪ Basic Statistical Knowledge	▪ Inter-Disciplinary & Generic Knowledge About Technology ▪ Specialized Knowledge About Warehouse and Storage Activities and Processes in Place ▪ Technical Know-How of Machines to Carry Out Maintenance Related Activities	▪ Adaptability & Ability to Change ▪ Decision Making ▪ Working in Team ▪ Communication Skills ▪ Mindset Change for Lifelong Learning

No.	Job Areas	IMPORTANT PREREQUISITE AND SKILLS FOR IR4.0			
		Knowledge About ICT	Ability to Work with Data	Technical Know-How	Personal Skills
1	Web Programming				
2	Mobile Programming				
3	Games Programming				
4	VR Software Application Programming				

5	Enterprise Application Programming				
6	Wearable Device Programming				
7	Drone				
8	IoT (Intenet of Things) Programming				
9	Big Data Programming				
10	Database				
11	UX (Front End Design)				
12	Quality Assurance/ Quality Control				
13	Infrastructure				
14	Consultancy				

SECTION 4: RELATED ISSUES

4.1 What is/are the key issue/s related to Computer Programming, Consultancy and Related Activities Industry?
Please rate **ALL** the key issues by using the scale below.

1	2	3
Disagree	**Agree**	**Strongly Agree**

No	KEY ISSUES	Computer Programming, Consultancy and Related Activities Industry
1	Extra working hours	
2	Technological change	
3	Economic conditions	
4	Underpayment of wages lead to high turn over	
5	ow skilled and low performance workforce	
6	Insufficient manpower	

ANNEX 4: CRITICAL JOBS TITLE

No	Critical Job Title	Area/ Sub-Area	Level	LS	SS	S
1	System Analyst	Programming/ Web	5	X	X	✓
2	Web Developer	Programming/ Web	4	X	✓	X
3	System Analyst	Programming/ Mobile	5	X	X	✓
4	Mobile Developer	Programming/ Mobile	4	X	✓	X
5	System Analyst	Programming/ Game	5	X	X	✓
6	Game Developer	Programming/ Game	4	X	✓	X
7	Game Programmer	Programming/ Game	3	X	✓	X
8	System Analyst	Programming/ VR Software Application	5	X	X	✓
9	VR Software Developer	Programming/ VR Software Application	4	X	✓	X
10	VR Software Programmer	Programming/ VR Software Application	3	X	✓	X
11	System Analyst	Programming/ Wearable Device	5	X	X	✓
12	Wearable Device Developer	Programming/ Wearable Device	4	X	✓	X
13	Wearable Device Programmer	Programming/ Wearable Device	3	X	✓	X
14	System Analyst	Programming/ Drone	5	X	X	✓
15	Drone Application Developer	Programming/ Drone	4	X	✓	X
16	Drone Application Programmer	Programming/ Drone	3	X	✓	X
17	System Analyst	Programming/IoT	5	X	X	✓

No	Critical Job Title	Area/ Sub-Area	Level	LS	SS	S
18	IoT Developer	Programming/ IoT	4	X	✓	X
19	IoT Programmer	Programming/ IoT	3	X	✓	X
20	Data Processing	Programming/ Big Data	3	✓	X	X
21	Data Entry	Programming/ Big Data	2	✓	X	X

ANNEX 5: JOBS RELATED TO IR4.0

NO	JOBS RELATED TO IR4.0	AREA
1	Data Processing	Programming (Big Data)
2	Data Entry	Programming (Big Data)
3	Data Processing	Programming (Database)
4	Data Entry	Programming (Database)
5	UX Developer	Programming (UX Front End Design)
6	UX Programmer	Programming (UX Front End Design)

ANNEX 6: OCCUPATIONAL DESCRIPTIONS (OD)

