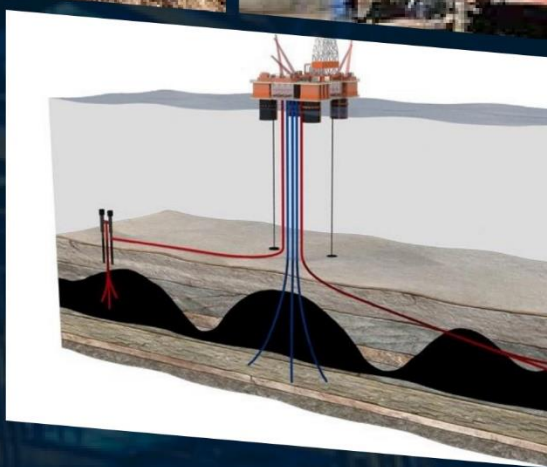
MSIC B09 : MINING SUPPORT SERVICE ACTIVITIES 2024

KEMENTERIAN SUMBER MANUSIA

Occupational Framework





MSIC B09
SECTION B : MINING AND QUARRYING
DIVISION 09 : MINING SUPPORT SERVICE ACTIVITIES

Jabatan Pembangunan Kemahiran
Kementerian Sumber Manusia, Malaysia

Department of Skills Development
Ministry of Human Resources, Malaysia

OCCUPATIONAL FRAMEWORK

SECTION B: MINING AND QUARRYING

DIVISION 09: MINING SUPPORT SERVICE ACTIVITIES

First Printing 2024

Published in Malaysia by

Department of Skills Development (DSD)
Ministry of Human Resources
Level 7-8, Block D4, Complex D
Federal Government Administrative Centre
62530 Putrajaya, Malaysia
Email : jpk@mohr.gov.my
Website : http://www.dsd.gov.my

Printed By

UPUM Resources Sdn. Bhd.(989963-D)
Aras 6, Kompleks Pengurusan Penyelidikan dan Inovasi,
Universiti Malaya, Wilayah Persekutuan Kuala Lumpur,
50603 Kuala Lumpur.
Tel : 03-7967 3556/3557
Email: upum@um.edu.my

Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

Occupational Framework B09
Mining Support Service Activities
ISBN 978-967-2393-42-9

Table of Contents

LIST OF APPENDICES

ABSTRACT

The Mining Support Service Activities sector (B09) is a significant contributor to the economy in Malaysia and a skilled workforce is required to meet the demand of the industry. The main objective of this research is to develop an Occupational Framework (OF) for B09. This framework will include two groups in the Malaysian Standard Industrial Classification (MSIC) 2008, which are: (1) B091: Support activities for petroleum and natural gas extraction, and (2) B099: Support activities for other mining and quarrying. The study utilized a design and developmental approach comprising three phases Phase 1: Analysis; Phase 2: Design and Development of the Occupational Framework; and Phase 3: Evaluation of the Occupational Framework. A variety of techniques were employed such as content analysis, focus group discussions (FGD), interviews and site visits so as to gain a deeper understanding of the complexities of the industry. A total of 23 experts from the industry were involved in Focus Group Discussions and interviews. The findings were used to generate an occupational structure which covers the job areas and job titles, an analysis on the current state of the industry, including the skilled worker requirements, competency in demand, jobs in demand, emerging skills, occupations related to technology and the Industrial Revolution (IR), related issues and challenges of this sector. For the first objective, to identify the previous studies with the needs of the current and future needs of the industry, the content analysis of documents indicated that there was a need for more talents in the industry to cater to economic growth. Next, three (3) FGDs were conducted to develop the occupational structures and identify the occupation responsibilities and the identification of occupational description for job in demand. The Occupational Framework (OF) developed was verified through interviews, and analysed according to themes, with four experts from the industry. For the second objective, to identify the job areas, job titles and job classifications, 12 job areas and 47 job titles were identified with 8 job areas and 30 job titles for B091 and 4 job areas and 17 job titles for B099. For the purpose of the third objective, the responsibilities for each job title were identified. For the fourth objective, to identify the critical jobs related to current developments in the industry, there are 10 critical jobs in B091 (e.g. petroleum engineers, geoscience, drilling engineers, pump engineers and operations engineer) and 12 job titles related to technology and IR (including pump technicians) while there are 2 critical jobs in B099 (mining technician and senior mining technician) and 8 job titles related to technology and IR (e.g. geologist, geological technician, mining project leader and mining engineer). For the fifth objective, to analyse the competency needed to address the demand and supply of the industry in Malaysia, the experts identified knowledge on safety, health and security as important in both B091 and B099. In addition, cognitive and metacognitive skills such as problem solving, social and emotional skills such as communication, as well as practical and physical skills such as leadership and time management were common to B091 and B099. However, the technical skills differed according to sector. Aptitudes such as team work, professionalism, work ethics, self-management and being independent, analytical thinking, paying attention to details, agility in thought and self-learning were important in both B091 and B099 according to the experts.

The OF developed will serve as a reference for the development of the National Occupational Skills Standard (NOSS) document and guide the development of curricula for institutions of higher education and training institutes. There is a need to incorporate new and emerging trends related to sustainability, green practices and emerging technologies such as Internet of Things and 3D Modelling. Higher education institutions also need to promote the programs and highlight the need for talent development for the critical jobs such as Petroleum engineers and training institutes should provide opportunities for upskilling and reskilling talents such as mining technicians to cater for new technologies in the sector. Only 2 of the NOSS listed in

MySPIKE for B09 are relevant to the sector while 31 NOSS are related to other divisions such as M71 and F43. Hence, these NOSS would need to be relooked at. The existing NOSS for firefighting services in B09 will need to be updated to include new technologies in the field. In addition, NOSS for the 10 critical job titles related to the industrial revolution should be developed according to the industry's need.

ABSTRAK

Sektor Aktiviti Perkhidmatan Sokongan Perlombongan (B09) menyumbang kepada pembangunan ekonomi Malaysia dan memerlukan tenaga kerja mahir untuk memenuhi permintaan industri. Objektif utama penyelidikan ini adalah untuk membangunkan Kerangka Pekerjaan (OF) untuk B09. Kerangka ini akan merangkumi dua kumpulan dalam *Malaysian Standard Industrial Classification* (MSIC) 2008 iaitu : (1) B091: Aktiviti sokongan untuk pengekstrakan petroleum dan gas asli, dan (2) B099: Aktiviti sokongan untuk perlombongan dan kuari lain. Kajian ini menggunakan pendekatan reka bentuk dan pembangunan yang terdiri daripada tiga fasa Fasa 1: Analisis; Fasa 2: Reka Bentuk dan Pembangunan Kerangka Pekerjaan; dan Fasa 3: Penilaian Kerangka Pekerjaan. Pelbagai teknik digunakan seperti analisis kandungan, perbincangan kumpulan fokus (FGD), temu bual dan lawatan tapak untuk mendapatkan pemahaman yang lebih mendalam tentang kerumitan industri. Seramai 23 pakar dari industri terlibat dalam Perbincangan Kumpulan Fokus dan temu bual. Penemuan ini digunakan untuk menjana struktur pekerjaan yang merangkumi bidang pekerjaan dan tajuk pekerjaan, analisis mengenai keadaan semasa industri, termasuk keperluan pekerja mahir, kecekapan dalam permintaan, pekerjaan dalam permintaan, kemahiran baru muncul, pekerjaan yang berkaitan dengan teknologi dan Revolusi Perindustrian (IR), isu dan cabaran berkaitan sektor ini. Bagi objektif pertama, untuk mengenal pasti kajian lepas dengan keperluan keperluan semasa dan masa hadapan industri, analisis kandungan dokumen berkaitan menunjukkan bahawa terdapat keperluan untuk lebih ramai bakat dalam industri untuk memenuhi pertumbuhan ekonomi. Seterusnya, tiga (3) FGD telah dijalankan untuk membangunkan struktur pekerjaan dan mengenal pasti tanggungjawab pekerjaan dan deskripsi pekerjaan bagi pekerjaan dalam permintaan. Kerangka Pekerjaan (OF) yang dibangunkan telah disahkan melalui temu bual dan dianalisis mengikut tema dengan empat pakar dari industri. Bagi objektif kedua, untuk mengenal pasti bidang pekerjaan, tajuk pekerjaan dan klasifikasi pekerjaan, 12 bidang pekerjaan dan 47 tajuk pekerjaan dikenal pasti dengan 8 bidang pekerjaan dan 30 gelaran pekerjaan untuk B091 dan 4 bidang pekerjaan serta 17 gelaran pekerjaan untuk B099. Bagi tujuan objektif ketiga, tanggungjawab bagi setiap tajuk pekerjaan telah dikenalpasti. Bagi objektif keempat, untuk mengenal pasti pekerjaan kritikal yang berkaitan dengan perkembangan semasa dalam industri, terdapat 10 pekerjaan kritikal dalam B091 (cth. jurutera petroleum, geosains, jurutera penggerudian, jurutera pam dan jurutera operasi) dan 12 jawatan yang berkaitan dengan teknologi dan IR (termasuk juruteknik pam) manakala terdapat 2 pekerjaan kritikal dalam B099 (juruteknik perlombongan dan juruteknik perlombongan kanan) dan 8 jawatan yang berkaitan dengan teknologi dan IR (cth. ahli geologi, juruteknik geologi, ketua projek perlombongan dan jurutera perlombongan).Bagi objektif kelima, untuk menganalisis ketrampilan yang diperlukan untuk menangani permintaan dan penawaran industri di Malaysia, pakar mengenal pasti pengetahuan tentang keselamatan dan kesihatan sebagai penting dalam kedua-dua B091 dan B099. Selain itu, kemahiran kognitif dan metakognitif seperti penyelesaian masalah, kemahiran sosial dan emosi seperti komunikasi, serta kemahiran praktikal dan fizikal seperti kepimpinan dan pengurusan masa adalah diperlukan bagi kedua-dua B091 dan B099. Walau bagaimanapun, kemahiran teknikal berbeza mengikut sektor. Kebolehan seperti kerja berpasukan, profesionalisme, etika kerja, pengurusan diri dan berdikari, pemikiran analitik, memberi perhatian kepada butiran, ketangkasan dalam pemikiran dan pembelajaran kendiri adalah penting dalam kedua-dua B091 dan B099 menurut pakar.

OF yang dibangunkan akan menjadi rujukan untuk pembangunan dokumen Standard Kemahiran Pekerjaan Kebangsaan (NOSS) dan panduan pembangunan kurikulum untuk institusi pengajian tinggi dan institut latihan. Terdapat keperluan untuk menggabungkan trend

baharu dan muncul berkaitan dengan kemampanan, amalan hijau dan teknologi baru muncul seperti Internet of Things (IoT) dan Permodelan 3D. Institusi pengajian tinggi juga perlu mempromosikan program dan menyerlahkan keperluan untuk pembangunan bakat untuk pekerjaan kritikal seperti jurutera petroleum dan institut latihan harus menyediakan peluang untuk meningkatkan kemahiran dan kemahiran semula bakat seperti juruteknik perlombongan untuk memenuhi teknologi baharu dalam sektor ini. Hanya 2 NOSS yang disenaraikan dalam MySPIKE untuk B09 adalah berkaitan dengan sektor tersebut manakala 31 NOSS berkaitan dengan bahagian lain seperti M71 dan F43. Oleh itu, senarai NOSS dalam MySPIKE perlu dikaji semula. NOSS sedia ada untuk perkhidmatan memadam kebakaran di B09 perlu dikemas kini untuk memasukkan teknologi baharu dalam bidang tersebut. Selain itu, NOSS untuk 10 jawatan kritikal dan berkaitan dengan revolusi perindustrian harus dibangunkan mengikut keperluan industri.

LIST OF FIGURES

LIST OF TABLES

ABBREVIATION

JMG	Jabatan Mineral & Geosains
ADTEC	Pusat Latihan Teknologi Tinggi
AI	artificial intelligence
CCUS	Carbon, Capture, Utilisation & Storage
CEFS	Central Emergency & Fire Services Response
DDR	Design and Developmental Research
DKM	Malaysian Skills Diploma (*Diploma Kemahiran Malaysia*)
DLKM	Malaysian Advanced Skills Diploma (*Diploma Lanjutan Kemahiran Malaysia*)
DMGM	Department of Mineral and Geoscience Malaysia
DOE	Department of Environment
DOSM	Department of Statistics Malaysia
DRTOS	Drilling Real Time Operations System
DSD	Department of Skills Development
ERT	Emergency Response Team
ESD	Expatriate Services Division
FGD	Focus Group Discussion
FLNG	Floating Liquid Natural Gas
GDP	Gross Domestic Product
ICSED	International Conference of Sustainability Education Development
iCWD	Intelligent Circulation while Drilling
ILB	Industry Lead Body
ILKBS	Institut Latihan Kemahiran Belia dan Sukan
ILMIA	Institute of Labour Market Information and Analysis
ILP	Institut Latihan Perindustrian
INSTEP	Institut Teknologi Petroleum PETRONAS

IoT	Internet of Things
IR	Industrial revolution
ISIC	International Standard Industrial Classification
LNG	liquified natural gas
LRS	Liquid Recovery System
MASCO	Malaysian Standard Classification of Occupations
MGA	Malaysia Gas Association
MGTC	Malaysian Green Technology and Climate Change
MIDA	Malaysian Industrial Development Authority
MITI	Ministry of International Trade and Industry Malaysia
MOCA	Malaysia Offshore Contractors Association
MOGEC	Association of Malaysian Oil & Gas Engineers
MOGSC	Malaysian Oil & Gas Services Council
MoHR	Ministry of Human Resources
MOSQF	Malaysian Occupational Skill Qualification Framework
MPA	Malaysian Petrochemicals Association
MSIC	Malaysian Standard Industrial Classification
MSNT	Malaysian Society for Non-Destructive Testing
NDT	Non Destructive Testing
NIOSH	National Institute for Occupational Safety and Health
NJT	No Job Title
NMP	Non-Metallic Pipe
NOSS	National Occupational Skills Standard
NR-REE	Non-Radioactive Rare Earth Elements
O&G	Oil and Gas
OD	Occupational Descriptions
OECD	Organization for Economic Cooperation and Development

OF	Occupational Framework
OGSE	Oil and Gas Service and Equipment
OMO	Oil and Mining Ordinance
OR	Occupational Responsibilities
OS	Occupational Structure
OSH	Occupational Safety and Health
PDA 1974	Petroleum Development Act 1974
AFMA	ASEAN Federation of Mining Associations
PDRM	Polis Diraja Malaysia
PPT	Accreditation of Prior Achievement
QHSE	Quality, Health, Safety and Environment
REE	Rare Earth Elements
ROV	Remote Operations Vehicles
SDG	Sustainable Development Goals
SKM	Malaysian Skills Certificate (*Sijil Kemahiran Malaysia*)
SLDN	National Dual Training System
SME	State Mineral Enactment
SPOT	Secure Personnel Online Tracking
SSM	Suruhanjaya Syarikat Malaysia
TIM	National Mineral Industry Transformation Plan

GLOSSARY

3D Modelling	Creating a three-dimensional representation of objects or scenes using specialized software.
Aggregate	A granular material, such as sand, gravel, or crushed stone, used in construction.
Agile Mindset	A flexible and adaptive approach to problem-solving and decision-making.
Artificial Intelligence (AI)	Simulation of human intelligence in machines for tasks requiring intelligence.
Attribute/Attitude	Personal qualities and characteristics, including professionalism, work ethics, teamwork, dependability, analytical thinking, and stress management.
Autonomous Technology	Technology capable of performing tasks without human intervention. In mining, it may involve the use of automated machinery.
B06 (Extraction of Crude Petroleum and Natural Gas)	Specific category within the Occupational Framework related to the extraction of petroleum and natural gas.
B09 Mining Support Service Activities	Division code for the mining and quarrying industry, specifically for support service activities.
Bauxite	An ore that is the world's main source of aluminium.
Circular Economy	An economic system designed to minimize waste and make the most of resources by reusing, sharing, and recycling.
Clay	A naturally occurring material composed primarily of fine-grained minerals.
Cloud Computing	The delivery of computing services, including storage, processing power, and analytics, over the internet (the cloud).
Coal	A combustible black or brownish-black sedimentary rock, primarily composed of carbon.
Competency	The ability to perform tasks effectively and efficiently, often associated with the skills and knowledge required for a particular job.
Competency in Demand	Overall skill set required for current and future jobs in the industry.

Copper	A ductile metal used in electrical wiring and plumbing.
Core Abilities	Fundamental skills and attributes essential for success in a particular industry or occupation.
Critical Jobs	Key occupations crucial for the smooth functioning of the mining support services activities, identified based on their relevance, demand, and strategic importance.
Crude Petroleum	Unrefined oil as extracted from the ground.
Data Automation	The process of automating the collection, processing, and analysis of data to derive insights and make informed decisions.
Data Exchange	Process of sharing and transferring data between devices or systems.
Department of Minerals and Geoscience Malaysia (JMG)	A government department responsible for overseeing mineral and geological activities in Malaysia.
Department of Skills Development	Part of the Human Resource Ministry in Malaysia, responsible for skills development programs.
Department of Statistics Malaysia	A government department responsible for collecting and publishing statistical information in Malaysia.
Design and Developmental Research (DDR)	Research framework involving analysis, design, development, and evaluation phases.
Digital Economy	Economy based on digital technologies, including online transactions and digital communication.
Digital Literacy	The ability to use, understand, and apply digital technologies effectively.
Digital Literacy Skills	Competence in using digital tools, technologies, and information to access, manage, integrate, analyze, and evaluate data.
Digital Skills	Proficiency in using digital tools, devices, and applications. In the context of mining, it includes using tablets and mobile devices for data input and monitoring.
Digital Technologies	Technologies related to digital information processing, including artificial intelligence, data analytics, and automation.
Diversity and Inclusion	Fostering workplace culture embracing diversity for improved innovation and performance.

Document Analysis	A research method involving the examination and interpretation of written or visual materials to extract relevant information.
Drilling Real Time Operations System (DRTOS)	A real-time software and hardware platform used for monitoring drilling operations.
Emerging Jobs	Positions evolving in response to industry changes, including roles related to green technology, renewable energy, and sustainability
Emerging Skills	Skills predicted to be crucial for the industry's progress in the future.
Environmental Monitoring	The systematic collection and analysis of data to assess the environmental impact of mining activities.
Export Value	The total value of goods or services a country exports.
Felspar	A group of rock-forming minerals used in ceramics and glassmaking.
Focus Group Discussion (FGD)	Qualitative research method involving group discussions to brainstorm industry-related topics.
Framework	A structure or plan guiding the study.
Geophysical and Geologic Surveying	Techniques for mapping and studying the Earth's physical features and geological structure.
Gold	A precious metal valued for its rarity and decorative uses.
Gravel	Small, rounded stones used in construction.
Green Technology	Practices and technologies aimed at reducing environmental impact, a growing focus in the mining, quarrying, and oil and gas industries.
Green Technology Principles	Practices that prioritize environmental sustainability in technological advancements and industrial processes.
Gross Domestic Product (GDP)	The total value of goods and services produced by a country in a specific period.
Gross Output	Total value of goods and services produced by the mining and quarrying sector.
Health and Safety Implementation	Measures and protocols put in place to ensure the well-being of workers, addressing concerns related to health, safety awareness, and reliable medical treatment.

Hybrid Working Environments	Work environments combining on-site and remote work.
Ilmenite	A titanium-iron oxide mineral, often used as a source of titanium dioxide.
Indeed	An online job search platform.
Industrial Revolution (IR)	Emergence of the Digital Economy and automation in industrial technologies, including IoT and robotics, disrupting various industries
Institute of Labour Market Information and Analysis (ILMIA)	An institute that provides information and analysis related to the labour market.
Internet of Things (IoT)	A network of interconnected devices that can communicate and exchange data, enhancing automation and efficiency in various processes.
Iron Ore	A mineral resource from which iron can be extracted.
Job Titles	Specific roles or positions within the job areas, indicating different responsibilities and tasks.
Jobs in Demand	Positions within the industry that have a high manpower shortage, indicating a need for qualified workers.
Kaolin	A type of clay used in the production of porcelain and ceramics.
Lack of Young Talents	Due to negative perceptions, limited interest, and challenges, necessitating strategies for attracting and retaining younger workers.
Limestone	A sedimentary rock composed mainly of calcium carbonate.
Limitation	A constraint or restriction on the study.
Liquefaction and Regasification	Processes involving the conversion of natural gas into liquid form for transport and the subsequent conversion back to gas.
Liquified Natural Gas (LNG)	Natural gas that has been converted into liquid form for ease of storage and transportation.
LNG FLNG Tanker	Liquefied Natural Gas Floating Liquefied Natural Gas Tanker, a vessel used for transporting LNG.
Machine Learning	A subset of artificial intelligence that enables machines to learn from data and improve their performance without explicit programming.

Malaysian Investment Development Authority (MIDA)	A Malaysian government agency promoting investments in various sectors, including oil and gas.
Malaysian Occupational Skill Qualification Framework (MOSQF)	Classifies skills into 8 levels, from routine tasks (Level 1) to strategic activities (Level 8).
Malaysian Qualification Agency (MQA)	Agency overseeing qualifications in Malaysia.
Metallic Mineral Resources	Minerals that contain metals and are economically valuable.
Mining and Quarrying	Extraction of valuable minerals or geological substances from the earth.
MSIC (Malaysian Standard Industrial Classification) 2008	Standardized classification system for economic activities and industries in Malaysia.
Multi-tasking/Flexibility	The ability to handle multiple tasks simultaneously and adapt to changing circumstances.
National Energy Transition Plan	Strategic plan for transitioning from fossil-fuel to green economies.
National Mineral Industry Transformation Plan (TIM)	A strategic plan outlining the transformation and development goals for the national mineral industry.
National Occupational Skills Standard (NOSS)	Standardized guidelines defining the skills, knowledge, and competencies required for specific job titles.
National OGSE Industry Blueprint	A comprehensive plan outlining the strategic direction and development goals for the national Oil, Gas, and Energy (OGSE) industry.
Non-Metallic Mineral Resources	Minerals that do not contain metals but have other economic value.
Non-Radioactive Rare Earth Elements	Uncommon elements with unique properties, often used in technology.
NOSS (National Occupational Skills Standards)	Documented standards that define the skills and knowledge required for specific job roles.

Observatory of Economic Complexity	A source providing data on economic complexity and trade.
Occupational Descriptions	Detailed explanations of the roles, responsibilities, and requirements of specific job titles.
Occupational Framework (OF)	Essential for skill development, it comprises Occupational Structure (OS) and Occupational Descriptions (OD), aligning job roles with MOSQF levels.
Occupational Hazards	Risks and dangers associated with mining and quarrying activities, both on and off the plant and site, involving exploration of new sites, sampling, and exposure to chemicals and unknown samples.
Occupational Responsibilities (OR)	The specific duties and tasks associated with different job titles within an industry.
Occupational Safety and Health Monitoring	The process of observing, assessing, and ensuring the safety and health conditions in the workplace.
Occupational Structure (OS)	The framework that defines the job areas, titles, and responsibilities within a specific industry, such as Support Activities for Mining and Quarrying.
Offshore Refineries	Facilities located at sea for processing and refining natural resources, such as oil and gas.
Oil and Gas (O&G) Industry	Industries involved in the exploration, extraction, refining, and distribution of oil and gas.
Petroleum Engineers	Professionals specializing in the extraction and production of oil and gas.
PETRONAS	Petroliam Nasional Berhad - Malaysia's state-owned oil and gas company.
PETRONAS CARIGALI	Entity established to explore and extract petroleum from Malaysia's shores.
PETRONAS Technology Ventures Sdn Bhd	A subsidiary of PETRONAS focused on technology innovation and development.
Rare Earth Elements (REE)	Chemical elements with unique properties used in various technological applications, including electronics and renewable energy.
Real-time Data	Information that is processed and made available immediately as events occur.

Remote Access and Autonomous Machines	Ability to control and monitor machines remotely without human intervention.
Remote Operations Vehicles (ROV)	Unmanned vehicles used for performing tasks in environments that are difficult for humans to access.
Renewable Energy	Sustainable and eco-friendly energy sources, an area of transition for the petroleum industry to reduce reliance on traditional fossil fuels.
Reskilling	The process of acquiring new skills or updating existing ones to meet the changing demands of a job or industry.
Robotics	The design, construction, operation, and use of robots to perform tasks traditionally done by humans. In mining, it can involve the use of drones and other automated technologies.
Robotics and Automation	The use of machines and technology to perform tasks without human intervention, commonly applied in industrial processes.
Sand	A granular material composed of finely divided mineral and rock particles.
Scope	The range or extent of a study.
Self-learning	The capacity to acquire new knowledge and skills independently.
Significance	The importance or relevance of the study.
Silica	A compound commonly found in nature, often used in the production of glass.
Simulation and Modelling	Creation of digital representations to imitate real-world processes or systems.
Simulations	The imitation of the operation of a real-world process or system over time. In mining, simulations may involve real-time data for virtual models.
Skills Gap	The difference between the skills workers possess and the skills required by employers.
Skills Mismatch	A situation where the skills possessed by workers do not align with the requirements of employers.
Stakeholders	Entities with an interest or involvement in mining support services activities, including government agencies, regulatory bodies, professional organizations, and training centres.

Strategies for Sustainable Mining	Approaches and plans aimed at ensuring environmentally conscious and sustainable practices throughout the mining value chain.
Struverite	A mineral containing tantalum and niobium, often used in electronics.
Summary	A brief recapitulation of key points in the text.
Support Activities for Mining	Services and tasks that contribute to the efficiency and success of mining operations.
Talent Corp	Talent Corporation Malaysia Berhad, an agency focused on addressing the talent needs of the nation.
Talent Gap	The difference between the skills and competencies demanded by an industry and the available workforce.
Talent Shortage	A situation where there is a lack of skilled workers in a particular industry.
Talent Transition	The process of adapting the workforce to new roles and skills, crucial in the Oil and Gas Service and Equipment (OGSE) sector's shift towards cleaner energy initiatives.
Tin	A metal used in various alloys and coatings.
TVET Training Institutions	Technical and Vocational Education and Training institutions offering practical and hands-on training.
UNIDO	United Nations Industrial Development Organization, a specialized agency of the United Nations.
Upskilling and Reskilling	The enhancement or acquisition of new skills by the existing workforce to meet the changing demands of the industry.
Upstream and Downstream	Segments of the oil and gas industry, with upstream involving exploration and extraction, and downstream involving distribution and retailing.
Upstream Areas	In the context of mining, refers to the initial stages of exploration and extraction.
Upstream Processes	Processes in exploration, extraction, and initial processing of raw materials in industries.
Urban Mining	The process of reclaiming, recycling, and reusing materials from products and buildings in urban environments.

Value Chain	The sequence of activities involved in the extraction, processing, and delivery of minerals and resources, emphasizing sustainability and responsible practices.
Value Chain Complexity	The intricate nature of the mining value chain, involving multiple stages from resource extraction to sustainable practices, often managed independently by different organizations.
Virtual Environments	Simulated digital spaces that replicate real-world environments, often used for training and design purposes.
Workforce Planning	The process of aligning workforce capabilities with business needs to ensure effective and efficient operations.
Yayasan PETRONAS	Foundation associated with PETRONAS involved in academic, skills, and entrepreneurship training programs.

CHAPTER I

INTRODUCTION

1.1 Research Background

Mining is one of the main, and oldest industries in Malaysia. Malaysia is blessed with over 22 different types of various metallic, non-metallic, energy minerals and non-radioactive rare earth elements scattered across the country. Some of it are aggregate, bauxite, clay, coal, copper, felspar, gold, gravel, ilmenite, iron ore, kaolin, limestone, sand, silica, struverite and tin. The latest report by the Department of Minerals and Geoscience Malaysia (JMG) indicated that the income generated by Malaysia's metallic mineral resources have bounced back in the late 2021 and has contributed RM97.49 billion in monetary value, while the non-metallic mineral resources contributed RM44.11 billion (*Jabatan Mineral dan Geosains Malaysia* & *Kementerian Tenaga dan Sumber Asli*. 2021, 4). This was attributed to a strong global demand and price increases (The Department of Minerals and Geoscience Malaysia & Ministry of Energy and Natural Resources, 2021, 27). Figure 1.1 shows the total trade for mineral-based products in 2021 achieved RM164.77 billion compared to RM125 billion during the pre-Covid era.

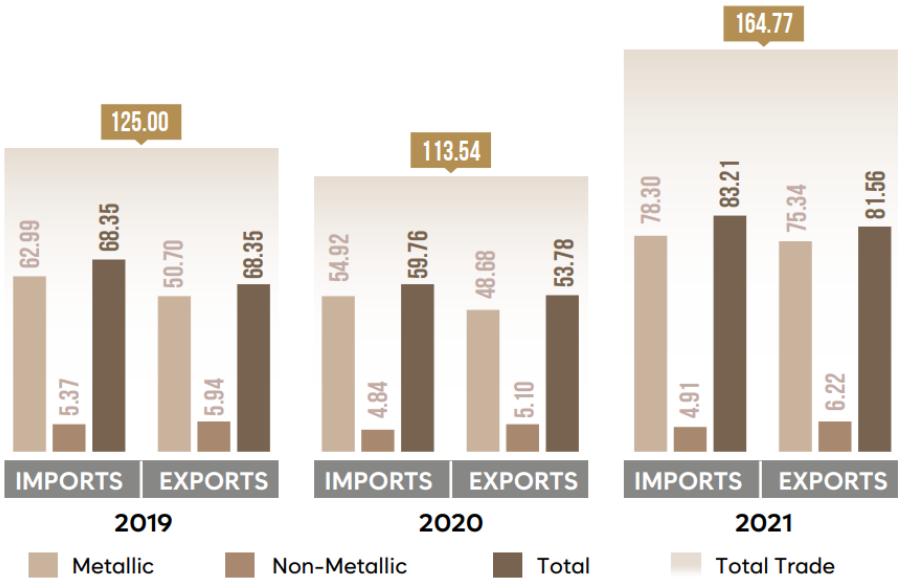


Figure 1.1: Mineral-based product trade performance (RM million) for 2019-2021. (The Department of Minerals and Geoscience Malaysia & Ministry of Energy and Natural Resources, 2021, p.26)

The oil and gas (O&G) industry on the other hand, has been one of the major sources of national revenue when the mining industries slowed down. This is due to the high price, demand and advancement of the technology for O&G extraction. In 2021, Malaysian Investment Development Authority (MIDA) reported that O&G contributed to 20% of the annual Gross

Domestic Product (GDP) with more than 3,500 businesses (Malaysian Investment Development Authority, n.d.). In 2022, the export value of crude petroleum in Malaysia was valued at approximately RM31.55 billion, compared to RM18.37 billion in 2021. Crude oil is exported to many countries with Australia as the main importer of Malaysia's crude oil (see Figure 1.2).

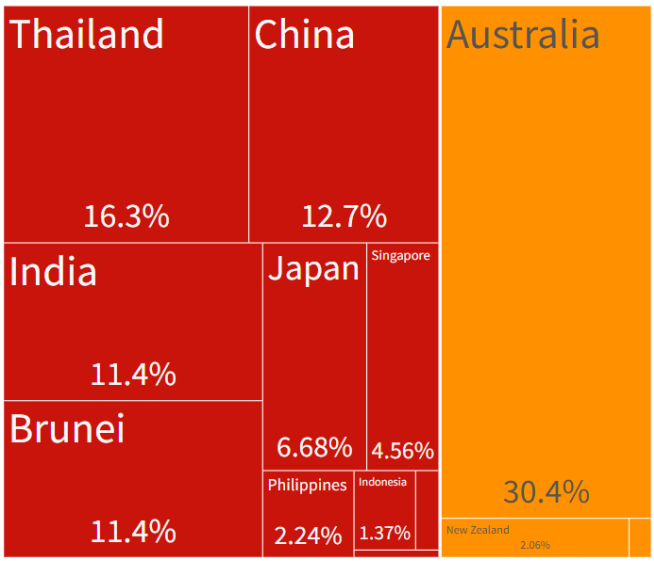


Figure 1.2: Malaysia's crude oil export and destinations. Source: (Observatory of Economic Complexity, n.d.)

Seeing that both mining and O&G industries are important and flourishing, it is important to ensure there is growth in the support services for both these industries as this will create more jobs. To date (24th July 2023), there are 3,737 job vacancies posted under mining support services in Australia alone (Indeed, 2022). In Malaysia, the employment rate in 2021 decreased by 4.4% from the previous year (Department of Statistics Malaysia, 2023, 15). Although there seemed to be 60,983 persons engaged in the mining and quarrying sector with salaries and wages paid amounting to RM7.2 billion (Department of Statistics Malaysia, 2022), the specific numbers for the mining support services is not known. This is because the practical activities related to support services for both mineral mining and quarrying as well as O&G extraction sometimes overlap with the operations of mining, quarrying and O&G extraction. On top of this, the statistics and reports from various agencies focus on the main mining and quarrying industry, and the O&G industry.

Therefore, it is crucial to plan, strategize and manage the whole occupational ecosystem in support services for mining and quarrying activities. Over the years, the industry performance has been uncertain, following the fluctuations in demand and prices, and this in turn, has repeatedly caused changes in the number of jobs created and closed both for the main industry and the support activity industry.

The issues and skills required in the workforce have also been investigated by (the Institute of Labour Market Information and Analysis (ILMIA) & Ministry of Human Resources, 2020).

While identifying the workforce and skills gap, the changes in technologies in the industry and its relevance to the industrial revolution (IR) needs to be identified and to ensure that the industry is sustainable and competitive. Hence, the Occupational Framework (OF) needs to be identified. The OF is an outcome of the Occupational Analysis and research in a particular industry sector. The contents of an OF include the Occupational Structure (OS), which identifies the generic job titles across the same industry, as well as the relevance to the IR and skills needed.

1.2 Problem Statement

The Occupational Framework (OF) for B09: Mining Support Service Activities has not yet been developed. Therefore, the Occupational Structure which contained the generic jobs title(s) for all similar tasks across companies, and mapped onto Malaysian Occupational Skill Qualification Framework (MOSQF) (Department of Skill Development, n.d.), needs to be developed.

On top of the changes in mineral prices, mineral resources are also getting scarce. Hence, new mineral resources need to continually be identified and mapped. Thus, the focus now would be more on managing natural resources, to upskill/reskill workers for new energy sources, and to invest in creating more jobs and increase economic growth (Hashmicro, 2022). The O&G industry, for example, has faced a talent shortage for years due to an aging workforce, limited new/young talent entering the industry, and growing competition for talent with the advances in technology in this industry. This difficulty in getting and retaining talent may pose a significant issue for the future of the industry (Alkadiri, 2022).

In addition, a thorough study on the relevancy and technology used in B09: Mining Support Service Activities to the Industry Revolution (IR) needs to be updated. This is important to ensure that the industry is not left behind in terms of getting into emerging industries. As the mining industry is an "old" industry, there is a pressing need to upskill the workers to keep up with technology, technical skills and new talents. Reskilling talent for soft skill in communication, collaboration and innovation (Maloney, 2021) using updated technology is also needed.

Finally, due to the limited attention paid to the quality and matching of the worker's education and skills to what is required in the workplace, there are impacts to the value chain. The skills mismatch significantly impacts the relevant industries, including the mining support services industry (Battu & Zakariya, 2015, 20).

1.3 Objective of Study

The objective of this research is to develop the Occupational Framework for B09: Mining Support Service Activities, which contains:

a. To identify the previous studies with the needs of the current and future needs of the industry

b. To identify the job areas, job titles and job classifications according to the definitions and levels of NOSS in B09: Mining Support Service Activities
c. To identify the responsibilities and job descriptions for each job title
d. To identify the critical jobs for B09 and/or related to current developments in the industry
e. To analyse the competency needed to address the demand and supply of the industry in Malaysia

1.4 The Scope of the Study for B09: Mining Support Service Activities

This study will be guided and limited to the definition declared in Malaysian Standard Industrial Classification (MSIC) 2008 code for B09, defined as **Mining Support Service Activities**. This study revolves around developing the occupational framework for support services for mining, quarrying as well as for the O&G industry. It includes identifying occupational areas, titles and descriptions that exist for support activities in mining, quarrying and O&G industries.

1.4.1 Limitations of the study

For O&G, activities below are excluded:

(a) service activities performed by operators of oil or gas fields,
(b) specialised repair of mining machinery,
(c) liquefaction and regasification of natural gas for purpose of transport, done off the mine site,
(d) geophysical, geologic and seismic surveying,

while support service activities for Mining and quarrying excludes:

(a) operating mines or quarries on a contract or fee basis,
(b) specialised repair of mining machinery,
(c) geophysical surveying services, on a contract or fee basis.

1.5 Significance of the Study for B09: Mining Support Service Activities

As Malaysia is becoming an important hub for the mining industry, the occupational framework for **Mining Support Service Activities** needs to be developed. There are Occupational Framework (formerly known as The Occupational Analysis) developed for the mining industry for Malaysia (Department of Skills Development, n.d., #), but it was not mapped into any of the existing MSIC code. However, the legislations in the Occupational Analysis can be referred to, as it applies to the **Mining Support Service Activities** as well.

The Occupational Framework (OF) is a document that guides the holistic occupational structure, including the job titles that are mapped to its competency level and are specific to a particular industry in Malaysia. Thus, the OF developed must be based on the MSIC 2008

(Department of Statistics Malaysia, 2011) because this classification was based on the International Standard of Industry Classification Revision 4. It has been the main reference for the Ministry of Economy and the Implementation and Performance Management Unit for the nation's skills and workforce data (Department of Skills Development & Ministry of Human Resources, 2020).

1.6 Structure of Chapters

This chapter concludes with a brief overview of the entire study which includes:

1.6.1 Chapter 1

This chapter summarises the motivation of this study, the objectives, scope and limitation of the study.

1.6.2 Chapter 2

This chapter analyses reviews from the industry's stakeholders, government policies, market intelligence and relation with the Industrial Revolution. The past reports and the needs for OS, job titles, relevancy to IR, critical jobs and the occupational descriptions will be academically discussed. Then it will be summarised to develop a holistic approach in achieving the objectives stated in chapter one.

1.6.3 Chapter 3

This chapter includes the methodology implemented in this study in order to obtain the results. It entails the steps taken to identify the problem, condition, job title and other related information needed for this study. The methodology is to make sure all information is collected from as many sources as possible to ensure quality and trustworthiness.

1.6.4 Chapter 4

This chapter includes the results of the analysis from Chapter 3. It comprises the validated Occupational Structure, skills in demand, job titles, critical jobs and the Occupational descriptions for B09 industry.

1.6.5 Chapter 5

This chapter includes the discussion and conclusion of the findings and other related information obtained from the industry. This chapter also comprises of suggestions or recommendations to be considered for future and related research, based on the finding.

1.7 Summary

From the overview of the current situation and trends in the B09: Mining Support Services Activities, the motivation of having a well-developed occupational framework for this industry

can be seen. The OF will be the framework for the industry to identify the jobs, skills, its level of importance, as well as to foresee the positions and skills that needs to be prepared or trained beforehand. Therefore, a thorough study on the government's plan as well as any policies, campaign, reports and technology used by all the stakeholders will need to be presented in Chapter 2. Input from the industry players are also very important to ensure the developed OF are practical and can be of help to improve the B09 industry. Existing practices should be put into consideration so changes and further alignment are possible.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

The Occupational Framework is one of the main references for the government's units, to strategize and plan the nation's skills and workforce (Department of Skills Development & Ministry of Human Resources, 2020). The Department of Skills Development (DSD), under the Ministry of Human Resources, is responsible to prepare the OF and continually update its content as needed by the industrial landscape. As of today, only the OF for B06 (Extraction of Crude Petroleum and Natural Gas) and the Occupational Analysis for the Mining industry which was done in 2009, has been developed (Department of Skill Development, 2021, 38-53; (Department of Skills Development, 2009, 17-29).

The OF consists of the Occupational Structure (OS) and Occupational Descriptions (OD). The OS is a matrix that shows the occupational areas and contains the generic job title(s) for all similar tasks across companies and mapped into the skill levels for a particular occupation, following the Malaysian Qualification Agency (Malaysian Qualifications Agency, 2017, 31-37). These identified job titles and skill levels will be further investigated to know the relevancy to the IR, and the overall idea for each particular occupational area. This allows us to classify critical job titles and the skills requirements, to prepare and fill in the skills gaps and shortages in the workforce. The job area, responsibilities, skills, attitude and knowledge needed for these critical jobs will be documented as the OD.