Job Titles (FGD)	e-Masco	COL
System Analyst	**1. 2511-14 RPG System Analyst** **2. 2511-32 Information Technology System Analyst (JDE)** **3. 2511-04 Computer Systems Analyst**	√
Application Developer	**1. 2512-28 SAP IT and Finance Applications Developers** **2. 2512-29 SAP Application Developer** **3. 2512-06 Application Developer (.Net)** 4. **2512-13 Java Application Developer**	√
Application Programmer	**2514-09 Applications Programmer**	**X**
Data Processing	**4413-02 Coding Clerk, Data-Processing**	**X**
Data Entry	**4132-12 Data Entry Clerk**	**X**

SECTION : (J) INFORMATION AND COMMUNICATION

DIVISION : (62) COMPUTER PROGRAMMING, CONSULTANCY AND RELATED ACTIVITIES

GROUP : (620) COMPUTER PROGRAMMING, CONSULTANCY AND RELATED ACTIVITIES

MSIC GROUP : 620

AREA : Programming (Web)

JOB TIILE : System Analyst

LEVEL : 5

RESPONSIBILITIES:

The System Analyst is responsible to identify user system requirement, propose and suggest solution based on requirement, translating user requirement into technical solution specification/ design, consolidate all specification into written document (solution design), coordinate with application developer on projects, analyse system solution design, conduct application functional test, ensure completion of development within timeline, ensure continuous improvement of projects and maintain project and technical documentation.

Knowledge:

- Programming languages
- Effects on pros and cons of every solution choices

Skills:

- Identification of user system requirement
- Propose and suggest solution based on requirement
- Translating user requirement into technical solution specification/ design
- Consolidate all specification into written document (solution design)
- Analyse system solution design
- Conduct application functional test

Attributes (Attitude/Safety/Environmental):

- Leadership in leading a group of people or an organization to achieve specific objectives
- Ethical and follows moral principle that guide work behaviour
- Works well as a member of a team
- Creative thinking and bring new perspective to the workplace
- Communicate effectively with teams
- Knowledgeable in solving complex problems
- Take responsibility and being accountable

MSIC GROUP : 620

AREA : Programming (Web)

JOB TITLE : Web Developer

LEVEL : 4

RESPONSIBILITIES:

The Web Developer is responsible to design and create websites, look of the site and site technical aspects, maintaining site's technical aspects are important such as maintaining its performance and capacity, which are measures of a website's speed and how much traffic the site can handle, establish coding standard and design, handle complex area of application, coordinate application programmers, design application structure, modify application structure, developer software solutions, follow the software development lifecycle and conduct system integration testing (SIT).

Knowledge:

- Web applications coding, terminology, concepts and best practices
- User experience (UX)
- Programming languages
- Basic debugging techniques
- Basic logic
- Basic algebra
- Basic system administration
- Common operating system terminology
- Development methodologies (Waterfall model/ Agile)

Skills:

- Design and create websites
- Establish coding standard and design
- Handle complex area of application
- Coordinate application programmers
- Modify application structure
- Conduct system integration testing (SIT)

Attributes (Attitude/Safety/Environmental):

- High flexibility and have the ability to adapt to changing work conditions
- Pays close attention to the detail of the job at hand and has the ability to stay focused throughout the working day
- Works well as a member of a team
- Creative thinking and bring new perspective to the workplace
- Ability to work well under pressure

MSIC GROUP : 620

AREA : Programming (Mobile)

JOB TITLE : System Analyst

LEVEL : 5

RESPONSIBILITIES:

The System Analyst is responsible to identify user system requirement, propose and suggest solution based on requirement, translating user requirement into technical solution specification/ design, consolidate all specification into written document (solution design), coordinate with application developer on projects, analyse system solution design, conduct application functional test, ensure completion of development within timeline, ensure continuous improvement of projects and maintain project and technical documentation, act as iOS and/ or Android developer which depending on the skills set can be lead on one platform and play a supporting role across the other, working closely with another mobile app developer leading the other platform development, deliver across the entire app life cycle –concept, design, build, deploy, test, release to app stores and support, work directly with developers and product managers to conceptualize, build, test and release products, gather requirements around functionality and translate those requirements into elegant functional solutions, build prototypes at tech scoping stage of projects, works collaboratively and professionally with fellow team mates and other teams to achieve goals, interact with customer on the integration and implementation related activities, apply a sense of urgency, commitment and focus on the right priorities in developing solutions in a timely fashion, work with the front end developers to build the interface with focus on usability features, create compelling device specific user interfaces and experiences and optimize performance for the apps, keep up to date on the latest industry trends in the mobile technologies.

Knowledge:

- Programming languages
- Effects on pros and cons of every solution choices
- iOS software development kit (UIKit, Cocoa Touch, Core Data, Core Location, etc)
- X code
- Programming skills
- SQLite, MySQL or similar database management system
- Eclipse
- Compiled languages
- Web service integration (SOAP, REST, JSON, XML)
- Web technology development
- Programming and design patterns
- Building web, native apps and hybrid apps

- Social media application programming interfaces (APIs)
- Version control (SVN, Git)

Skills:

- Identify user system requirement
- Suggest solution based on requirement
- Translate user requirement into technical solution specification/ design
- Conduct application functional test
- Act as iOS and/ or Android developer

Attributes (Attitude/Safety/Environmental):

- Leadership in leading a group of people or an organization to achieve specific objectives
- High flexibility and have the ability to adapt to changing work conditions
- Ethical and follows moral principle that guide work behaviour
- Works well as a member of a team
- Creative thinking and bring new perspective to the workplace
- Communicate effectively with teams
- Knowledgeable in solving complex problems
- Take responsibility and being accountable

MSIC GROUP : 620

AREA : Programming (Mobile)

JOB TITLE : Mobile Developer

LEVEL : 4

RESPONSIBILITIES:

The Mobile Developer is responsible to establish coding standard and design, handle complex area of application, coordinate application programmers, design application structure, modify application structure, developer software solutions, follow the software development lifecycle and conduct system integration testing (SIT), responsible to develop code, test, debug, monitor and document changes for mobile applications, implement application programming interfaces (APIs) to support mobile functionality, migrate and adapt existing web applications to the leading mobile platforms. work closely with other departments to brainstorm and optimize deployments, recommend changes and enhancements to existing mobile applications.

Knowledge:

- Mobile applications coding, terminology, concepts and best practices
- Programming languages
- Basic debugging techniques
- Basic logic
- Basic algebra
- Basic system administration and familiarity with common operating system terminology
- Application programming interfaces (APIs) to support mobile functionality.

Skills:

- Establish coding standard and design
- Handle complex area of application
- Coordinate application programmers

Attributes (Attitude/Safety/Environmental):

- High flexibility and have the ability to adapt to changing work conditions Team Player
- Works well as a team member
- Knowledgeable in solving complex problems

MSIC GROUP : 620

AREA : Programming (Game)

JOB TITLE : System Analyst

LEVEL : 5

RESPONSIBILITIES:

The System Analyst is responsible to identify user system requirement, propose and suggest solution based on requirement, translating user requirement into technical solution specification/ design, consolidate all specification into written document (solution design), coordinate with application developer on projects, analyse system solution design, conduct application functional test, ensure completion of development within timeline, ensure continuous improvement of projects and maintain project and technical documentation.

Knowledge:

- Programming languages
- Effects on pros and cons of every solution choices
- Broad knowledge of hardware, software and programming
- Business awareness

Skills:

- Manage expectations and explain technical detail
- Interact with audience, transmit the messages with clarity, interpret and understand the mindsets of the listener
- Gives an excellence communication in term of oral and written
- Planning and negotiating

Attributes (Attitude/Safety/Environmental):

- Leadership in leading a group of people or an organization to achieve specific objectives
- High flexibility and have the ability to adapt to changing work conditions
- Ethical and follows moral principle that guide work behaviour
- Works well as a team member
- Creative thinking and bring new perspective to the workplace
- Communicate effectively with teams
- Knowledgeable in solving complex problems
- Take responsibility and being accountable