The OS and OD will be used to prepare the country for a better plan in sustaining skill sets and labour force for the B09 (Mining Support Services Activities) industry and Malaysia's economy. This OF would also be used to ensure a reliable source of information for developing relevant NOSS, certification and training requirements.

This chapter reviews acts, legislations, policies, initiatives, relevant frameworks, standards, types of training, key stakeholders, and a list of National Occupational Skills Standards (NOSS) relevant to B09 Mining Support Services Activities as in the MSIC. This will also include an overview of several other countries in relation to the B09: Mining Support Services Activities for comparison and benchmarking. Findings in this chapter were obtained primarily through literature reviews, shaping a deeper understanding of the OF and the industry.

2.2. Industry Background

2.2.1 Mining and Quarrying

Mining and quarrying is the extraction of valuable minerals or other geological substances from the earth. The Department of Minerals and Geoscience Malaysia (JMG) is responsible for

providing the inventory of the country's mineral reserves. It includes the value assessment, hazard management and the mapping. This is carried out by geochemical sampling studies, geological mapping and geophysical investigation to determine mineral reserves of iron, gold, bauxite, tin, silica, coal and non-radioactive rare earth elements (NR-REE) in ion adsorption clay. On top of that, JMG coordinates, monitors and enforces mining and quarrying activities in Malaysia.

It should be noted that petroleum and natural gas are not included in the definition. This is because JMG is responsible for the enforcement and regulation of mining and quarrying for non-petroleum and natural gas in Malaysia. JMG has divided the mineral resources into three types which are metallic mineral, non-metallic materials and energy minerals (Department of Minerals and Geoscience Malaysia, 2022, 23). Studies conducted by JMG shows that until 2020, the metallic minerals values are estimated around RM 1.03 trillion, the non-metallic minerals are around RM2.96 trillion and the energy minerals around RM0.12 trillion (coal only).

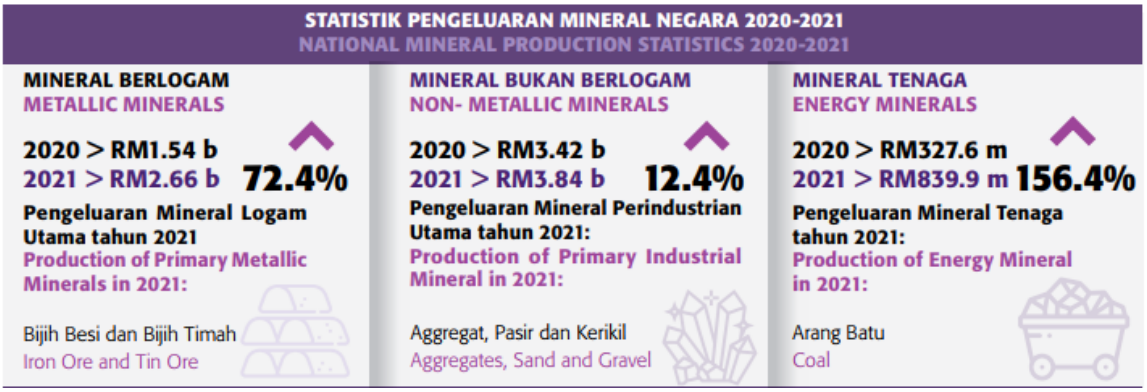


Figure 2.1: Malaysia's mineral production statistics (Department of Minerals and Geoscience Malaysia, 2022, 24)

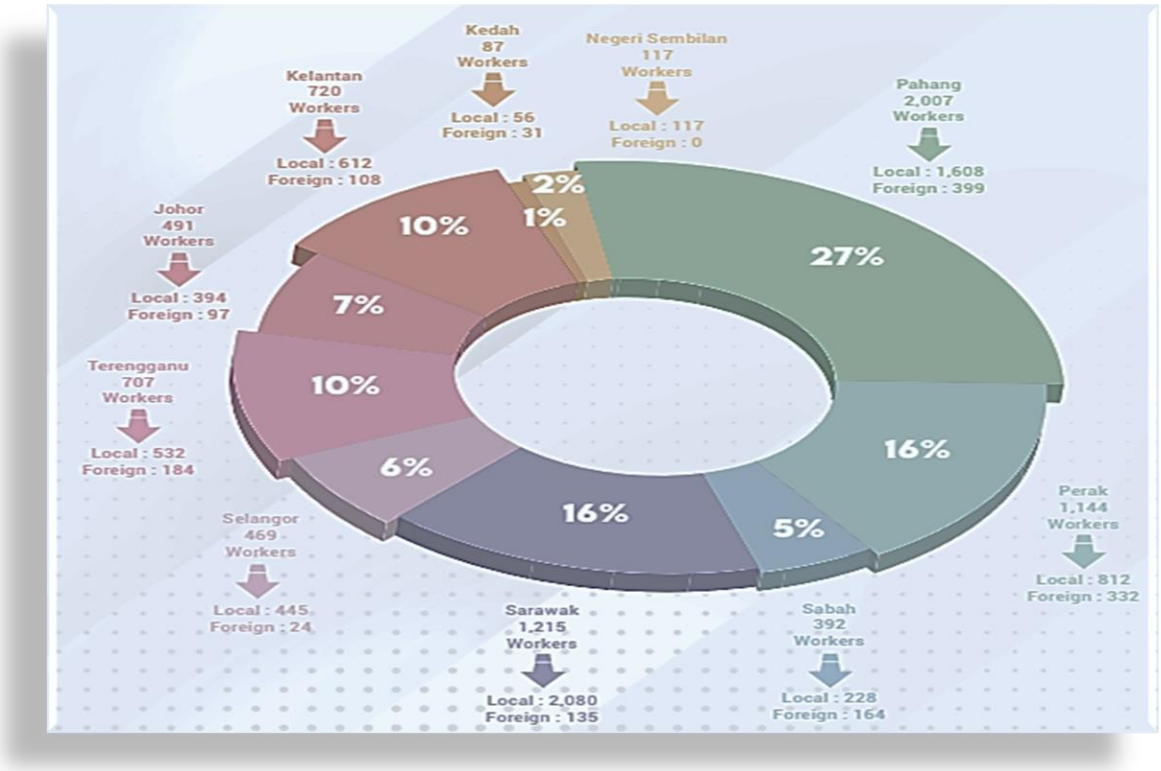
Malaysia's tin mining was once the world's premium producer, back in 1883 to 1980's. Since the falling price of tin, only Rahman Hydraulic Sdn. Bhd, which operates in Perak, is still doing the large-scale tin mining. The mining industry in Malaysia as a whole, is made up of small sectors such as coal, ferrous and non-ferrous metals, and the processing of minerals. As of 2021, Malaysia has 169 mines with only 187 mineral licence holders, as shown in Figure 2.2.

Figure 2.2: Malaysia mining and quarrying portfolio in Malaysia (Department of Minerals and Geoscience Malaysia, 2022, p. 30)

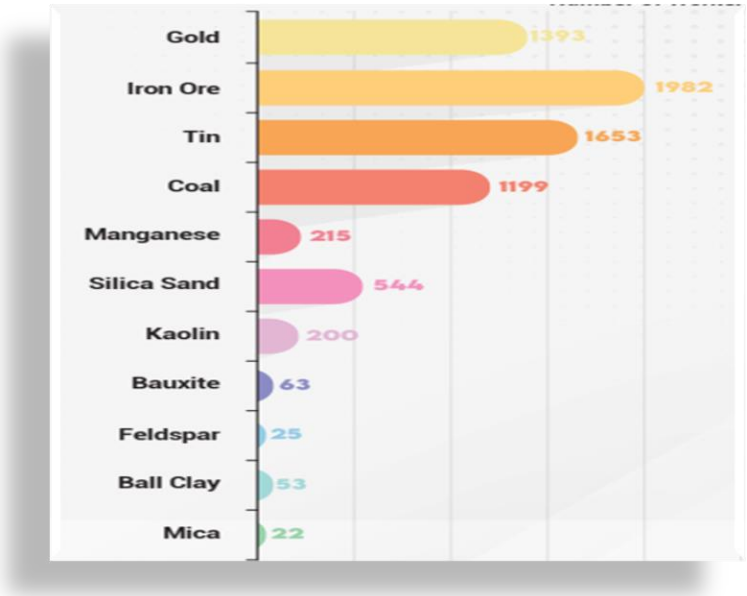
As for the workforce for Mining and Quarrying sectors, it is highly dependable on the types of minerals that are being mined. On top of that, 59% of these workers are semi-skilled and unskilled.

Malaysia is blessed with many natural resources as shown in Figure 2.4 where each state in Malaysia has mineral resources. The government has set a vision for Malaysia to become an important hub for the mineral industry (Bernama, 2021) under the 12th Malaysia Plan. The growth in the demand and value of the mining industry shows potential and the government is planning to revive this industry as the prices of minerals is currently high (Crowe Malaysia PLT, n.d.). Thus, the National Mineral Industry Transformation Plan 2021-2030 was launched by the Ministry of Energy and Natural Resources in April 2021 to achieve sustainable growth (Ministry of Energy and Natural Resources, 2021, xi).

Although the trends shown here are for the Mining and Quarrying industry and not specifically for support services activities, it may still indicate the same trends for support service activities for mining and quarrying. The numbers for job creation and the workforce for the support service activities will be increased as well with the growth of the Mining and Quarrying industry.



(a)



(b)

Figure 2.3: Workforce for Mining and Quarrying industry by state (a) and the workforce group by the types of minerals (b) (Department of Minerals and Geoscience Malaysia & Ministry of Energy and Natural Resources, 2021, p. 86).

Figure 2.4: Percentage share of gross output for each state (Department of Statistics Malaysia, 2023, p. 13).

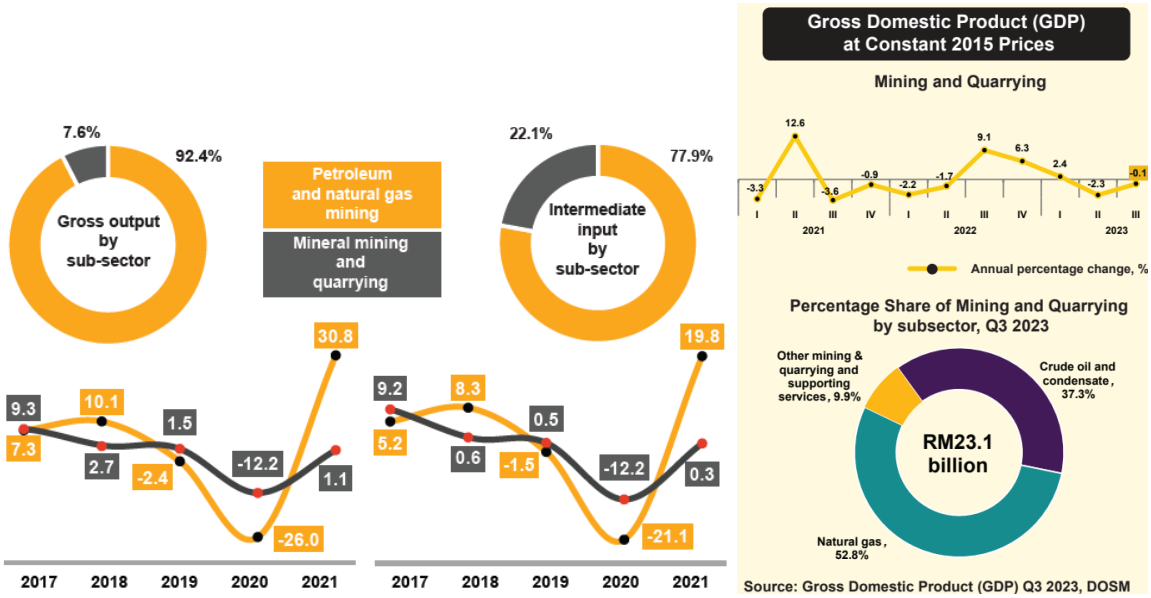
2.2.2 Oil and Gas Support Service Activities

PETRONAS has been recognized as the sole national custodian in terms of ownership and exclusive rights over Malaysia's hydrocarbon resources; by the 1974 Petroleum Development Act. This O&G industry is segregated into upstream (exploration and extraction) and downstream (distribution and retailing) functions. The other upstream O&G operators working with PETRONAS are ExxonMobil, Shell and Conoco Philips; while for O&G services and Equipment, PETRONAS works with companies such as Sapura Energy Bhd., and Dialog Group Bhd. PETRONAS CARIGALI was established to explore and extract petroleum from Malaysia's shores.

Meanwhile, the Department of Statistics Malaysia (DOSM) considers both minerals and quarrying and petroleum production as part of the mining and quarrying sector. This compilation is in line with the International Standard of Industrial Classification of All

Economic Activities (ISIC) used at the international level. Hence the details can be seen in 3-digit MSIC levels (group).

In the report, the gross output for mining and quarrying sector grew 27.9% in 2021 to RM156.0 billion (DOSM, 2023 March 16). the gross output for petroleum and natural gas mining had increased 30.8% in 2021, while the gross output for mineral mining and quarrying had increased 1.1% in 2021. A similar pattern was shown in the intermediate output for the mineral mining industry, as shown in Figure 2.5. Although, there has been a decrease in the total Gross Domestic Product (GDP) for mining and quarrying since the second quartile of 2021, in general the change is in each quarter is small. In the third quartile (Q3) 2023, the GDP was RM23.1 billion, where other mining and quarrying and support services had contributed to 9.9% of the percentage share while petroleum (from crude oil and condensates as well as natural gas) contributed to a total 90.1% of the GDP (see Figure 2.5(b)). In general, the production of crude oil and condensate in Q3 amounted to 45.9 million barrels, higher by 0.3% compared to a year ago (DOSM, September 15).



(a) (b)

Figure 2.5: (a) The growth of gross output and intermediate input for Mining and Quarrying Sector from 2017 until 2021 (Department of Statistics Malaysia & Ministry of Economy, 2023 March); (b) The Gross Domestic Product for in the third quartile, 2023 (Department of Statistics Malaysia & Ministry of Economy, 2023 September)

In addition to that, petroleum holds a probable reserve of 6.9 billion barrels (BBO) as published in February 2023 (Business Today Editorial, 2023): almost double the amount published for January 2020 which were 3.6 BBO (Endeavor Business Media, 2019). Therefore, there is a need to chart the O&G industries for sustainable growth and competitiveness. The National Oil and Gas Services and Equipment Blueprint (OGSE Blueprint) 2021-2030 was launched in April 2021 by Minister in the Prime Minister's Department (Economy) to develop a robust,

resilient and globally-competitive Malaysian OGSE sector which contributes to the sustainable development of National priorities.

2.2.3 The Mining and Quarrying Support Service Activities

The mining and quarrying support service activities (B09) in this research follows the definition by the Malaysian Standard Industrial Classification (MSIC) 2008. This classification system is used in Malaysia to categorise economic activities and industries for statistical and administrative purposes. MSIC 2008 provides a standardised way to classify businesses and organisations based on their primary economic activities.

At the backbone of the petroleum and gas extraction, as well as the mineral mining, are mining support activities. This support activities industry plays a vital role in providing essential services and support to mining companies. These activities include exploration, site preparation, drilling, blasting, excavation, and other services necessary for the extraction and processing of minerals. The mining support activities market has witnessed significant growth in recent years, driven by the increasing demand for minerals and the expansion of mining operations worldwide (Markets and Markets, n.d.).

The ecosystem of mining support activities comprises six entities as shown in Figure 2.6. The mining companies are the primary customers for mining support activities throughout the mining lifecycle. The mining support service providers specialise in providing services such as drilling, blasting, excavation and maintenance. The equipment manufacturers produce equipment for mining operations including necessary tools and heavy machineries. Technology providers offer automation, artificial intelligence, data analytics as well as cyber protections while regulatory bodies ensure responsible mining practice for the safety of the workers, community and environment. The R&D institutions contributed to collecting data and surveying the impacts of current and new technology and processes. Then they will have to take actions, provide useful feedback and innovate for new solutions if needed.

Figure 2.6: The mining activities ecosystem as mentioned in the market report (Markets and Markets, n.d.).

There are 5 key segments in mining support activities, suggested by (Markets and Markets, n.d.) as illustrated in Figure 2.7. This will be used as a guide to identify and differentiate the mining support activities, and the mining process itself. Apart from that, this can be referred to when identifying panels for the development of the Occupational Structure.

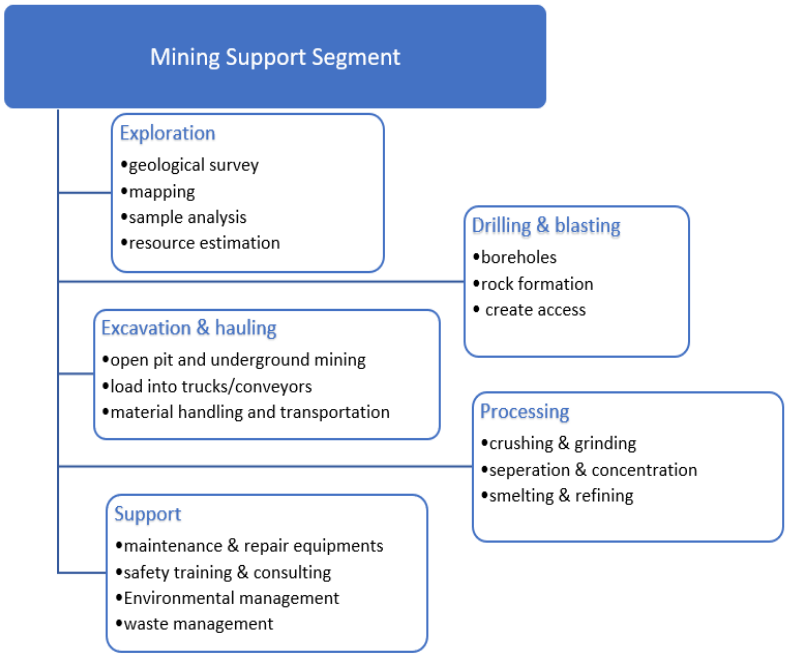


Figure 2.7: The key segments for mining Support activities, (Markets and Markets, n.d.)

However, the ecosystem for Malaysia's B09: Mining Support Services Activities, might have its own segment for support services. For example, blasting in quarrying is the main process to get the mineral rock, and is not considered as a support task/activity. However, depending on the size of the site, blasting could be authorised depending on the application from the operator and approval given by the Department of Minerals and Geoscience (JMG), as often as once per week to once or twice a year. However, blasting needs a proper formulation, planning and detailed paperwork for licensing each time. Thus, a mining company would hire a consultant company to prepare all the paperwork, blasting formulation and blast the needed area, rather than blasting the site themselves.

In addition, both petroleum and gas, as well as mineral mining has contributed significantly to Malaysia Economic growth. RM156 billion gross output has been recorded, as shown in Figure 2.8 where the biggest contributor is Sarawak, followed by Sabah and other states. Thus, it can be concluded (as of 2022) that petroleum from Sarawak and Sabah has contributed largely to this, followed by a combination of multiple types of minerals produced from all over Peninsular Malaysia. This is also due to the high demand and price for crude oil and natural gas, not the amount of production.

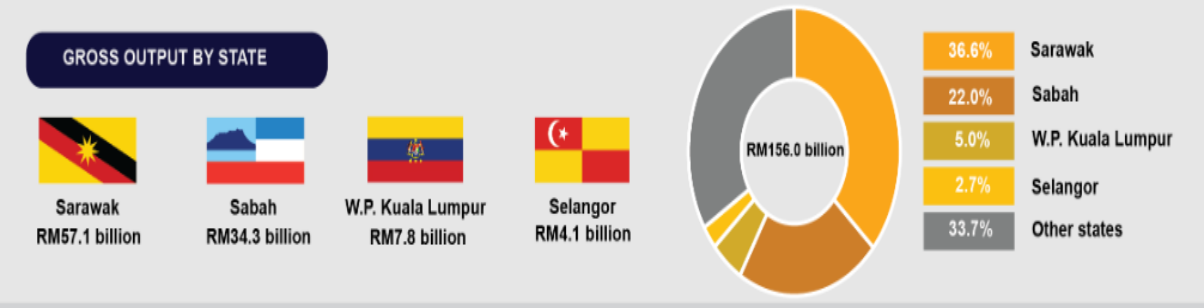


Figure 2.8: The gross output group by states, for the mining sector. (Department of Statistics Malaysia & Ministry of Economy, 2023)

2.3 B09: Mining Support Services Activities and the Sustainable Development Goals

In lieu of this, B09: Mining Support Services Activities have to be aligned to the Sustainable Development Goals (SDG) in Malaysia. The SDG is the United Nations's global call to all participating countries, in order to end poverty as well as protecting the earth's environment and climate (Gankhuyag & Gregoire, 2018, 12). The SDGs are actually factors or points that industry players need to consider to make their business, society and environment, sustainable in a longer run.