MSIC GROUP : 620

AREA : Programming (Game)

JOB TITLE : Game Developer

LEVEL : 4

RESPONSIBILITIES:

The Game Developer is responsible to establish coding standard and design, handle complex area of application, coordinate application programmers, design application structure, modify application structure, developer software solutions, follow the software development lifecycle and conduct system integration testing (SIT), design, develop and deliver systems and high quality code using programming languages, such as C++ and C#, perform code reviews to ensure code quality, refactor code to improve the design of existing code, quality test coding in a systematic and thorough way to find problems or bugs and record precisely where the problem was discovered, debug programs and solve complex technical problems that occur within the game's production, work closely with games development team members to meet the needs of a project, work closely with designers, artists and other staff involved in the design process in order to create a quality product to schedule, develop designs or initial concept designs for games including game play, generate game scripts and storyboards, create the visual aspects of the game at the concept stage, responsible to plan game projects, design games and role play mechanics, write code, test and debug game, maintain game projects.

Knowledge

- Game applications coding, terminology, concepts and best practices
- Programming languages
- Basic debugging techniques
- Basic logic
- Basic algebra
- Basic system administration and familiarity with common operating system terminology

Skills:

- Conduct coding with a range of programming languages and/or software packages
- liaise with other developers and other teams involved in making a game
- Self-motivation and work independently on certain projects
- Solve complex technical problems
- Flexible in meeting deadlines and client requirements
- Manage and prioritise workload effectively with attention to details
- Work and willingness to keep learning and developing skills
- Conduct implementation of 2D/3D design

Attributes (Attitude/Safety/Environmental):

- High flexibility and have the ability to adapt to changing work conditions
- Works well with team members
- Creative thinking and bring new perspective to the workplace
- Communicate effectively with teams
- Knowledgeable in solving complex problems
- Take responsibility and being accountable

MSIC GROUP : 620

AREA : Programming (Game)

JOB TITLE : Game Programmer

LEVEL : 3

RESPONSIBILITIES:

The Game Programmer is responsible to take the vision of game designers and bring it to life. They use computer code to create the programs that a computer, smart phone or video game system can read to run the game. Application Programmer decides which programming language will work best for a given game and chooses the programming language for particular aspects within the game. Application Programmers also choose the coding language that best suits the gaming platform, decide which programming language will work best for a given game, chooses the programming language for particular aspects within the game, choose the coding language that best suits the gaming platform, developing and implementing game software, ensuring that the game design is fully implemented and performs as expected, creating unit tests and validation procedures, and documenting technical specifications, working closely with a lead game developer to create task/project deliverables and interface with Quality Assurance, Game Procedures, Game Designers, Artist Mathematicians and Sound Designer.

Knowledge:

- Programming languages
- Data structure and algorithm
- Structuring and developing software code
- Object-oriented software engineering

Skills:

- Track record of successful application development
- Write clean and well-documented code
- Solve complex technical problems
- Work on SQL and Microsoft SQL Server
- Conduct troubleshooting on the system
- Use Microsoft Office tools (Excel, Visio)
- Demonstrate analytical study

Attributes (Attitude/Safety/Environmental):

- Perform objective analysis and evaluation of an issue in order to form a judgement
- Knowledgeable in solving complex problems
- High flexibility and have the ability to adapt to changing work conditions
- Works well with team members

- Pays close attention to the detail of the job at hand and has the ability to stay focused throughout the working day
- Take responsibility and being accountable

MSIC GROUP : 620

AREA : Programming (VR Software Application)

JOB TITLE : System Analyst

LEVEL : 5

RESPONSIBILITIES:

The System Analyst is responsible to identify user system requirement, propose and suggest solution based on requirement, translating user requirement into technical solution specification/ design, consolidate all specification into written document (solution design), coordinate with application developer on projects, analyse system solution design, conduct application functional test, ensure completion of development within timeline, ensure continuous improvement of projects and maintain project and technical documentation.

Knowledge:

- Programming languages
- Effects on pros and cons of every solution choices
- Broad knowledge of hardware, software and programming

Skills:

- Ability to learn quickly
- Solve complex technical problems
- Manage expectations and explain technical detail to client and has good client handling skills
- Conduct methodical, investigative and inquisitive
- Interact with audience, transmit the messages with clarity, interpret and understand the mindsets of the listener
- Gives an excellence communication in term of oral and written
- Conduct planning and negotiation

Attributes (Attitude/Safety/Environmental):

- Leadership in leading a group of people or an organization to achieve specific objectives
- High flexibility and have the ability to adapt to changing work conditions
- Take initiative and have high self-confidence
- Ethical and follows moral principle that guide work behaviour
- Work well as a team member
- Creative thinking and bring new perspective to the workplace
- Communicate effectively with teams

- Knowledgeable in solving complex problems
- Take responsibility and being accountable

MSIC GROUP : 620

AREA : Programming (VR Software Application)

JOB TITLE : VR Software Developer

LEVEL : 4

RESPONSIBILITIES:

The VR Software Developer is responsible to establish coding standard and design, handle complex area of application, coordinate application programmers, design application structure, modify application structure, developer software solutions, follow the software development lifecycle and conduct system integration testing (SIT), work with tech lead to design and program new solutions in the whole spectrum of virtual reality related software: from user interaction, interfaces and devices to functionalities like physics and AI, rewrite existing systems as directed for increased functionality, reduced memory usage, and increased performance, continuously test, debug, profile, analyse, and optimize on applicable console, PC, mobile, and Web platforms, research, Develop, and Implement current virtual reality software technologies in the industry. The Application Develop also responsible to build on current technology and implement better solutions in terms of efficiency and interaction, software development of real-time 3D VR User Interfaces, developing and testing new tools and applications, write well-commented, collaborate with clients, art team, and programming team unit-tested code, design, review, and maintain functional specifications, wireframes, etc, Identify, investigate, and report problems for bug tracking and develop gameplay, tools, and networking logic for VR applications

Knowledge:

- VR software applications coding, terminology, concepts and best practices
- Programming languages
- Basic debugging techniques
- Basic logic
- Basic algebra
- Basic system administration and familiarity with common operating system terminology
- DirectX and/or OpenGL
- 3D math and modern graphics pipeline
- Game engines, including Unity3D and Unreal

Skills:

- Conduct deployment to multiple platforms (Console, PC, mobile, web, etc.)
- Demonstrate experience with VR
- Conduct debugging on specific game platforms
- Build, deploy and commence application programming interfaces from third-party vendors a plus

Attributes (Attitude/Safety/Environmental):

- High flexibility and have the ability to adapt to changing work conditions
- Work well as a team member
- Creative thinking and bring new perspective to the workplace
- Communicate effectively with teams
- Knowledgeable in solving complex problems

MSIC GROUP : 620

AREA : Programming (VR Software Application)

JOB TITLE : VR Software Programmer

LEVEL : 3

RESPONSIBILITIES:

The VR Software Programmer is responsible to interpret user requirement document (solution design), create source code according to solution document, comply with data security guideline and conduct internal test.

Knowledge:

- Programming languages
- Data structure and algorithm
- Structuring and developing software code
- Object-oriented software engineering
- Microsoft Office tools (Excel, Visio)

Skills:

- Conduct user interfaces (UI) trends and best practices
- Track record of successful application development
- Write a clean and well-documented code
- Solve complex technical problems
- Work on SQL and Microsoft SQL Server
- Conduct troubleshoots on the system
- Conduct analytical study

Attributes (Attitude/Safety/Environmental):

- Knowledgeable in solving complex problems
- High flexibility and have the ability to adapt to changing work conditions
- Pays close attention to the detail of the job at hand and has the ability to stay focused throughout the working day
- Works well as a team member
- High flexibility and have the ability to adapt to changing work conditions

MSIC GROUP : 620

AREA : Programming (Wearable Device)

JOB TITLE : System Analyst

LEVEL : 5

RESPONSIBILITIES:

The System Analyst is responsible to identify user system requirement, propose and suggest solution based on requirement, translating user requirement into technical solution specification/ design, consolidate all specification into written document (solution design), coordinate with application developer on projects, analyse system solution design, conduct application functional test, ensure completion of development within timeline, ensure continuous improvement of projects and maintain project and technical documentation.