Thus, collective efforts from many industries from all countries are needed. There are 17 goals set up for the SDG. The mining and quarrying industries supports SDG 12, which is Responsible Consumption and Production (Ministry of Energy and Natural Resources, 2021, 30) by emphasising **the circular economy concept** in the mining industry ecosystem to maximise the country's resources. Then, SDG 6, clean water and sanitation would be supported by empowering promotion for urban mining by recycling resources and **ensuring treatment of wastewater from mining**. SDG 9, Industry Innovation and Infrastructure is an important aspect as green technology is used to minimise negative impacts to society and the environment. Careful planning and strategizing for sustainable resources for the future is in-line with again, SDG 12.

Figure 2.9 shows the SDGs that are directly related to the O&G industry, (Petroliam Nasional Berhad, 2022, 11). SDG 8 Decent Work and Economic Growth and SDG 4 Quality Education for example, is fulfilled by Yayasan PETRONAS by introducing various academic, skills and entrepreneurship training programmes to uplift and empower the low-income communities and improve their income level and be self-sustaining in the long term. SDG 3; Good Health and Well-being, SDG 9; Industry Innovation and Infrastructure and SDG 12; Responsible Consumption and Production, is done by PETRONAS by exploring methods to convert end-of-life plastic waste into reusable products and supporting local suppliers. Lastly, PETRONAS is growing their own solar capacity for clean energy and complying with international standards which support SDG 7; Affordable and Clean Energy and SDG 13; Climate Action.

Figure 2.9: The SDG goals related to O&G industry by PETRONAS (Petroliam Nasional Berhad, 2022, 112)

2.3 Malaysian Standard Industrial Classification

The MSIC 2008 was developed, owned and maintained by the Department of Statistics Malaysia (DOSM) based on ISIC (International Standard Industrial Classification) revision 4, which is internationally accepted and maintained by the United Nations. The MSIC is tailored to the specific economic structure and needs of Malaysia. The classification system is typically used by government agencies, researchers, and businesses to analyse and report economic data, track industry trends, and make informed policy decisions. It helps in organizing and grouping various economic activities into specific sectors and sub-sectors, making it easier to gather and interpret economic statistics and information.

The development of the occupational framework, occupational structure and job descriptions for the critical jobs are following the Malaysian Standard Industrial Classification (MSIC) 2008. This classification system is used in Malaysia to categorise economic activities and industries for statistical and administrative purposes. MSIC 2008 provides a standardised way to classify businesses and organisations based on their primary economic activities.

As mentioned in 1.2, the scope for this study is B09: Mining Support Services Activities, in tandem with description Section B, Division 09 defined in MSIC 2008 code. In this code, the area being researched falls under the Section and Division listed in Table 2.1 below, up until Group 091 and 099 (coloured in grey).

Table 2.1: MSIC 2008 Code and its detailed descriptions for B09.

Section	**B -Mining and Quarrying**		
Division	**09- Mining Support Service Activities**		
Group	091- Support activities for petroleum and natural gas extraction		099- Support activities for other mining and quarrying
Class	0910- Support activities for petroleum and natural gas extraction		0990- Support activities for other mining and quarrying
Item	09101	09102	09900
Description	Oil and gas extraction service activities provided on a fee or contract basis	Oil and gas field firefighting services	Support activities for other mining and quarrying
Includes	(a) exploration services in connection with petroleum or gas extraction (e.g. traditional prospecting methods, such as making geological observations at prospective site)		(a) support services on a fee or contract basis, required for mining and quarrying activities of division 05, 07 and 08.
	(b)directional drilling and redrilling, "spudding in", derrick erection in site, repairing and dismantling, cementing oil and gas well casings, pumping of wells, plugging and abandoning wells		(b) exploration services (e.g traditional prospecting methods, such as taking core samples and making geological observation at prospective sites)
	(c)liquefaction and regasification of natural gas for purpose of transport, done at the mine site		(c) draining and pumping services, on a fee or contract basis
	(d)draining and pumping services, on a fee or contract basis		(d) test drilling and test hole boring
	(e)test drilling in connection with petroleum or gas extraction		(e) cleaning services e.g. cleaning of '*palong*'
Excludes	(a) service activities performed by operators of oil or gas fields, see 0610, 0620 (b) specialised repair of mining machinery, see 33120 (c) liquefaction and regasification of natural gas for purpose of transport, done off the mine site, see 19201 (d) geophysical, geologic and seismic surveying, see 71103		(a) operating mines or quarries on a contract or fee basis, see divisions 05 (coal and lignite), 07 (metal ores) and 08 (other mining and quarrying) (b) specialised repair of mining machinery, see 33120 (c) geophysical surveying services, on a contract or fee basis, see 71103

2.4 National Skill Development Act 652 (2006)

This act is to support the individual development and competency skill via skills training. The training provided must follow a certain standard and the training providers would be audited. On top of this, the training module must be updated from time to time according to the industry. Starting with the OF development which will produce the job descriptions based on the Malaysian Occupational Skill Qualification Framework and the industrial needs, the National Occupational Skill Standard then will be identified. Then it continues with the development of the training module known as Written Instructional Materials, followed by Evaluation Questions and then identifying the training centre. The cycles are repeated as shown in Figure 2.10 and in several years the content will be updated through the cyclic process to ensure the content remains relevant.

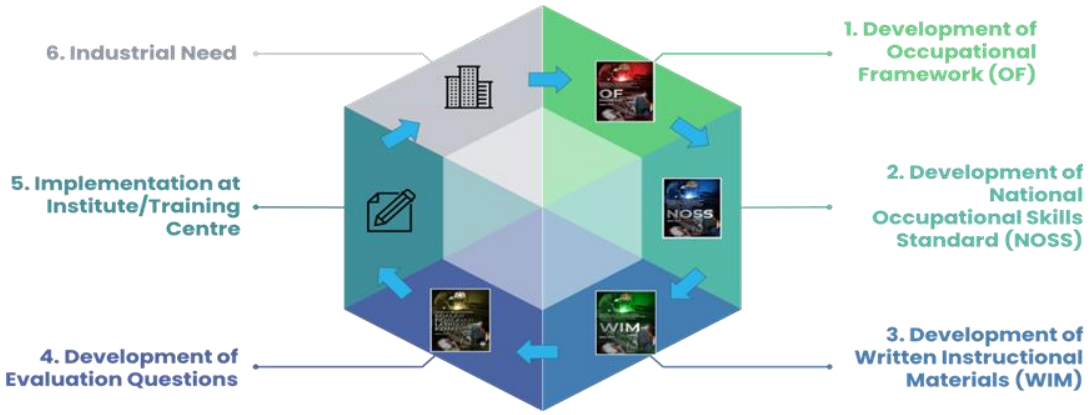


Figure 2.10: Cycle of Malaysian Skill Certification System (Department of Skills Development, 2009)

2.4.1 Malaysian Occupational Skill Qualification Framework

The Malaysian Occupational Skill Qualification Framework (MOSQF) levels refer to a system used in Malaysia to classify and assess the qualifications and skills of individuals in various occupational fields. The MOSQF levels are designed to provide a standardised way of recognizing and certifying an individual's competencies and skills in a particular occupation. These qualifications are typically awarded through vocational and technical education and training programs. The MOSQF is developed and owned by the Department of Skill Development, Ministry of Human Resources.

There are 8 levels of skill qualification defined in MOSQF with Level 1 is the lowest competency level of skills and Level 8 is the highest competency level of skills. The detailed definition for each level is as shown in Table 2.2.

Table 2.2: Malaysian Occupational Skills Qualification Framework (MOSQF) Level Descriptors.

Level	Description
Level 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 organizational change. It also reflects a critical understanding of relevant theoretical and methodological perspective and how they affect the field of knowledge or work.
Level 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.
Level 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 understanding of different perspectives, approaches of schools of thought and the theories that underpin them.
Level 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 judgement within broad parameters. It also reflects understanding of different perspectives, approaches of schools of thoughts and the reasoning behind them.
Level 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 judgement within fairly board parameters. It also reflects understanding of different perspective or approaches within a sub-area of study or work.
Level 3:	Achievement at this level reflects the ability to identify and use relevant understanding, methods and skills to complete tasks 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 judgement within limited parameter. It also reflects awareness of different perspectives or approaches within a sub-area of study or work.
Level 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 judgement subject to overall direction or guidance.
Level 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 task and procedures subject to direction or guidance.

2.4.2 National Occupational Skills Standards (NOSS)

National Occupational Skills Standards (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 the National Skills Development Act 652. Standards are developed by industry experts based on the needs of the industry and are utilised as the main tool in the implementation of the Malaysian Skills Certification System, in which the performance of existing industry workers and trainees are assessed based on Standards for awarding of Malaysian Skills Certificate 10.

NOSS is designed tailored to the occupational need. It also follows the level of qualification framework in the occupational structure, supporting the career path in each job. NOSS is prepared by the industry experts and the high-skilled workers in the said occupation.

As of today, there are 34 related NOSS for B09 Mining Support Services Activities, as published by DSD (see Table 4.6 pg. 76).

2.4.3 Malaysia Skills Certification System

Malaysian Skills Certification is one of the main functions of the Department of Skills Development (DSD). This certification offers five (5) levels of authentication:

i) Malaysian Skills Certificate (SKM) Level 1;
ii) Malaysian Skills Certificate (SKM) Level 2;
iii) Malaysian Skills Certificate (SKM) Level 3;
iv) Malaysian Skills Diploma (DKM); and
v) Malaysian Advanced Skills Diploma (DLKM).

The Malaysian Skills Certification may be obtained through three (3) methods:

i) Through Training in a Recognised Institution – Through training programmes at JPK accredited centres for specific fields and skill levels that have been accredited.
ii) Through Industry-Oriented Training – Through an apprenticeship with the National Dual Training System (SLDN) conducted by industries and skills training institutes.
iii) Through Accreditation of Prior Achievement (PPT) – Obtaining the Malaysian Skills Certification through past experience (work or training). The candidate is required to submit proof of his skills competency, which will be assessed by the Assessing Officer and approved by the External Verification Officer appointed by DSD.

2.4.3 Malaysia Standard Classification of Occupations (MASCO)

The Malaysia Standard Classification of Occupations (MASCO) is the classification of occupations in the employment structure of Malaysia as a national benchmark. MASCO classifies the professional activities in the Malaysia according to the International Standard Classification of Occupations (ISCO) and lists the descriptions and tasks as well as the code for each position. MASCO has ten major groups (Managers; Professionals; Technicians and

Associate Professionals; Clerical Support Workers, Service and Sales Workers; Skilled Agricultural, Forestry, Livestock and Fishery Workers; Craft and Related Trades Workers; Plant and Machine Operators and Assemblers; Elementary Occupations and Armed Forces) which features 5 levels of classification, and is further divided into four skills levels based on the complexity and range of tasks and duties (Ministry of Human Resources, 2020).

2.5 Market Analysis, Issues, and Job Creation in B09: Mining Support Services Activities

As the gross output in the industry has increased significantly by 27.9% from 2020 (RM 121.9 billion) to 2021 (RM156.0 billion) (Department of Statistics Malaysia, 2023), this indicates the potential growth for this industry . However, the number of people engaged in this sector has declined by 0.2% with a 9.6% decrease in the salaries and wages paid. This decrease in salaries and wages could be a potential problem and may slow down the growth of the mining industry, and impact the mining support activities, directly. The decrease in wages paid as well as slight increase of the number of persons engaged, is shown in Figure 2.11 for both mineral mining and petroleum extraction.

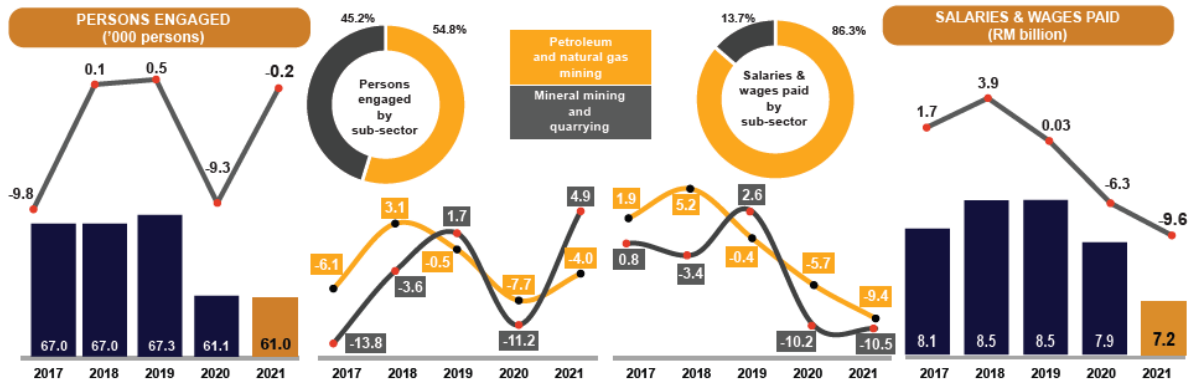


Figure 2.11: Job creation and wages by the Mining and Quarrying sector (Department of Statistics Malaysia & Ministry of Economy, 2023)

On the other hand, contractors in this industry are handsomely paid compared to other industries. Figure 2.12 shows the daily wage for the Asian region (which includes Malaysia) is an average of USD621 daily, which is the average between O&G, mining and renewable energy.

AVERAGE DAILY RATES FOR CONTRACTORS IN 2020*

	REGIONAL AVERAGE	OIL & GAS	RENEWA-BLES	MINING
North America	711.19	753.07	663.22	651.43
South America	689.15	701.22	714.75	634.19
Europe	674.34	677.79	631.2	714.93
Africa	568.84	544.86	552.96	542.25
Middle East	749.19	738.13	730.62	834.20
CIS	651.43	616.18	461.44	791.78
Asia	621.20	628.94	648.27	623.63
Australasia	713.91	826.43	623.16	677.12

Figure 2.12. The daily pay in USD for contractors (mining support) in 2020 (OilandGasJobSearch.com, n.d.)

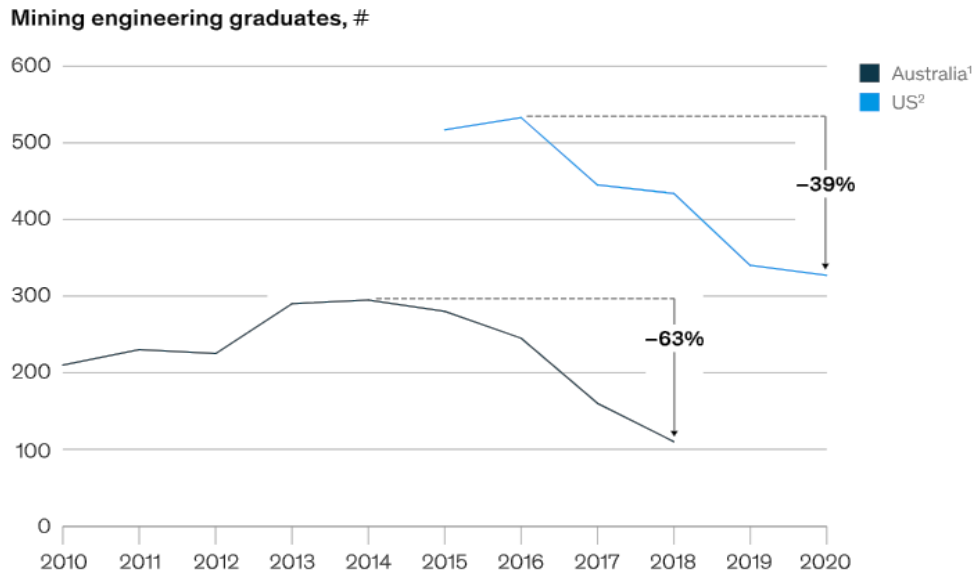
Over the years, there have been changes impacting the mining industry. Hence, it is crucial obtain the feedback from the industry players for B09 (Mining Support Services Activities) in order to identify emerging vacancies and the crucial skills needed . Furthermore, gaps in skills between senior workers and the juniors need to be reduced. Training is needed to upskill and reskill workers and training needs should be identified. Some training may involve specialized equipment which may be expensive and is not available at every site. Hence, training institutions may need to identify stakeholders in the industry to for the possibility of collaborative training at potential mining sites.

In identifying the workforce and skills gap, the emerging skills required to address the changes in technologies used and the relevancy to the IR needs to be identified as well. This is to ensure that the B09 (Mining Support Services Activities) industry is sustainable. The OF for B09 (Mining Support Services Activities) needs to be developed based on valid and reliable research methods in order to conduct the occupational analysis for the Mining Support Service Activities industry. The OF should comprise an Occupational Structure which identifies the generic job titles across the same industry, complete with its IR relevancy and skills needed as well as highlighting the critical job with its occupational descriptions.

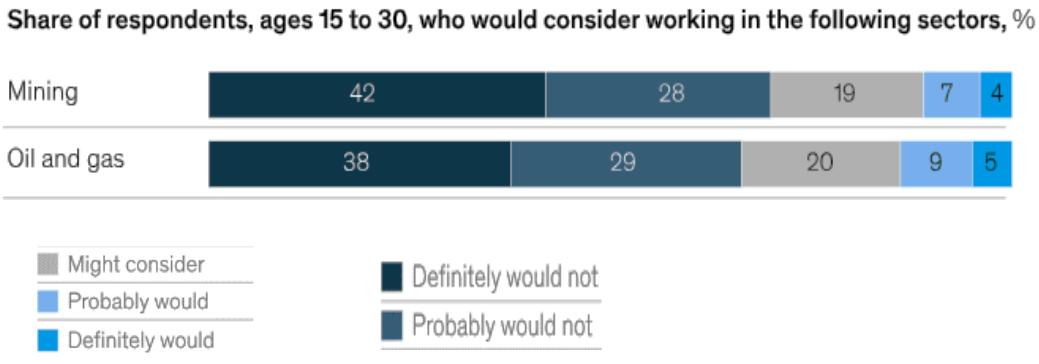
2.5.1 Lack of Young Talents

The O&G industry is currently facing several issues as reported by Brunel International. The workforce is ageing while the number of young talents joining the industry is limited. This is crucial especially when new technological skills are required. The lack of young talents might

come from a negative perception toward the industry and its workload and occupational descriptions which has resulted in the influx of foreign talents to address the need for import (KPMG International Limited, 2022). However, importing foreign workers in bulk may result in political, immigration and security issues in the future. Figure 2.13 shows the decreasing trend in interest to pursue their career in O&G and mining related industries, including the Mining Support Services Activities, reported in Australia and the United States.



(a)



(b)

Figure 2.13: Surveys in Australia and the United States showing lack of interest among the younger generation to pursue their career in O&G and mining related industries (Abenov et al., 2023).

On top of that, working in mining-related industries often involves travelling, as the mining site and plants are normally a considerable distance from the urban areas. Thus, while servicing

the site or plant, or even transporting goods, tools and services, workers need to travel long distances and even stay a night. In the Oil and Gas industry, those who work on the offshore platforms have to spend months on the plants before getting back to their families. In some mining sites and plants, there are dangers and workers need to be equipped with heavy weapons to mitigate dangers such as pirate attacks, and other dangerous situations which may occur with political instability and countries at war. This can be seen in Figure 2.14 where 48.8% votes political instability as the reason not to work in this industry. In this survey, 5 out of 10 reasons are regarding location and travelling. The for Critical Occupations report by TalentCorp (2021) also states the difficulty in securing good candidates especially when they needed to be relocated to the East Coast of Malaysia.