Knowledge:

- Programming languages
- Client requirement
- Effects on pros and cons of every solution choices

Skills:

- Identify user system requirement
- Propose and suggest solution based on requirement
- Translate user requirement into technical solution specification/ design
- Consolidate all specification into written document (solution design)
- Analyse system solution design
- Conduct application functional test

Attributes (Attitude/Safety/Environmental):

- Leadership in leading a group of people or an organization to achieve specific objectives
- High flexibility and have the ability to adapt to changing work conditions
- Ethical and follows moral principle that guide work behaviour
- Work well as a team member
- Creative thinking and bring new perspective to the workplace
- Communicate effectively with teams
- Knowledgeable in solving complex problems
- Take responsibility and being accountable

MSIC GROUP : 620

AREA : Programming (Wearable Device)

JOB TITLE : Wearable Device Developer

LEVEL : 4

RESPONSIBILITIES:

The Wearable Device Developer is responsible to establish coding standard and design, handle complex area of application, coordinate application programmers, design application structure, modify application structure, developer software solutions, follow the software development lifecycle and conduct system integration testing (SIT)

Knowledge:

- VR software applications coding, terminology, concepts and best practices
- Programming languages
- Basic debugging techniques
- Basic logic
- Basic algebra
- Basic system administration and familiarity with common operating system terminology
- 2D/3D design

Skills:

- Establish coding standard and design
- Handle complex area of application
- Coordinate application programmers
- Design application structure
- Modify application structure
- Implement 2D/3D design

Attributes (Attitude/Safety/Environmental):

- High flexibility and have the ability to adapt to changing work conditions
- Work well as a team member
- Creative thinking and bring new perspective to the workplace
- Communicate effectively with teams
- Knowledgeable in solving complex problems

MSIC GROUP : 620

AREA : Programming (Wearable Device)

JOB TITLE : Wearable Device Programmer

LEVEL : 3

RESPONSIBILITIES:

The Wearable Device Programmer is responsible to interpret user requirement document (solution design), create source code according to solution document, comply with data security guideline and conduct internal test.

Knowledge:

- Programming languages
- Data structure and algorithm
- Structuring and developing software code
- SQL and Microsoft SQL Server

Skills:

- Interpret user requirement document (solution design)
- Create source code according to solution document
- Comply with data security guideline
- Conduct internal test
- Operate data processing software
- Operate multi programming software

Attributes (Attitude/Safety/Environmental):

- Knowledgeable in solving complex problems
- High flexibility and have the ability to adapt to changing work conditions
- Pays close attention to the detail of the job at hand and has the ability to stay focused throughout the working day
- Works well as a team member
- Take responsibility and being accountable

MSIC GROUP : 620

AREA : Programming (Drone)

JOB TITLE : System Analyst

LEVEL : 5

RESPONSIBILITIES:

The System Analyst is responsible to identify user system requirement, propose and suggest solution based on requirement, translating user requirement into technical solution specification/ design, consolidate all specification into written document (solution design), coordinate with application developer on projects, analyse system solution design, conduct application functional test, ensure completion of development within timeline, ensure continuous improvement of projects and maintain project and technical documentation.