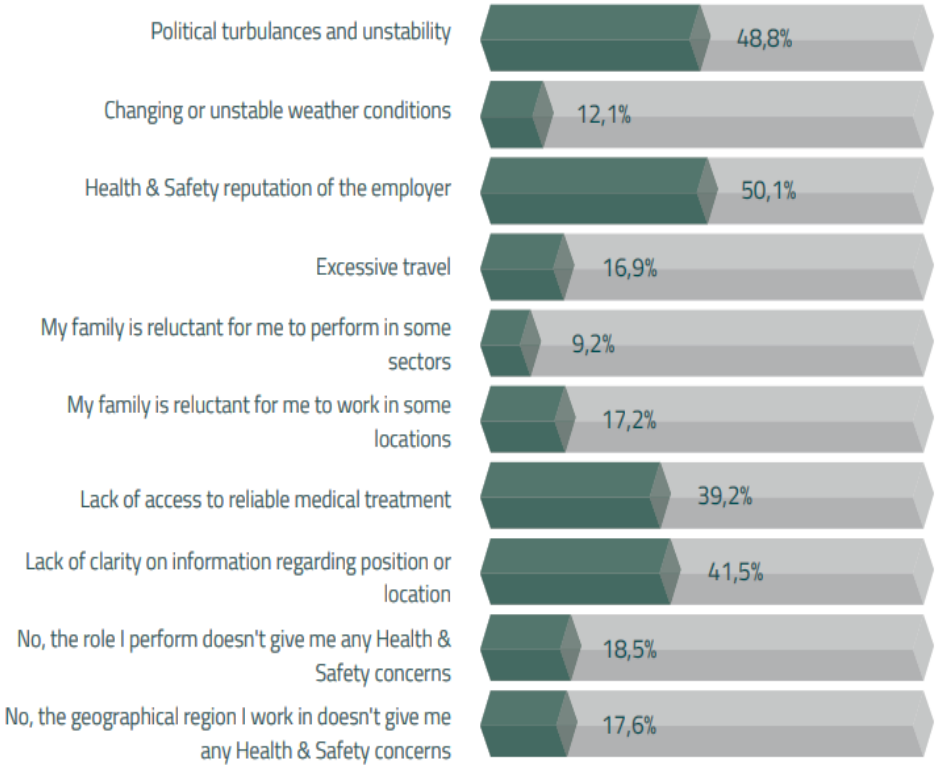


Figure 2.14: Reasons of reluctance to join mining and quarrying related works (OilandGasJobSearch.com, n.d.).

The lack of young talents is also faced by the mining industry. In addition, there is an attrition in the existing workforce who are retiring. A lack of demand for the mineral production during the 2-year COVID-19 pandemic and the drop in prices for minerals has contributed to this problem (Abenov et al., 2023). However, as new mineral sources are being sourced and with an increase in demand in certain minerals, prices are increasing again and there is a crucial need to recruit new staff.

Attracting young talents is vital for the mining industry's future. Many existing workers in the sector are nearing retirement, thus creating a skills gap. To bridge this gap, an occupational framework should focus on highlighting the industry's potential for innovation, safety, and career growth. Embracing modern technologies, promoting sustainable practices, and offering

opportunities for training and education can help attract the younger workforce and foster a new generation of skilled professionals who can drive the industry forward.

2.5.2 Health and Safety Compliance

Occupational hazards are high for mining and quarrying, on or off the plant and site as it involves exploration of new sites, sampling and exposure to chemicals and unknown samples. Understandably, one of issues that has been repeatedly raised in several reports is empowering health and safety implementation and awareness as well as work benefits for reliable medical treatment (Abenov et al., 2023; OilandGasJobSearch.com, n.d. & Markets and Markets, n.d.). In addition to that, offers to support and services works to mining sometimes did not mention medical benefits, and does not practise strict monitoring and standard operating procedures for health and safety. This can be seen from Figure 2.14 as 4 out of 10 items asked in the surveys are regarding health and safety issues, with the company's bad reputation in regard to this, scoring 50% votes.

In a world-sampling report by Brunel International (OilandGasJobSearch.com, n.d.) for example, a staggering 42.6% workers received 'average level to none' training of health and safety for their work, as shown in Figure 2.15.

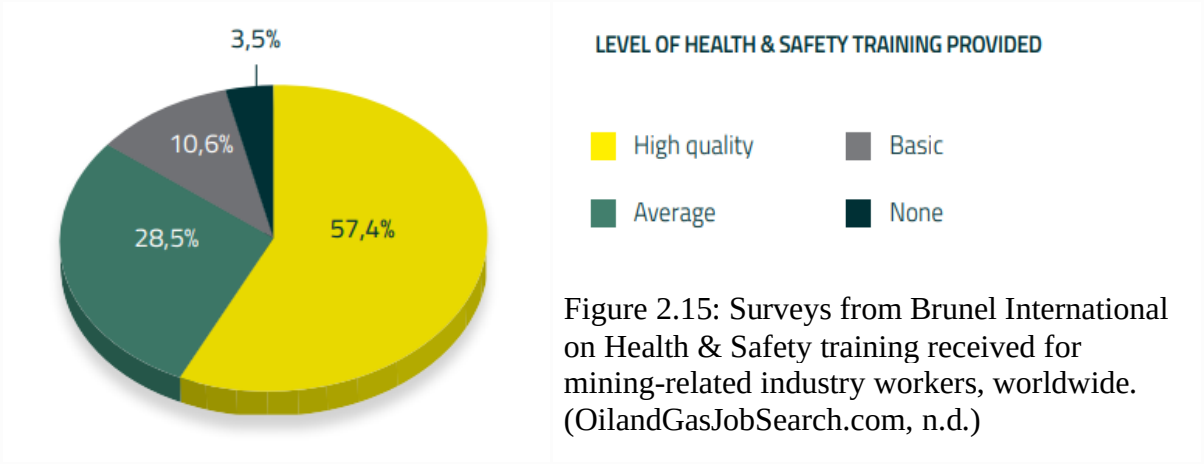


Figure 2.15: Surveys from Brunel International on Health & Safety training received for mining-related industry workers, worldwide. (OilandGasJobSearch.com, n.d.)

This could also mean upgrading and reskilling workers in health and safety equipment. Figure 2.16 shows the country/areas with the percentage of health and safety concerns. Same survey has also established that less than 45% of the companies are constantly monitoring the health and safety procedures in their workplace.

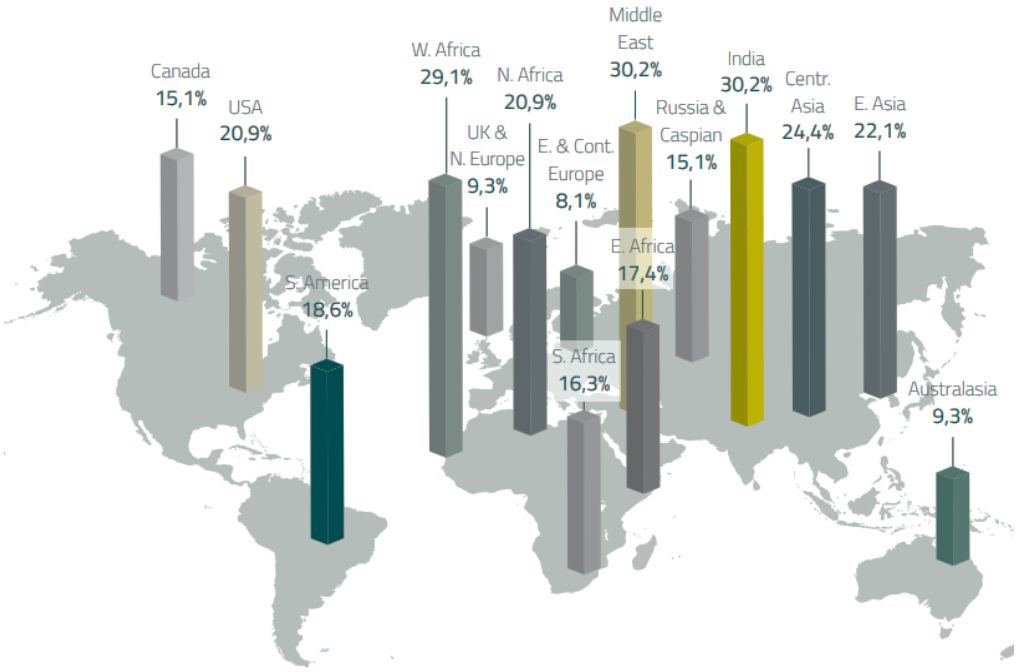


Figure 2.16: Health and safety concerns percentage, grouped by the regions (OilandGasJobSearch.com, n.d.)

In Malaysia, the Department of Safety and Health, Ministry of Human Resources has developed a training module for upgrading health and safety for the Mining and Quarrying Sector (Department of Occupational Health and Safety, n.d.). The Department of Minerals and Geoscience ensures that Occupational Safety and Health is upheld by ensuring that there are staff who are trained and certified for 'INOSH Occupational Safety and Health Course for the Quarrying Industry'.

2.5.3 Skill gaps

On top of recruiting young talents for both O&G and mineral mining, several other issues need to be tackled. Similar to other industries, there are skill gaps between the senior and junior workers. It is becoming more prominent with B06 (Extraction of Crude Petroleum and Natural Gas) as scouting younger talents is more challenging as explained in 2.4.1. Surveys conducted globally on both workers and employers, as illustrated in Figure 2.15, shows a gap in the education and training plan, followed by improper succession planning for knowledge transfer as the reasons. Figure 2.17 shows the activities as well as short term and long-term measures already being carried out by companies to solve this problem.

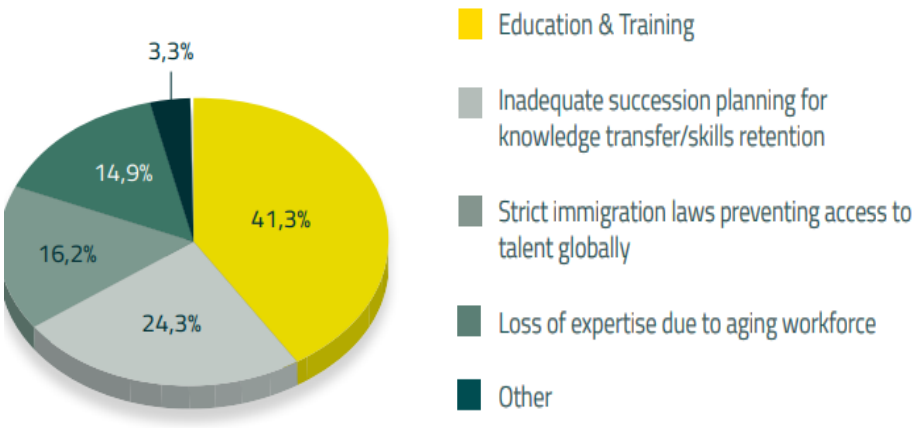


Figure 2.17: Reasons for the skills gap in mining related industries globally, as reported by Brunel International.

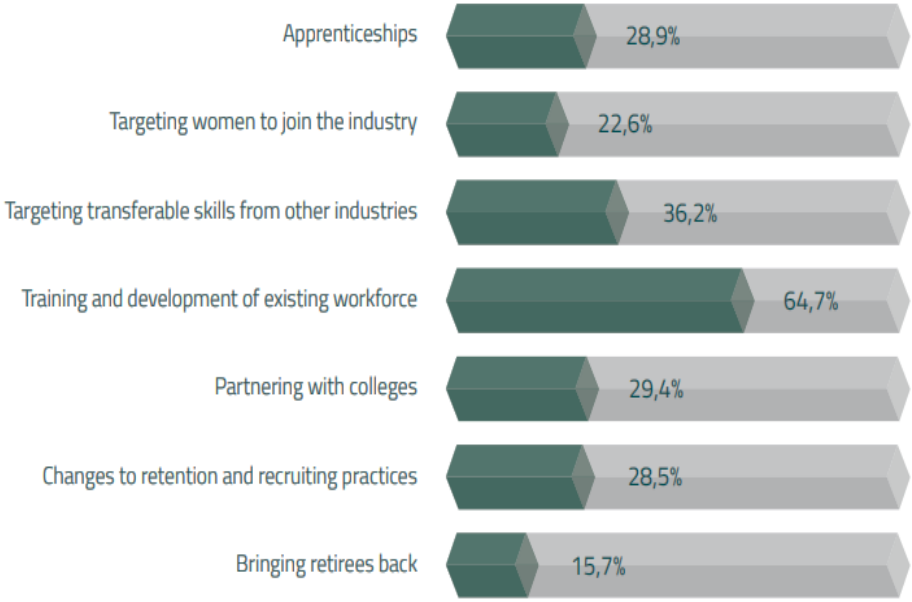


Figure 2.18 The implemented strategies by companies to bridge the skill gaps, as reported by Brunel International.

Thus, knowledge transfer is also one of the issues that need to be taken care of in mining-related industries. Formal training is needed for workers to keep up with technology, technical skills and emerging technology. On top of that, workers need to improve their talents, especially for soft skills such as communication, collaboration and innovation (Maloney, 2021).

Plans for special training, coaching and mentoring knowledge transfer, protégé, as well as including certain items in the school syllabus can warrant a good candidate to fill those positions promptly (Brown & Washburn, 2020). This is why identifying the correct skill for each occupation at every level is important so proper training and certification can be provided. The forecasted skills and knowledge, as well as the critical jobs, sought-after work or hard-to-fill positions can then be fulfilled.

2.5.4 Critical jobs for B09 Mining Support Services Activities

According to the Organization for Economic Cooperation and Development (OECD), unemployment is when people above a specified age are not in paid employment or self-employment but are currently available for work. Although there are jobs created in B09: Mining Support Services Activities, there might be very few or no candidates are suitable for the posts at certain times. Brunel International reported that 1 in 10 positions offered worldwide in this industry are not filled for months (OilandGasJobSearch.com, n.d.). Identifying the critical occupations is important to ensure the operations in the industry is not disrupted. us, the Government of Malaysia commissioned the Critical Occupations List, which has been published annually since 2015 for all sectors. The list is defined according to three main criteria, which are skilled, sought-after and strategic jobs, as summarized in Figure 2.19. For B09-related jobs in the Mining Support Services Activities, there are seven jobs listed as critical jobs: welders and flame cutters, machinery mechanics and repairers, site safety supervisor, electrical mechanics and fitters, hydraulics and geotechnical engineer, occupational health and safety officer (TalentCorp, 2021). The sought-after jobs in O&G internationally, are listed in Figure 2.19.

Figure 2.19: Definition of critical jobs
Source: ILMIA & Ministry of Human Resources 2017

By identifying the critical jobs, policymakers can make an informed decision on how best to mitigate the skills gap and policy-related issues. Identifying critical jobs also enables the government to prepare a comprehensive upskilling and reskilling training plan and realign targets for addressing the in shortages of certain occupations.

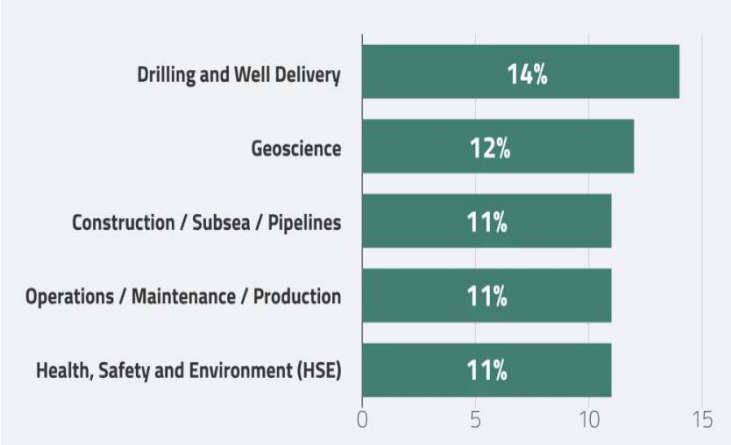


Figure 2.20: Most difficult role to fill in by recruiters (OilandGasJobSearch.com, n.d.).

2.5.4 Emerging Job, Green Technology, Renewable Energy and Sustainability

The mining and quarrying, as well as the O&G industries are moving towards green and renewable energy due to the importance of reducing the impact to the environment and addressing climate change. Although efforts are being encouraged for a better and more sustainable environment, there needs to be more changes for the use of technology, machinery and chemical substances, which means that processes need to be updated and upgraded. A change of mindset is needed among employees to ensure sustainable and green processes are practiced, and workers might need to be reskilled in new processes and practices. This need is evident among graduates who also wish for their employers to have green technology practices and to make use of renewables as can be understood from the survey snippet shown as Figure 2.20. Mining and quarrying sites are bound to conform with government regulations and need to control the damages on the site, to ensure minimum impact on the environment. The handling and process of minerals use safer and cleaner technology, with better protection to the workers. As demand for minerals such as silica and rare earth elements, as well as petroleum and natural gas is high, the companies involved are challenged to increase output but using cleaner and sustainable practices at a lower cost. The O&G industry is exploring renewable energy as crude oil reserves will eventually be exhausted. Lots of investment has been put aside for research and development in this sector. Therefore, the processes in the whole value chain for the O&G industry will need to be updated and changed.

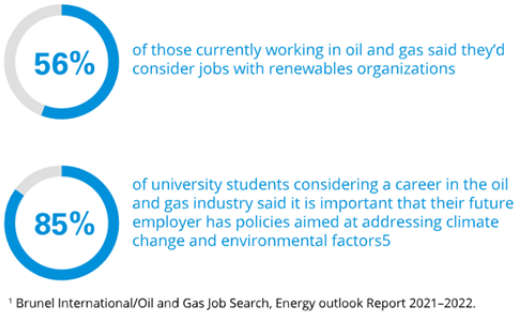


Figure 2.21: Survey of O&G workforce and renewable energy impact (KPMG International Limited, 2022).

In line with the National Energy Transition Roadmap (Ministry of Economy, 2023),the petroleum industry is changing its future directions to expedite the nation's transition from traditional fossil-fuel into a high-value green economy (Petroliam National Berhad, 2023). PETRONAS is changing their upstream long-term focus to pursue and achieve sustainable value-driven production growth, keeping tab on Net Zero Carbon Emissions by 2050 pathway, monetise oil and gas resources and strengthen core capabilities. PETRONAS' activity outlook for 2024 to 2026 has focused on ensuring clean energy initiatives among the Oil and Gas Service and Equipment (OGSE) providers. Rejuvenation projects, gas turbine and gas generator change-out activities as well as other major maintenance work will be used to maximise production efficiency and sustainability of oil and gas supply while cleaner energy initiatives are being planned (Petroliam Nasional Berhad, 2023). However, this highlights the issue of talent transition in the OGSE industry where the need for qualified talent with both broad and specialised expertise are needed to acquire new skill sets. The OGSE is a significant sector as 200,000 new jobs are predicted to be created in Malaysia alone and 30 million new jobs worldwide in order to achieve a net-zero carbon scenario (Nair, K. (2023, June 29). The OGSE industry needs to be dynamic and ensure an available pool of talents are created with the skills needed for the new roles in the industry. Existing talents would also need to be upskilled and reskilled.

In order to ensure the governments' policies, guidelines and road maps are considered, the industry players need to be included in this research. This is because the industry is directly affected by the objectives and strategies in the guidelines arising from these road maps and policies. In Malaysia, the stakeholders for the Mining Support Services Activities comprises government agencies, regulatory bodies, professional bodies and training centres of the mining industry. Thus, the definition, **inclusion** and **exclusion** criteria of B09: Mining Support Activities needs to be understood.

2.5.5 Value Chain for B09: Mining Support Services Activities

The Value Chain represents a transformative journey from resource extraction to sustainable practices. The value chain for mining is usually complex as it is not a straightforward journey from the extractions to its user. To date, the value chains for mining are often handled in silos by each organisation/company. However, McKinsey in their report has generalised the mining value chain across each company and product, as shown in Figure 2.21.

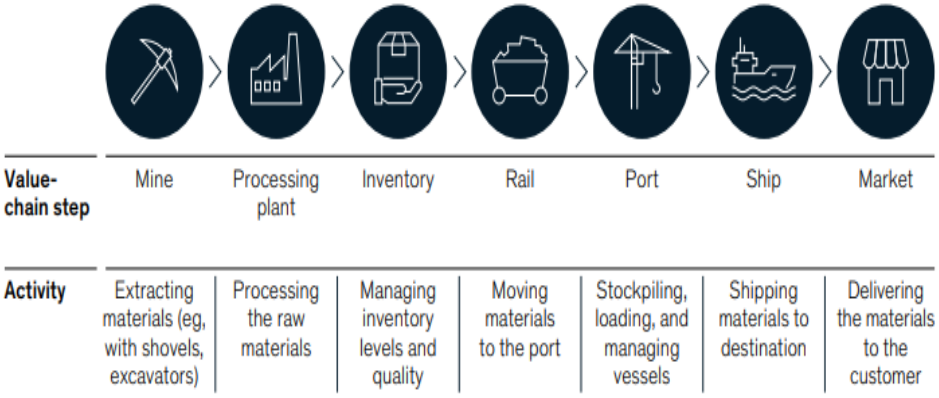


Figure 2.22: The global mining value chain. (McKinsey's Global Energy & Materials Practice., 2020, p.3)

Malaysia's mining value chain, as being developed by KETSA is as shown in Figure 2.22 is very general and seem to emphasize on strategies for sustainable mining.

2.23: Mining value chain for Malaysia (Ministry of Energy and Natural Resources, 2021, p. 28)

However, the Malaysia mining value chain published by Malaysian Green Technology and Climate Change (MGTC) as shown in Figure 2.23 is more specific. MGTC has developed an individual value chain for petroleum and gas extractions; and another for mineral mining

activities. As B09 is supporting activities for mining, its trends and changes follows the mineral mining industry and the petroleum and natural gas extractions.

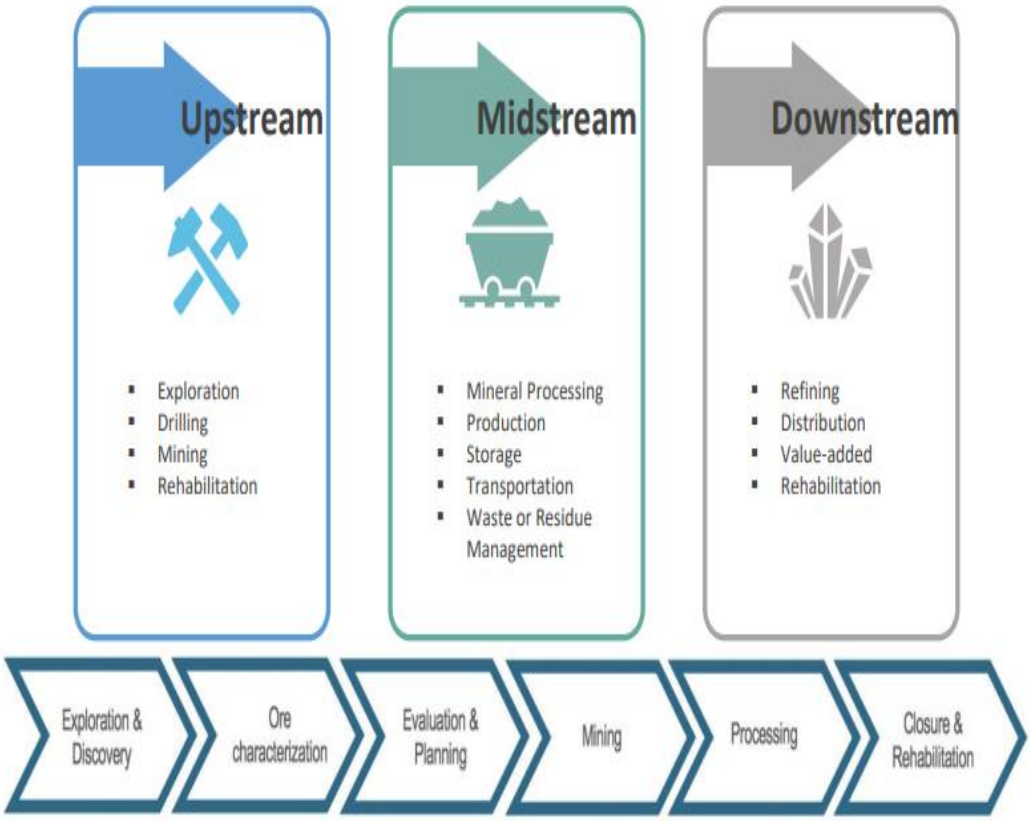


Figure 2.24: Malaysia mining value chain developed by MGTC (Malaysia Green Technology and Climate Change, 2012, p.11)

2.6 Key Stakeholders

A key stakeholder is important because they have a direct stake and an important role in the success of a company's or an initiative. Key stakeholders are highly interested in the industry's success, as they are most affected by its business. Hence, a stakeholder can be either an individual or group, has an interest in any decision or activity of the industry. In this OF, the stakeholders listed are from the government agencies, regulatory bodies, industry associations, professional bodies and training institutions.

2.6.1 Government Agencies, Regulatory Bodies, Policies and Initiatives

Table 2.3: List of government agencies/regulatory bodies for support activities for mining and quarrying.

No.	Government agencies/regulatory bodies	Roles, functions, and responsibilities
1.	**Ministry of Natural Resources, Energy, and Climate Change**	1) Perform administrative and financial services, human resource management, information technology and development project monitoring. 2) Prepare and implement policy planning, regulations and programs of the Ministry. 3) Determine environmental protection policies, strategies and programs as well as climate change adaptation and mitigation actions at the national, regional and international levels. 4) Formulate the overall policy direction and strategy of the mining service industry. 5) Establish and review the regulatory framework for the mining services industry.
2.	**Department of Minerals and Geoscience**	1) Handle mineral exploration systematically 2) Ensure that mining activities are done in a systematic, efficient, and safe way. 3) Functions as the national data bank regarding geoscience and the nation’s mineral resource 4) Execute government policies and enforce legislations, and regulations in the mineral industry.
3.	**Department of Director General of Lands & Mines Federal**	1) Amendment or improvement of any provision of land law and legislation regarding with land administration 2) Management of the record of Federal Government's Property in Land by approving land applications for mining and quarrying purposes on state land and private land

No.	Government agencies/regulatory bodies	Roles, functions, and responsibilities
		3) To make an acquisition of the alienated land for Federal Project purposes 4) Tenancy and enforcement of Federal Government's Property in Land
4.	**Forestry Department of Peninsular Malaysia**	1) Approve land applications for quarry purposes on forest reserve land
5.	**Ministry of Finance**	Monitor the economical aspect and study the impact of O&G industry to Malaysia
6.	**Ministry of Human Resources (MoHR)**	● Develop competent, productive, responsive & resilient human capital in the labour market to increase national productivity. ● Ensure the smooth operation of the nation's labour market. ● Increase employability and employment rate of the local workforce to meet the national labour market needs. ● Ensure harmonious and conducive industrial relations. ● Prioritise the aspect of occupational safety and health. ● Ensure comprehensive, dynamic and progressive social safety net.
7.	**Department of Skills Development (DSD), Ministry of Human Resources (MoHR)**	1) Coordinate and control the implementation of the skills training system to produce K-Workers for employment needs and recognition at the national and international levels. 2) Conduct research and develop the National Occupational Skills Standards (NOSS) to continuously improve the quality of skilled human resources to contribute to the country's economic growth.
8.	**Department of Environment (DOE)**	1) Review, update and draft legislation and emission standards related to air pollution and odours from industry 2) Collect, update and prepare GHG inventory reports for the Waste Sector.

No.	Government agencies/regulatory bodies	Roles, functions, and responsibilities
		3) Authorised as a Competent Authority (CA) for the application process, permits issuance, inputs to regional and international meetings, approval of import and export of scheduled/hazardous wastes 4) Manage contaminated soil inventory, conduct contaminated soil survey and soil remediation
9	**Ministry of International Trade and Industry Malaysia (MITI)**	Plan, formulate and implement policies on industrial development, international trade and investment
10	**Malaysian Industrial Development Authority (MIDA)**	Ensure the promotion and coordination of industrial development in Malaysia. Authorise manufacturing license under The Industrial Coordination Act 1975
11	**Department of Statistics, Malaysia (DOSM)**	A premier government agency under the Prime Minister's Department entrusted with the responsibility to collect, interpret and disseminate latest statistics in monitoring the national economic performance and social development.

Table 2.4: List of government policies/initiatives for support activities for mining and quarrying.

No.	Policies / Initiatives	Roles, functions, and responsibilities
1.	**National Mineral Policy 2**	A series of goals, actions, and decision expressed by the government to: 1) Ensure sustainable development and optimised mineral usage 2) Ensure that minerals are mined in a responsible, eco-friendly and sustainable manner 3) Increase the competitiveness and progress of the nation's mineral industry 4) Promote the reusing of minerals and metals
2.	**Malaysia Mineral Industry Transformation**	Strategic planning to drive the industry for sustainable and competitive industry

No.	Policies / Initiatives	Roles, functions, and responsibilities
	Plan 2021-2030	
3.	**State Mineral Enactment (SME)**	All thirteen states have adopted the SME. SMEs are essentially based on a model template created pursuant to the National Mineral Policy. Be that as it may, it is imperative to note that there are minor differences between various SMEs, in particular the operational and administrative aspects. In respect of the issuance of licences and mining lease, this responsibility befalls upon the State Director of the Lands and Mines Department, which is currently a sub-division of each State's Land Office.
4.	**Majlis Mineral Negara**	To hold Consultative meetings between the Federal and State for mineral sector
5.	**National Forestry Act 1984**	An Act to provide for the administration, management and conservation of forests and forestry development within the States of Malaysia. The act includes every activity involved in forest management including mining and quarrying .
6.	**Mineral Development Act 525 1994**	In short, the Act provides provisions for the inspection and regulation of the exploration and mining of minerals and mineral ores and for other matters connected therewith. The act provides the Project Proponent to conduct the Environmental Impact Assessment.
7	**Geology Survey Act 1974**	An Act to regulate and control geological surveys, to establish geological archives and to provide for matters incidental thereto
8.	**Environmental Quality Act 1974**	The Act provides rules and regulations on environment quality specifications that have to be adhered to by mining companies for certain parameters such as air, noise, and ground pollution as well as chemical disposal.
9.	**The Occupational Safety and Health Act 1994 (Act 514)**	An Act to make further provisions for securing the safety, health and welfare of persons at work, for protecting others against risks to safety or health in connection with the activities of persons at work

No.	Policies / Initiatives	Roles, functions, and responsibilities
10.	**Employment Act 1955 (Amendment 2022)**	An Act that covers all employees in Malaysia regardless of wages. It includes various overtime rates, working arrangements, working hours, leaves and other protection needed by employees.
11.	**Minimum Wages Order 2022**	An order that increases the minimum monthly wage of employees to RM1,500 and applies to all employees in the private sector contracted under a service except for domestics (household helpers, gardeners, cooks in personal households)
12	**Sabah Labour Ordinance**	The legislation that regulates the employment law in Sabah for employees who has a monthly salary of RM 2,500.00 or less, excluding commissions, allowances and overtime payments for those working in Sabah.
13	**Sarawak Labour Ordinance**	The legislation that regulates the employment law in Sarawak for employees who has a monthly salary of RM 2,500.00 or less, excluding commissions, allowances and overtime payments for those working in Sarawak.

Although there are federal acts on mining and quarrying, the state government has the authority for implementation and enforcement, following the suitability of the area and economic plan of the state.

Table 2.5: List of government agencies/regulatory bodies for support activities in O&G.

No.	Government agencies/ regulatory bodies /	Roles, functions, and responsibilities
1	**Ministry of International Trade and Industry Malaysia**	To plan, formulate and implement policies on industrial development, international trade and investment
2.	**Ministry of Human Resources (MoHR)**	Developing competent, productive, responsive & resilient human capital in the labour market to increase national productivity. Ensuring the smooth operation of the nation's labour market. Increasing employability and employment rate of the local workforce to meet the national labour market needs. Ensuring harmonious and conducive industrial relations.

No.	Government agencies/ regulatory bodies /	Roles, functions, and responsibilities
		Prioritising the aspect of occupational safety and health. Ensuring comprehensive, dynamic and progressive social safety net.
3	**Malaysian Industrial Development Authority**	Promotion and coordination of industrial development in Malaysia. Authorising manufacturing licensed under The Industrial Coordination Act 1975
4	**Ministry of Finance**	Monitor the economical aspect and study the impact to Malaysia
5	**Prime Minister's Office, Economy Planning Unit**	Preparing the blueprint and planning 2021-2030 for OGSE industry
6	**Petroliam Nasional Berhad**	Custodian for the petroleum and natural gases of Malaysia.
7	**The Expatriate Services Division (ESD), Immigration Department Malaysia**	The first point of contact for companies who wish to employ eligible expatriates. Companies need to advertise the vacancy in MyfutureJob portal. When no successful hiring happens, the company can apply for approval under section 60(K) employment act 1955 and create EDS account. Once MIDA support letter is obtained, the employment pass can be applied.
8	**Department of Statistics, Malaysia (DOSM)**	A premier government agency under the Prime Minister's Department entrusted with the responsibility to collect, interpret and disseminate latest statistics in monitoring the national economic performance and social development.

Table 2.6: List of government policies/initiatives for support activities for O&G.

No.	Policies / Initiatives	Roles, functions, and responsibilities
1	**Petroleum Development Act 1974 (PDA 1974)**	An Act to provide for exploration and exploitation of petroleum whether onshore or offshore by a corporation in which will be vested This enabled Petronas to be set up.

No.	Policies / Initiatives	Roles, functions, and responsibilities
2	**Continental Shelf Act 1966 (Revised - 1972) (Act 83) /*Akta 83 Akta Pelantar Benua 1966***	An Act relating to continental shelf of Malaysia, the exploration thereof and the exploitation of its natural resources and for matters connected therewith.
3	**Petroleum (Safety Measures) Act 1984**	An Act for petroleum and natural gas transportation, storage and handling as well as the utilisation and instalment of equipment, plant, buildings etc.
4.	**The Occupational Safety and Health Act 1994 (Act 514)**	Act to make further provisions for securing the safety, health and welfare of persons at work, for protecting others against risks to safety or health in connection with the activities of persons at work
5.	**National OGSE Industry Blueprint 2021-2030**	Prepared by the Economy Planning Unit, Prime Minister's Office. To develop a robust, resilient, and globally-competitive Malaysian OGSE sector which contributes to the sustainable development of National priorities.
6.	**Employment Act 1955 (Amendment 2022)**	An Act that covers all employee in Malaysia regardless of wages. It includes various overtime rates, working arrangements, working hours, leaves and other protection needed by employees.
7.	**Minimum Wages Order 2022**	An order that increases the minimum monthly wage of employees to RM1,500 and applies to all employees in the private sector contracted under a service except for domestics (household helpers, gardeners, cooks in personal households)
8.	**Sabah Labour Ordinance**	The legislation that regulates the employment law in Sabah for employees who has a monthly salary of RM 2,500.00 or less, excluding commissions, allowances and overtime payments for those working in Sabah.
9.	**Sarawak Labour Ordinance**	The legislation that regulates the employment law in Sarawak for employees who has a monthly salary of RM 2,500.00 or less, excluding commissions, allowances and overtime payments for those working in Sarawak.
10	**Petroleum Mining Act 1966 (Amendment 2006)**	An act to make provision with regard to mining for petroleum and matters connected to it. Applicable throughout Malaysia but effect on Sabah and Sarawak only to off-shore land.

No.	Policies / Initiatives	Roles, functions, and responsibilities
11	**Petroleum Development Act 1974**	An Act to provide for exploration and exploitation of petroleum whether onshore or offshore by a Corporation in which will be vested.
12	**Sarawak's Oil and Mining Ordinance (OMO) 1958 (Amendment 2018)**	An ordinance to exist to control the development of oil resources in Sarawak, in line with current practices and operation in upstream sector of the oil and gas Industry. Petronas is not exempted from complying with OMO or Land Code when Petronas or its contractors undertake exploration, prospecting and mining for petroleum in Sarawak. (Bernama, 2018)

2.6.2 Industry Associations and Professional Bodies

The industry association and professional bodies for B09: Mining Support Services Activities in Malaysia are responsible for regularly sharing information, discussing issues, developing standards and establishing rules for best practices within this industry. The leading industry association and professional bodies and their function in the B09 industry are listed in Table 2.7.

Table 2.7: List of Industry Associations and Professional Bodies for support activities in mining and quarrying

No.	Industry Associations / Professional Body	Roles, functions, and responsibilities
1.	**Malaysian Chamber of Mines**	A chamber made up of major mining companies, mining consultants, engineers, individuals and other mining associations. It aims to: 1) protect, promote and advance the general interest of the minerals resource community in Malaysia 2) communicate and exchange information on minerals resource industry matters to and with other minerals industry associations in Malaysia and elsewhere 3) promote and facilitate the minerals resource industry contribution to sustainable development within the national and global sustainable development strategies 4) collect, classify and diffuse minerals resource information
2	**ASEAN Federation of Mining**	To foster cooperation and mutual assistance among the members; promote the dissemination and exchange of

No.	Industry Associations / Professional Body	Roles, functions, and responsibilities
	Associations (AFMA)	information on the mineral policies
3	**Institute of Quarrying Malaysia**	To promote and provide a platform to facilitate the orderly development of the quarrying and related extractive and processing industries in Malaysia
4	**Malaysia Quarry Association**	To provide perfect platform to reach out to your potential clients, create awareness
5	**Malaysian Iron and Steel Industry Federation**	To assist and support members in carrying out their business efficiently and successfully
6	**Board of Engineers Malaysia**	A statutory body constituted under the Registration of Engineers Act 1967 • To facilitate the registration of Engineers, Engineering Technologists, Inspectors of Works, Sole Proprietorships, Partnerships and Bodies Corporate providing professional engineering services and; • To regulate the professional conduct and practice of registered person in order to safeguard the safety and interest of the public.
7	**The Institution of Engineers, Malaysia**	To promote and advance the science and profession of engineering in any or all of its disciplines. To facilitate the exchange of information and ideas related to engineering.
8	**Board of Geologist Malaysia**	To manage registration of geologists, the regulations of geological practice and for related matters.
9.	**Institute of Mineral Engineering, Malaysia (IME)**	To promote and advance the knowledge and practice of mineral engineering in support of the socio-economic development objective of the nation.

Table 2.8: List of Industry Associations and Professional Bodies for support activities for O&G

No.	Industry Associations / Professional Body	Roles, functions, and responsibilities
1	**Malaysian Society for Non-Destructive Testing (MSNT)**	Establishes and provides linkages and networking with other technical and scientific organisations to disseminate and Exchange information to enhance the promotion of the

No.	Industry Associations / Professional Body	Roles, functions, and responsibilities
		advancement and recognition of Non-Destructive Testing (NDT) practice in Malaysia. MSNT is the appointed Malaysian Industry Lead Body (ILB) for NDT by the Department of Skills Development (DSD), Ministry of Human Resources. • To create knowledge and sensitivity of the advancement of new technology in the welding field. • To enhance the optimal steering forward on the welding field. • Information through communication and sharing knowledge among the welders.
2	**Malaysian Oil & Gas Services Council (MOGSC)**	Establish an association driven and promoted by the services sector of the Malaysian Oil and Gas Industry
3	**Association of Malaysian Oil & Gas Engineers (MOGEC)**	Foster a closer relationship among the oil and gas engineering consultants
4	**Malaysia Offshore Contractors Association (MOCA)**	Promote cohesive working relationships among staff from various contractors in Oil & Gas offshore business of the industry
5	**MGA (Malaysia Gas Association)**	Play a prominent role in promoting engagement, discourse and dialogue with key stakeholders to develop a vibrant and sustainable gas industry, while fuelling Malaysia's socio-economic growth. The purpose is to facilitate the growth of Malaysia's natural gas sector by positioning natural gas as a clean and efficient source of energy,
6	**Malaysian Petrochemicals Association (MPA)**	Provide a forum to discuss and resolve common problems of the petrochemical industry as well, disseminate information and facilitate consultations and exchange of views between members. Provide a focal point for the petrochemical industry to liaise with the public and the government and to make recommendations on relevant issues, within Malaysia and on an international basis

2.6.3 Training Centres

Government and Non-Government Organisations who give training are listed below. However, this list is not extensive.