Knowledge:

- Programming languages
- Client requirement
- Effects on pros and cons of every solution choices
- Broad knowledge of hardware, software and programming

Skills:

- Identify user system requirement
- Propose and suggest solution based on requirement
- Translate user requirement into technical solution specification/ design
- Consolidate all specification into written document (solution design)
- Analyse system solution design
- Conduct application functional test

Attributes (Attitude/Safety/Environmental):

- High flexibility and have the ability to adapt to changing work conditions
- Works well with team members
- Creative thinking and bring new perspective to the workplace
- Communicate effectively with teams
- Knowledgeable in solving complex problems
- Take responsibility and being accountable
- Leadership in leading a group of people or an organization to achieve specific objectives
- Ethical and follows moral principle that guide work behaviour

MSIC GROUP : 620

AREA : Programming (Drone)

JOB TITLE : Drone Application Developer

LEVEL : 4

RESPONSIBILITIES:

The Drone Application Developer is responsible to establish coding standard and design, handle complex area of application, coordinate application programmers, design application structure, modify application structure, developer software solutions, follow the software development lifecycle and conduct system integration testing (SIT).

Knowledge:

- Drone applications coding, terminology, concepts and best practices
- Programming languages
- Basic debugging techniques
- Basic logic
- Basic algebra
- Basic system administration and familiarity with common operating system terminology

Skills:

- Conduct and establish coding standard and design
- Handle complex area of application
- Coordinate application programmers
- Design application structure
- Operate data processing software
- Conduct system integration testing (SIT).

Attributes (Attitude/Safety/Environmental):

- High flexibility and have the ability to adapt to changing work conditions
- Works well with team members
- Creative thinking and bring new perspective to the workplace
- Communicate effectively with teams
- Knowledgeable in solving complex problems
- Take responsibility and being accountable
- Self-motivation and the ability to work independently on your own projects

MSIC GROUP : 620

AREA : Programming (Drone)

JOB TITLE : Drone Application Programmer

LEVEL : 3

RESPONSIBILITIES:

The Drone Application Programmer is responsible to interpret user requirement document (solution design), create source code according to solution document, comply with data security guideline and conduct internal test.

Knowledge:

- Programming languages
- Data structure and algorithm
- Structure and develop software code
- Object-oriented software engineering
- SQL and Microsoft SQL Server
- Microsoft Office tools (Excel, Visio)

Skills:

- Interpret user requirement document (solution design),
- Create source code according to solution document
- Conduct internal test
- Conduct data structure and algorithm
- Conduct structuring and development of software coding

Attributes (Attitude/Safety/Environmental):

- Knowledgeable in solving complex problems
- High flexibility and have the ability to adapt to changing work conditions
- Pays close attention to the detail of the job at hand and has the ability to stay focused throughout the working day
- Work well as a team member
- Take responsibility and being accountable

MSIC GROUP : 620

AREA : Programming (IoT)

JOB TITLE : System Analyst

LEVEL : 5

RESPONSIBILITIES:

The System Analyst is responsible is to identify user system requirement, propose and suggest solution based on requirement, translating user requirement into technical solution specification/ design, consolidate all specification into written document (solution design), coordinate with application developer on projects, analyse system solution design, conduct application functional test, ensure completion of development within timeline, ensure continuous improvement of projects and maintain project and technical documentation.

Knowledge:

- Programming languages
- Client requirement
- Effects on pros and cons of every solution choices

Skills:

- Identify user system requirement
- Propose and suggest solution based on requirement
- Translating user requirement into technical solution specification/ design
- Consolidate all specification into written document (solution design)
- Analyse system solution design

Attributes (Attitude/Safety/Environmental):

- Leadership in leading a group of people or an organization to achieve specific objectives
- High flexibility and have the ability to adapt to changing work conditions
- Ethical and follows moral principle that guide work behaviour
- Work well as a team member
- Creative thinking and bring new perspective to the workplace
- Communicate effectively with teams
- Knowledgeable in solving complex problems
- Take responsibility and being accountable
- Take Initiative and have high self-confidence

MSIC GROUP : 620

AREA : Programming (IoT)

JOB TITLE : IoT Developer

LEVEL : 4

RESPONSIBILITIES:

The IoT Developer is responsible to establish coding standard and design, handle complex area of application, coordinate application programmers, design application structure, modify application structure, developer software solutions, follow the software development lifecycle and conduct system integration testing (SIT).