Table 2.9: Training Centres for mining and quarrying

No.	Training Centre	Roles, functions, and responsibilities
1	**National Institute for Occupational Safety and Health (NIOSH)**	Under Ministry of Human Resources • To be a leading centre of excellence in Occupational Safety and Health in Malaysia. • To provide practical solutions in the field of Occupational Safety and Health
2	***Institut Latihan Perindustrian*** **(ILP)**	Part of *Institusi Latihan Jabatan Tenaga Manusia*, Ministry of Human Resources • To produce skilled workers in industrial sectors. • To enhance workers' skills that contributed to the progress of the nation. • To create a platform for the school leavers in preparing themselves in the skill workers environment.
3	***Pusat Latihan Teknologi Tinggi*** **(ADTEC)**	Part of *Institusi Latihan Jabatan Tenaga Manusia*, Ministry of Human Resources • To produce skilled workers in the high impact industry and new technology. • To increase the quality of the skilled workers in the demanding in advanced sectors. • To create a platform for the school leavers in preparing themselves in the skill workers environment
4	***Institut Latihan Kemahiran Belia dan Sukan*** **(ILKBS)**	Under *Kementerian Belia dan Sukan* • To offer practical training to gear up the youth with the skill needed by the industry after finishing their studies.
5	**PERKESO**	Design the Career Bridge Tool to support the mapping of occupational standards • To help connect occupations with qualifications by linking them to real-time vacancies posted in MyFutureJobs
6	**Universities**	UTM, USM, UKM, UMP, UMS, UMK, Sunway University, Curtin University

Table 2.10: Training Centres for O&G services

No.	Training Centre	Roles, functions, and responsibilities
1	***Institut Teknologi Petroleum* PETRONAS (INSTEP)**	Belong to PETRONAS • To provide technical training institutions located on the shores of Malaysia's East Coast. The integrated live plant is supported by three (3) academies, complete with practical workshops: • Operations (Exploration & Production, Process & Analytical) • Maintenance (Electrical, Mechanical & Inspection, Instrumentation) • Health, Safety & Environment
2	**National Institute for Occupational Safety and Health (NIOSH)**	Under the Ministry of Human Resources • To be a leading centre of excellence in Occupational Safety and Health in Malaysia. • To provide practical solutions in the field of Occupational Safety and Health
3	***Institut latihan Perindustrian* (ILP)**	Part of *Institusi Latihan Jabatan Tenaga Manusia*, Ministry of Human Resources • To produce skilled workers in industrial sectors. • To enhance workers' skills that contributed to the progress of the nation. • To create a platform for the school leavers in preparing themselves in the skill workers environment.
4	***Pusat Latihan Teknologi Tinggi* (ADTEC)**	Part of *Institusi Latihan Jabatan Tenaga Manusia*, Ministry of Human Resources • To produce skilled workers in the high impact industry and new technology. • To increase the quality of the skilled workers in the demanding in advanced sectors. • To create a platform for the school leavers in preparing themselves in the skill workers environment
5	***Institut Latihan Kemahiran Belia dan Sukan* (ILKBS)**	Under *Kementerian Belia dan Sukan* • To offer practical training to gear up the youths with the skills needed by the industry after finishing their studies.
6	**PETRONAS**	Provide scholarship for student as part of community service and sustainable workforce
7	**Universities**	UTM, USM, Curtin University, Harriot Watt University, Lincoln University College, University Tunku Abdul Rahman, University Teknologi Petronas

2.7 The Relevance of the Industrial Revolution (IR) for B09: Mining Support Services Activities

The Industrial Revolution (IR) is used to describe the emergence of the Digital Economy and the use of automation and data exchange in industrial technologies. The latest IR revolution includes the Internet of Things (IoT) and sensory devices, as well as the integration of networked machines and humans in decision-making. Technology experts talk about the future 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 the digital revolution, which is at the heart of the IR. This is already happening in businesses and industries as robotics and artificial intelligence can take over jobs traditionally manned by human labour, particularly routine technical processes that can easily be computerised.

The industry needs to be prepared in order to be current and relevant. The 4th revolution marked the implementation of artificial intelligence, robotics and big data as well as cyber physical system placement in the industry. This has been carried out in phases as some exploration, monitoring, and control has been using automated and intelligent machines, as well as reporting and push notifications for certain conditions. This can be seen in the replacement of human workers in transferring raw materials such as blasted granites for the cleaning processes using conveyor belts from the site to the cleaning area.

In the 5th industrial revolution, people will be working alongside robots and smart machines. The Internet of Things (IoT) and big data are expected to help humans work more efficiently and faster by leveraging on advanced technologies for decision-making. The use of drones in monitoring, exploration and sampling has been in place but simulations and modelling of virtual environments or mine and quarry sites can be done for planning and decision making. In addition, remote access and autonomous use of machines to monitor support activities are increasing both for mining and quarrying as well as for O&G. This can be seen in Figure 2.24. As new business models are in place and people adapt to working from home and hybrid working environments, offshore platforms and remote site should be coupled with better broadband internet connectivity for improved quality of video calls and hence, people would not mind working away from the family.

In addition to the technology skills, generic skills are also needed, namely communication, problem-solving, computer literacy, planning and detail oriented (Human Resource Development Corporation, 2020). These, as well as areas in Figure 2.24, are the areas that have rapidly changed following the IR wave.

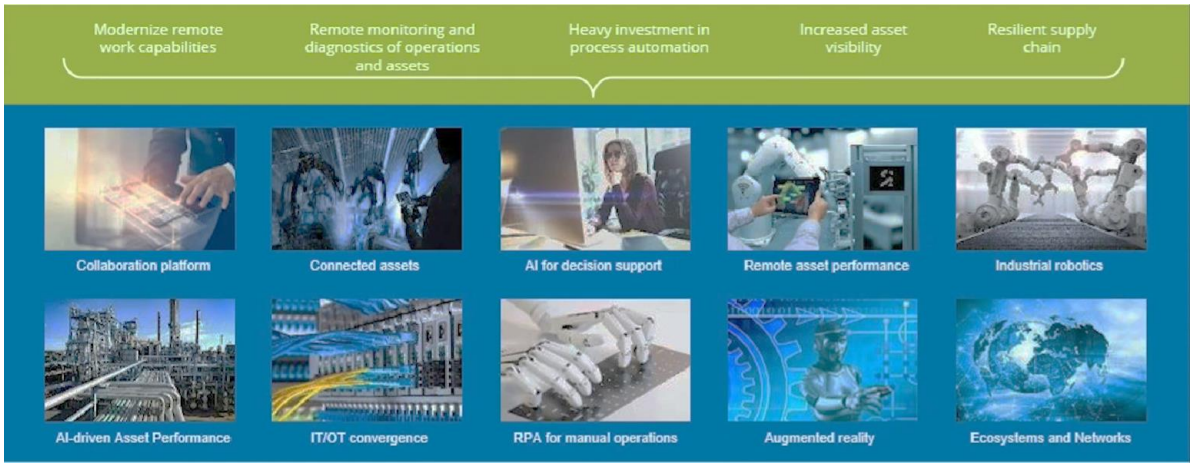


Figure 2.25: Major potential digitalisation in O&G (International Data Corporation, 2022)

Support activities for the mining industry are typically diverse and encompass a range of functions in the upstream processes such as exploration, and processing of minerals and ores. The relevance of industrial relations in the support activities for the mining industry stems from the need to manage a complex workforce, ensure safety and compliance, maintain productivity, and build positive relationships with labour unions and communities. Effective IR practices are essential for the sustainable and responsible operation of mining activities.

2.8 Conclusion

An occupational framework for mining support activities is imperative in today's rapidly evolving landscape. The mining industry is at a crossroads, driven by two major factors: the increasing demand for minerals and ores due to the growth of renewable energy technologies, and the need to attract young talents to ensure its sustainability. To address these challenges, a well-structured occupational framework is crucial.

The surge in demand for minerals and ores, driven by the renewable energy sector, underscores the importance of a clear and adaptable framework. The transition to cleaner energy sources, such as electric vehicles and solar panels, relies heavily on minerals like lithium, cobalt, and rare earth elements. As this demand grows, mining support activities need a framework that can keep pace with evolving technology and environmental standards. This includes not only optimising extraction processes but also ensuring that these activities align with sustainable practices and environmental regulations, making the sector more attractive to investors and stakeholders. Lastly, the framework should also emphasise the importance of fostering diversity and inclusion within the mining support activities. Encouraging a diverse workforce, including women and underrepresented groups, not only contributes to a broader talent pool but also brings fresh perspectives and ideas to the industry. Inclusion efforts can lead to improved innovation, safety, and overall performance, making the mining sector more resilient and adaptive to changing market dynamics.

Meanwhile, the petroleum industry is already transforming to expedite the nation’s transition from traditional fossil-fuel economy towards a high-value green economy in line with the National Energy Transition Plan. The support services activities in the O&G sector will be

affected in this change to adopt this new agenda, and will require collaboration among Federal and State Governments, industries, the public and the international community.

In conclusion, an occupational framework for mining support activities is essential to navigate the industry's evolving landscape. It must address the surging demand for minerals driven by renewable energy, attract young talents through innovation and sustainability initiatives, and promote diversity and inclusion. Such a framework will not only ensure the industry's viability but also position it as a vital player in the transition towards a greener and more sustainable future.

CHAPTER III

METHODOLOGY

3.1 Introduction

In this chapter, the research design for achieving the objectives of the study is clarified. The research aim and objectives are shown in Figure 3.1.

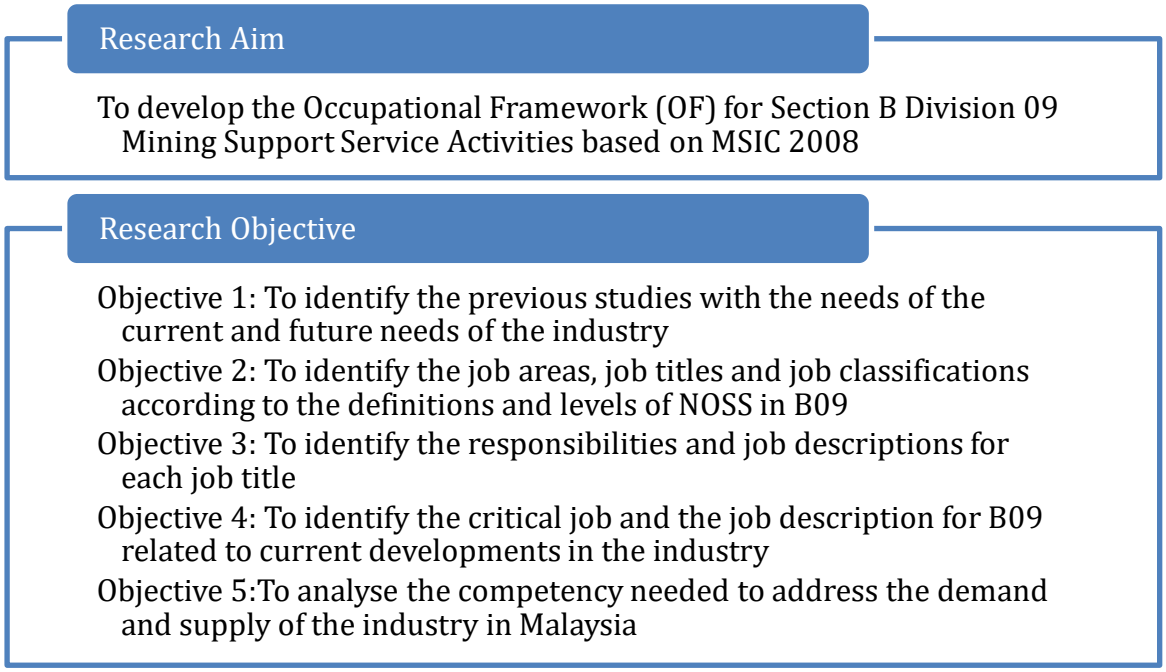


Figure 3.1. The research objectives

The deliverables would consist of the following: (1) Occupational Structure (OS); (2) Occupational Responsibilities (OR); (3) Occupation Description (OD); (4) jobs in demand; (5) critical jobs; (6) competency in demand; (7) jobs relevant to the industry and technology revolution as well as (8) emerging skills for the industry.

3.2 Research Approach and Design

In order to achieve the objectives of the study a Design and Developmental Research (DDR) framework (Richey & Klien, 2007) is applied. The three phases of the DDR are: Phase 1: Analysis; Phase 2: Design and Development of the Occupational Framework; and Phase 3: Evaluation of the Occupational Framework. A variety of techniques will be used to develop the occupational framework for Section B Division 09 Mining Support Service Activities based on MSIC 2008. The summary of the research objectives according to the three phases is shown

in Table 3.1 and the summary of the research methods, data analysis and outputs for achieving the objectives are in Table 3.2.

.

Table 3.1 Summary of the Research Objectives according to the phases of The Design and Developmental Research (DDR)

Phase 1 **The Analysis Phase**	**Phase 2** **Development of the OF**	**Phase 3** **Evaluation of the OF**
Objective 1: To identify the previous studies with the needs of the current and future needs of the industry	Objective 2: To identify the job areas, job titles and job classifications according to the definitions and levels of NOSS in B09 Objective 3: To identify the responsibilities and job descriptions for each job title Objective 4: To identify the critical job and the job description for B09 related to current developments in the industry Objective 5: To analyse the competency needed to address the demand and supply of the industry in Malaysia	To document and validate the OF for B09 industry in Malaysia based on the MSIC 2008 ver.1.0

Table 3.2: Summary of the research methods, analysis and outputs for achieving the objectives

Phase 1 **The Analysis Phase**	**Phase 2** **Development of the OF**		**Phase 3** **Evaluation of the OF**
Objective 1: To identify the previous studies with the needs of the current and future needs of the industry	Objective 2: To identify the job areas, job titles and job classifications according to the definitions and levels of NOSS in B09 Objective 3: To identify the responsibilities and job descriptions for each job title	Objective 4: To identify the critical job and the job description for B09 related to current developments in the industry Objective 5: To analyse the competency needed to address the demand and supply of the industry in Malaysia	To document and validate the OF for B09 industry in Malaysia based on the MSIC 2008 ver.1.0
Method • Literature review • Document review o Relevant policies and acts o Department of Statistics Malaysia & Ministry of Economy. (2023). Annual Economic Statistics of the Mining and Quarrying Sector. o The Department of Minerals and Geoscience Malaysia Yearbook 2021 and Directory 2021. o Other documents • Existing NOSS (MySPIKE)	**Method** • Focus Group Discussion (FGD) • Site Visit & Interviews	**Method** • Focus Group Discussion (FGD) – verification of OS and OR, & identification of technologies and competencies.	**Method** • Presentation at international conference • Interview with experts
Data analysis Content analysis	**Data analysis** Thematic analysis from FGD and interviews	**Data analysis** Thematic analysis	**Data analysis** Thematic analysis
Output Information for Chapters 1, 2 and 3	**Output** Draft Occupational Structure (OS) & Occupational Responsibilities (OR)	**Output** • Review & Refine OS and OR • Brainstorming & Develop Occupational Descriptions (OD) • Identify critical jobs titles	**Output** Update of OF for B09

Phase 1: The Analysis Phase

Objective	Data collection methods	Sources of data / Respondents	Data analysis method
Objective 1: To identify the previous studies with the needs of the current and future needs of the industry	Literature Review and Document review	Documents. 1. Malaysia Standard Industrial Classification 2008 (MSIC 2008) 2. Department of Statistics Malaysia & Ministry of Economy. (2023). *Annual Economic Statistics of the Mining and Quarrying Sector*. Mining and Quarrying. 3. Malaysian Investment Development Authority (MIDA) (2022). *Sustainable investments for growth, Malaysian Investment Performance Report 2022*. MIDA 4. Malaysian Investment Development Authority (MIDA) (2021). *Powering resilience, Malaysian Investment Performance Report 2021*. MIDA. 5. Department of Mineral and Geoscience Malaysia (DMGM) (2021). *Malaysian Minerals Yearbook 2021.* Ministry of Energy and Natural Resources. 6. Economic Planning Unit, Prime Minster's Department (2021). *National OGSE Industry Blueprint 2021-2030 Abridged Report*. Prime Minster's Department 7. Economic Planning Unit, Prime Minster's Department (2022). *National Energy Policy: 2022-2040.* Prime Minster's Department 8. Kementerian Tenaga dan Sumber Asli (2021). *Kerangka Pelan Transformasi Industri Mineral: 2021-2030*. KTSA.	Content analysis and comparative analysis

Objective	Data collection methods	Sources of data / Respondents	Data analysis method
		9. Other related documents to the mining and quarrying sector. 10. Existing NOSS (MySPIKE)	

Phase 2: Development of the Occupational Framework (OF)

Objective	Data collection methods	Sources of data / Respondents	Data analysis method
Objective 2: To identify the job areas, job titles and job classifications according to the definitions and levels of NOSS in B09 **Objective 3:** To identify the responsibilities and job descriptions for each job title	(a) Focus Group Discussion (FGD1 and FGD2) involving experts from industry in a workshop to brainstorm on the occupational structure (OS). The FGDs would involve discussion on the occupational structure (OS). Structured interview protocol for the FGD is in **Appendix 3.1.**	**Seven** experts from the mining industry. **Criteria of expertise:** • Employed with registered companies under *Suruhanjaya Syarikat Malaysia* **(**SSM) (SME companies, multinational companies) • A minimum of 5 years' experience in the Mining industry **Three** experts from Professional bodies related to the mining industry **Criteria of expertise:** • Member of the professional body • A minimum of 5 years' experience in the Mining and Quarrying industry Panel of experts for FGDs are tabulated in the chapter.	Thematic Analysis

Objective	Data collection methods	Sources of data / Respondents	Data analysis method
	(b) Site Visit and Interviews with experts at **silica mining quarry**. (c) Site Visit and Interviews with experts at a **tin mine** (d) Site Visit and Interviews with experts at Oil & Gas Training Centre. (e) Interviews: a. One expert in mining and REE b. One expert on **environmental** issues at mines c. One expert on Surveying in mining	Interview Protocol : see **Appendix 3.2** List of experts for interviews is tabulated in the chapter.	Thematic analysis – job areas in the industry.
Objective 4: To identify the critical job for B09 and/ or related to current developments in the industry **Objective 5:** To analyse the competency needed to address the demand and supply of the industry in Malaysia	(a) Focus Group Discussions (FGD2 & FGD3) involving experts from industry in a workshop to identify the critical jobs and/ or related to current developments in the industry the competences needed to address the demand and supply of the industry.	**Nine** experts from the mining and quarrying industry. **<u>Criteria of expertise:</u>** • Employed with registered companies under SSM (SME companies, multinational companies) • A minimum of 5 years' experience in the Mining and Quarrying industry Three experts from Professional body related to the mining industry **<u>Criteria of expertise:</u>** • Member of the professional body	Thematic analysis

Objective	Data collection methods	Sources of data / Respondents	Data analysis method
		• A minimum of 5 years' experience in the Mining and Quarrying industry Panel of experts for FGD2 and FGD3 are tabulated in the chapter. FGD2 protocol in **Appendix 3.3**	

Phase 3: Evaluation of the OF

Objective	Data collection methods	Sources of data / Respondents	Data analysis
To document and validate the OF for the industry in Malaysia based on the MSIC 2008 ver. 1.0.	a) Interview experts from industry to verify the structure. b) Presentation of findings at International Conference of Sustainability Education Development (ICSED 2023) on 25 & 26 Oct 2023. (See **Appendix 3.4** for acceptance of abstract).	a) Two experts from the mining and quarrying industry and Petroleum and Natural Gas Extraction each. The criteria of the experts are as follows: • Employed with registered companies under SSM • A minimum of 5 years' experience in the Mining industry	Thematic analysis

3.3 Phase 1: The Analysis Phase

In Phase 1, information was gathered to identify the current and future needs of the industry. Firstly, a document analysis was done on the literature review to gather relevant information for developing Chapters 1, 2, and 3 of this research. Next, the interview questions for the focus group discussions for Phase 2 was designed.

Academic literature, reports, and other sources of information related to the mining and quarrying sector was reviewed and analysed. Content analysis is a systematic approach in reviewing literature and documents on a research topic, where relevant information for the study is extracted.

The documents reviewed include the Malaysia Standard Industrial Classification 2008 (MSIC 2008), Economic Database Reports from the Department of Statistics Malaysia census, and other reports related to the occupations in the Mining Support Services. The issues in the industry as well as impact of technologies and sustainable development practices are reviewed. Acts related to the industry such as the Mineral Development Act 525 and Petroleum (Safety Measures) Act, as well as the National Skills Development Act 2006 are referred to.

Next, the focus group discussion protocol was designed from the content analysis which included the value chain for the industry. This was done to determine the processes and potential jobs areas for the industry.