Knowledge:

- VR software applications coding, terminology, concepts and best practices
- Programming languages
- Basic debugging techniques
- Basic logic
- Basic algebra
- Basic system administration and familiarity with common operating system terminology

Skills:

- Establish coding standard and design
- Handle complex area of application
- Proficient in structuring and developing software code
- Coordinate application programmers
- Design application structure
- Modify application structure

Attributes (Attitude/Safety/Environmental):

- High flexibility and have the ability to adapt to changing work conditions
- Works well with team members
- Creative thinking and bring new perspective to the workplace
- Communicate effectively with teams
- Knowledgeable in solving complex problems

MSIC GROUP : 620

AREA : Programming (IoT)

JOB TITLE : IoT Programmer

LEVEL : 3

RESPONSIBILITIES:

The IoT Programmer is responsible to interpret user requirement document (solution design), create source code according to solution document, comply with data security guideline and conduct internal test.

Knowledge:

- Programming languages
- Data structure and algorithm
- Structuring and developing software code

Skills:

- Conduct internal test
- Interpret user requirement document (solution design)
- Operate software programming
- Operate multi data processing software

Attributes (Attitude/Safety/Environmental):

- Knowledgeable in solving complex problems
- High flexibility and have the ability to adapt to changing work conditions
- Pays close attention to the detail of the job at hand and has the ability to stay focused throughout the working day
- Work well as a team member
- Take responsibility and being accountable

MSIC GROUP : 620

AREA : Programming (Big Data)

JOB TITLE : Data Processing

LEVEL : 3

RESPONSIBILITIES:

The Data Processing is responsible to formatting information in a particular manner, which is easy to access and utilize. It is the process of organizing and controlling the large amount of data. It is useful to deal with the important data in synchronized manner. Data processing services typically includes excel data processing, word data processing, order processing, forms processing, image processing, survey processing and more. The Data Processing also responsible to in charge of proofreading and organizing information, which is entered in the company database, gather information and organize, analyse information and examines the document accuracy, fixed or deleted error before data area transfer to database and in charge of administrative duties which include filing, mailing, and contacting people.

Knowledge:

- Grammar and Punctuation
- Microsoft Suite (Excel, Word, and Access).

Skills:

- Operate multi data processing software programs including Microsoft Suite (Excel, Word, and Access).
- Perform formatting information in a particular manner
- Handle proofreading and organizing information
- Gather information and organize
- Analyse information and examines the document accuracy

Attributes (Attitude/Safety/Environmental):

- Quality of being honest and have strong moral principles
- Pays close attention to the detail of the job at hand and has the ability to stay focused throughout the working day

MSIC GROUP : 620

AREA : Programming (Big Data)

JOB TITLE : Data Entry

LEVEL : 2

RESPONSIBILITIES:

The Data Entry is responsible to entering data from various sources into the company computer system for processing and management. A candidate working in data entry will need to efficiently manage a large amount of information that is often sensitive or confidential. The integrity of any company is based on the data they produce which validates the importance of the Data Entry position. Any information inputted by the Data Entry team will then be used by other people for reference or reports, Data Entry also responsible to prepare and sorting documents for data entry, entering data into database software and checking to ensure the accuracy of the data that has been inputted, creating data backups as part of a contingency plan, respond to information requests from authorised members and testing new database system and software update

Knowledge:

- Grammar and Punctuation
- Microsoft Suite (Excel, Word, and Access).

Skills:

- Manage a large amount of information
- Enter data from various sources into the company computer system for processing and management
- Prepare and sorting documents for data entry

Attributes (Attitude/Safety/Environmental):

- Quality of being honest and have strong moral principles
- Pays close attention to the detail of the job at hand and has the ability to stay focused throughout the working day