3.4 Phase 2: The Development of the OF

Phase 2 involves two Focus Group Discussions (FGD) with the experts who are the professionals and managers involved in the industry. In addition, two other Focus Group Discussion was conducted online with the panel. The criteria for experts are elaborated in **Section 3.6: Participants: Panel of experts**. Site visits and interviews are used to verify and obtain more data from expert.

3.4.1 Focus Group Discussion 1

FGD 1 was conducted on 19-20 August 2023 at the Hotel Grand Dorsett, Putrajaya and 10 experts from industries related to B09 attended these two days sessions. The objectives of FGD 1 are to discuss and develop the occupational structure, determining the competencies in demand, emerging skills, job related to IR, and issues related for B09 industry.

The initial OS for the two groups, **Group 091: Support Activities for Petroleum and Natural Gas Extraction**, and **Group 099: Support Activities for Other Mining and Quarrying** were successfully developed from the FGD 1. Nevertheless, additional industrial engagement with experts from the industries, through interviews were conducted to develop and confirm the initial OS. The details result and explanation of the OS are discussed in this section.

Interviews with four experts identified from industry which are NR-REE, tin mining, silica quarrying as well as Oil and Gas industry. These experts are identified from the experts during the Focus Group Discussions. In addition to their experience in the industry and their willingness to commit, they would be selected on their innovative approach in the industry.

Figure 3.2. Panel members during Focus Group Discussion 1.

Figure 3.3: Photos of activities during Focus Group Discussion 1.

Table 3.3: List of Experts for FGD1

List of Experts for Focus Group Discussion 1			
No.	**Name**	**Organization/ Company/ Agency**	**Representing Group B09**
1	Ir. Ismail Musa	Principal Engineer, Mechanical, Petronas Pengerang	B091 for Support Activities for Petroleum and Natural Gas Extraction
2	En Murtaza Hassan	Head, People Strategy & Rewards, Sapura Energy Berhad Group HR, People & Culture Office	B091 for Support Activities for Petroleum and Natural Gas Extraction
3	En Aiman Naufal	HR & Admin Executive, MR Technology Sdn. Bhd.	B091: Support Activities for Petroleum and Natural Gas Extraction
4	Albert Chan Kim Tee	Group Manage, Human Resource and Administration, Malaysia Smelting Corporation Bhd	B099: Support Activities for Other Mining and Quarrying
5	Puan Mimi Afzan binti Afza	VP People and Culture, Lynas Malaysia Sdn Bhd	B099: Support Activities for Other Mining and Quarrying
6	Mr Liew Ban Hing	Manager, Ang Cheng Ho Quarry Sdn Bhd	B099: Support Activities for Other Mining and Quarrying
7	En Affendi Md Yusri	Director, Yusri Holdings Legacies	B099: Support Activities for Other Mining and Quarrying
8	Mr Wong Shee Kin	Manager, Malaysia Quarries Association	B099: Support Activities for Other Mining and Quarrying
9	Ahmad Ashraf Abdul Ghafar	Technical Manager, Dewan Perlombongan Malaysia	B099: Support Activities for Other Mining and Quarrying
10	Tuan Hj Mustapha Mohd Lip	Advisor Institut Kuari Malaysia Berhad	B099: Support Activities for Other Mining and Quarrying

3.4.2 Focus Group Discussion 2

The second FGD (FGD 2) was conducted on 14th October 2023 at the Hotel Grand Dorsett, Putrajaya and 5 experts from industries related to B09 attended. The objectives of the FGD 2 are to finalize the developed OS, and gather information on the jobs in demand and critical jobs, competencies as well as confirm the job responsibilities and description for all related job titles in the B09 industries. The findings and outcome of the FGD are discussed later in this section.

Figure 3.4: Panel members during Focus Group Discussion 2.

Table 3.4: List of Experts for FGD2

List of Experts for Focus Group Discussion 2			
No.	**Name**	**Organization/ Company/ Agency**	**Representing Group B09**
1	Ir. Ismail Musa	Principal Engineer, Mechanical, Petronas Pengerang	B091 for Support Activities for Petroleum and Natural Gas Extraction
2	En Murtaza Hassan	Head, People Strategy & Rewards, Sapura Energy Berhad Group HR, People & Culture Office	B091 for Support Activities for Petroleum and Natural Gas Extraction
3	En Aiman Naufal	HR & Admin Executive, MR Technology Sdn. Bhd.	B091: Support Activities for Petroleum and Natural Gas Extraction
4	En. Mohd Hafiz Adam	Executive Mechanical Rotating, Rotating Planning and Scheduling, Petronas Pengerang	B091: Support Activities for Petroleum and Natural Gas Extraction
5	En Affendi Md Yusri	Director, Yusri Holdings Legacies	B099: Support Activities for Other Mining and Quarrying
6	Ahmad Ashraf Abdul Ghafar	Technical Manager, Dewan Perlombongan Malaysia	B099: Support Activities for Other Mining and Quarrying
7	Tuan Hj Mustapha Mohd Lip	Advisor Institut Kuari Malaysia Berhad	B099: Support Activities for Other Mining and Quarrying

3.4.3 Focus Group Discussion 3

The third FGD (FGD 3) was conducted on 18th January 2024 at the Petronas Head Office, Kuala Lumpur. Seven experts from the Oil and Gas industry were involved in the discussion to develop the OS for the B091 group, to take into account the upstream processes. The list of experts in the panel is in Appendix 3.4. Information on the jobs in demand and critical jobs, competencies as well as the job responsibilities and description for all related job titles in the industry. The findings contributed to comprehensive OS for B09.

Figure 3.5: Panel members during Focus Group Discussion 3.

Table 3.5: List of Experts for FGD3

List of Experts for Focus Group Discussion 3			
No.	**Name**	**Organization/ Company/ Agency**	**Representing Group B09**
1	Ir. Ismail Musa	Principal Engineer, Mechanical, Petronas Pengerang	B091 for Support Activities for Petroleum and Natural Gas Extraction
2	Haria Irman Djuli	Manager Operations & Maintenance Competency, PETRONAS	B091 for Support Activities for Petroleum and Natural Gas Extraction
3	Nurlili Elilza A. Jalil	Head Subsurface Capability, PETRONAS	B091 for Support Activities for Petroleum and Natural Gas Extraction
4	Jeffri B. Nasir	Manager, PETRONAS	B091 for Support Activities for Petroleum and Natural Gas Extraction
5	Zainuri Bawan	Manager, PETRONAS	B091 for Support Activities for Petroleum and Natural Gas Extraction
6	Khairul Hakimi bin Awang	Manager, PETRONAS	B091 for Support Activities for Petroleum and Natural Gas Extraction
7	Daliainie Mat Saaid	Manager, PETRONAS	B091 for Support Activities for Petroleum and Natural Gas Extraction

3.4.4 Online Focus Group Discussions

There were other online focus group discussions and communications with the panel throughout the period using online platforms. These discussions were for the purpose of developing the OF and were among the panel of experts.

FGD with panel members to validate the OS and discuss competences required. The FGD with B099 group was on 28th November 2023 and with the B091 group on 30th November 2023.

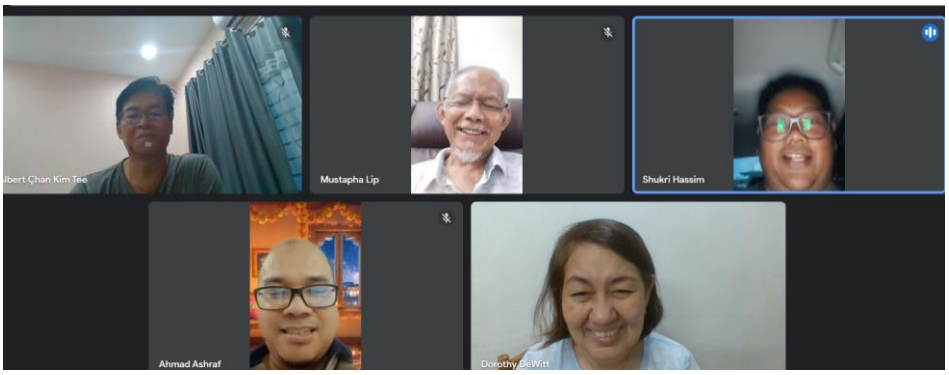


Figure 3.6: Panel members during Online Focus Group Discussion 4 (28th November 2023).

3.4.5 Interviews

There were interviews with other panel members to discuss the structure and validate the OF. This included physical interviews and the mine as well as phone interviews. These discussions were for the purpose of developing the OF and were among the panel of experts.

Table 3.6: List of Experts for Interviews

List of Experts for Interviews				
No.	**Name**	**Organization/ Company/ Agency**	**Representing Group B09**	**Discussion**
1	Dato' Sia Hok Kiang	Executive Chairman Malaco Mining Sdn Bhd	B099: Support Activities for Other Mining and Quarrying	Mining and REE on 21st August 2023
2	En. Razali Harun	Principal Consultant DOE Consultant, REM Consultant Sdn Bhd	B099: Support Activities for Other Mining and Quarrying	Environmental Effects Mining 1st September 2023
3	En Abdul Aziz Md Noor	Senior Executive Koperasi Kakitangan Sada Kedah Berhad (KOSADA)	B099: Support Activities for Other Mining and Quarrying	Sand cleaning services at Silica Quarrying on 29th August 2023
4	En. Micheal Ban	Proprietor Abanco Mining Works.	B099: Support Activities for Other Mining and Quarrying	Silica Quarrying on 29th August 2023

List of Experts for Interviews				
No.	**Name**	**Organization/ Company/ Agency**	**Representing Group B09**	**Discussion**
5	En. Mohd. Aswadi Ali	Manager, Operations and HSE Academy	B099: Support Activities for Other Mining and Quarrying	Upstream Drilling Engineering and Supervising
6	En. Fradico Minos	Geomatics Operation PETRONAS Carigali Sdn Bhd.	B091 for Support Activities for Petroleum and Natural Gas Extraction	Geomatics for Hydrocarbon Exploration

3.5 Phase 3: The Evaluation of the OF

In Phase 3, the OF would be evaluated and validated by two experts from the industry on the Occupational Structure. These experts are professionals and managers in the industry. The verification of the final OF will be conducted.

(1) The interview will be to confirm the occupational structure, job descriptions and critical job titles as well as the competences in demand. The aim of this task is to gather further information to verify, support and add on to the data.

3.6 Participants: Panel of Experts

In this study, experts were selected for the FGD. The definition of experts is that experts should have background or experience in the related field of study and be able to contribute opinions to the needs of the study (Pill, 1971). A minimum of five years of experience is required to be an expert.

1. Seven experts from the mining and quarrying / Oil and Gas industry
   Criteria of expertise:
   - Employed with registered companies under SSM (SME companies, multinational companies)
   - A minimum of 5 years' experience in the Mining and Quarrying/ Oil and Gas industry

2. Three experts from Professional body related to the mining industry
   Criteria of expertise:
   - Member of the professional body
   - A minimum of 5 years' experience in the Mining and Quarrying industry

(See the Annex for details of the panel of experts)

For FGD1, a total of ten (10) experts were invited to develop the OS while six (6) experts were involved in FGD2 and seven (7) in FGD3.

Site visit to verify processes in the OS and interviews were conducted with four (4) experts from the industry which are NR-REE, mining and Oil and Gas industries. These experts are

identified from the experts during the Focus Group Discussions and selected based on their experience in the industry and their willingness to commit. The reports are in Appendix 4.1 and Appendix 4.2.

3.7 Data Collection and Analysis

3.7.1 Focus Group Discussion

In order to achieve the objectives 2 and 3, FGD1 and FGD2 were conducted to brainstorm the occupational structure. The instrument for data collection in this phase is the Focus Group Discussions (FGD) protocol.
The protocol for FGD1 in general is as follows:

(1) The Opening and Introduction.
(a) Introduction to expert panel
(b) Introduction to the purpose and context of the study, the exclusion and inclusion criteria for the Groups 091: Support activities for petroleum and natural gas extraction, and Group 099 Support activities for other mining and quarrying.

(2) The Development of the Occupational Framework. The discussion and contribution among panel members will be to obtain the occupational structure (OS) and job description (JD).

For objective 4 and 5, FGD2 and FGD3 was conducted to obtain the job-in demand for the skills, jobs' title and critical jobs.

a) Competency in Demand: The overall skill set required for workers in the industry to perform their current and future job and the factors which may contribute to the skills gap of the current graduates and current workers. **b) Jobs in Demand:** The jobs and job areas which have a high manpower shortage. The critical jobs are identified as well as the factors contributing to the shortage of workers. **Critical jobs** are jobs which are skilled, sought-after and strategic jobs. **c) Emerging Skills**: The emerging skills predicted to be important for the progress of the industry and factors leading to the need for such skills. **d) Related Issues :** The common problems or challenges in the industry.
(2) FDG 2 and FGD3 was done to evaluate and validate the OS.

3.7.2 Data Analysis

The data from the interview was analysed according to the themes for the critical jobs, jobs in demands, emerging skills, competencies and technologies needed for the job. The themes and sub-themes would be the data emerging from the discussions.

3.8 Conclusion

The DDR approach comprising three phases: the analysis phase, development phase and evaluation phase and applies several data collection methods (document analysis, focus group discussions, and interviews) for the development of the OF. The development and evaluation of the OF is done with experts from the industry and the findings are a reliable source of data for the Occupational Structure, Occupational Responsibilities and Description and competency in demand for the industry.

CHAPTER IV

FINDINGS

4.1 Introduction

In this chapter, the results of the study for the division **B09 Mining Support Service Activities** are reported. Firstly, the report of the document analysis to determine the current needs of the industry and the future needs is reported. Then, the job areas, job titles and job classifications (Occupational Structure) according to the definitions in B09 is tabulated. Next the responsibilities and job descriptions (Occupational Responsibilities (OR) and Occupation Description (OD) respectively) for each job title will be elaborated. In addition, the critical job and the Job Description for B09 related to current developments in the industry is identified and the competency needed to address the demand and supply of the industry in Malaysia is analysed. This is reported according to the objectives of the study as follows:

Objective 1: To identify the previous studies with the needs of the current and future needs of the industry

Objective 2: To identify the job areas, job titles and job classifications according to the definitions and levels of NOSS in B09

Objective 3: To identify the responsibilities and job descriptions for each job title

Objective 4: To identify the critical job and the job description for B09 related to current developments in the industry

Objective 5: To analyse the competency needed to address the demand and supply of the industry in Malaysia

4.2 Objective 1: To identify the previous studies with the needs of the current and future needs of the industry

Chapter 2 provides a review of the literature. The analysis indicates there is an urgent need to develop and update the Occupational Framework (OF) for the B09 industry. Advances in technologies, renewable energy and sustainability practices have impacted the industry and workers need to be provided with new skills.

In addressing Objective 1, the documents analysed have shown that the current and future needs of the industry have been a result of the following:

(a) steady economic growth of the mining sector,
(b) the increase in production and demand of liquified natural gas and minerals such as rare-earth elements,
(c) sustainable practices for the preservation of the environment and natural resources, and

(d) technologies such as artificial intelligence, robotics and automation influencing the industry.

The summary of the impact of these phenomena is outlined in Table 4.1.

Table 4.1 : The current and future needs of the mining industry

Description	Current Need	Future Need
Economic growth in the mining sector		
• Domestic and Foreign investments related to mining have increased (MIDA, 2022). • Malaysia's O&G industry contributes to 13.8% governments revenue (EPU, 2021). • Guided by policies (e.g. TIM 2021-2030; NOGSE Industry Blueprint 2021-2030) • Increase in projects have created new jobs (MIDA, 2021; MIDA 2022). • The top 100 companies in OGSE contributed RM5.3 billion in revenue (MPRC, 2021).	Need more talents to address the growth in the industry	Need skilled and semi-skilled talents workers to address continued growth in the industry. • 60,000 in the OGSE industry in 2030 (EPU, 2021)
Increase in Production		
Increased production and demand for liquified natural gas (LNG) despite a decline in output of crude oil and condensates from slowdown in worldwide demand (MIDA, 2022). Increase in production of metallic minerals, including non-radioactive rare earths elements (NR-REE) and non-metallic minerals such as dolomite and silica (DMGM, 2021)	Need for reskilling talents to support processes for liquid natural gas (LNG) extraction and other minerals. • Zircon, rutile, ilmenite and NR-REE minerals for manufacturing of medical products, rechargeable batteries and	Need for new skilled and semi-skilled talents/ upskilling of talents for innovation in extraction of LNG and production of minerals • Clean energy practices will encourage use of LNG • Electric and Hybrid vehicles require NR-REE • Increase in use of solar energy results

Description	Current Need	Future Need
	other electronics products. • Dolomite and silica for manufacturing	in increase in demand for silica.
Sustainability		
The preservation of the environment and natural resources is emphasised for environmental sustainability • Malaysia net zero carbon target by 2050 in the 12th Malaysia Plan • National Energy Policy 2022-2040 • United Nations Sustainable Development Goals (SDGs). • Incentives are given to companies which practice sustainable practices.	Talents who are skilled in adoption of sustainability standards to reduce impact of the industry to environment is needed. Talents skilled and semi-skilled in low carbon development, resource efficiency and the preservation of environment and natural resource sustainability is required.	Skilled and semi-skilled talents for application of green technology principles • OGSE companies adopting sustainability practices and incorporating sustainability indices (EPU, 2021) • Circular economy and urban mining • Social and environmental impacts need to be considered (Xavier et al., 2021)
Technologies in the industry		
Robotics, automation and digital technologies • Value creation and cost-effective in upstream and downstream processes • Remote work and automation for enhancing decision-making	Talents need to be upskilled in **contemporary data and digital technologies** • Occupations are redesigned (remote vehicle operators and geologists) Talents require **high level of data and digital literacy skills** • Occupations related to machines integrated to remote operating centres.	Upskilling talents to have the capabilities to respond to **the digital transformation** and the "**volatile changes in external environments**" in the future of work. This require shifting the mindset and developing new capabilities. • High technology development and innovation activities for increase in OGSE patents filed by local inventors (EPU, 2021)

In Chapter 2, the stakeholders for the **B09 Mining Support Service Activities** industry have been identified. Industry players, government agencies, training and educational institutions, and certification bodies are important stakeholders.

(a) The government has a critical role in the development and growth of the B09 industry as policies, regulations, and financial incentives are provided to support the industry's growth and development. Some of the **policy and regulatory frameworks** that affect the B09 industry are The National Mineral Industry Transformation Plan (TIM) 2021-2030 and the National OGSE Industry Blueprint 2021-2030. These plans influence **sustainability practices**, and place importance on the preservation of the environment and natural resources. Compliance with these regulations is necessary but may require resources to be assigned to these activities.

(b) Educational institutions which provide training in the mining support activities are important stakeholders for the B09 industry. These institutions would provide the **necessary training for talents as well as upskilling and reskilling existing talents**. This is important as talents are needed to fill the gap for the mining industry. Workers in the B09 industry need to be trained to be skilled in **sustainability practices** applied in the industry. In addition, new technologies are influencing processes in the industry and talents with **digital skills** are required to meet the demand of the industry. Hence, educational institutions keep up to date with the policies and demands of the industry. There is a need to strengthen the link between educational institutions and industry players to ensure that the training being offered is relevant and up-to-date.

In summary, more talents will be needed for occupations in **B09 Mining Support Service Activities** industry as a result of the economic growth in the mining industry.

a) **Workers who are skilled and semi-skilled are required to ensure continued growth.** The increased production and demand of specific minerals and liquefied natural gas (LNG) is to meet the demand from manufacturing and other industries. New skills are required to meet the production demands. The skills for processing LNG differ from crude oil and hence, workers need to be reskilled to meet the manpower demand.
b) **Ensuring green and sustainable practices in the industry also has an impact on manpower demand.** New jobs need to be created in other to ensure environmental health and safety. New talents for green technology practices and to support the circular economy in the industry are required.
c) **Emerging technologies have also had an impact in the mining industry as the move towards automation and robotics**. This is prominent in the Oil and Gas industry. New jobs are being created and talents need to acquire high levels of digital skills for this purpose.
   A move towards more automation in the mining and quarrying may be seen in the future as digital technologies and the Internet of Things (IoT) are important for monitoring processes and for predictive analytics which are important for decision-making. These

technologies for important for monitoring processes related to production as well as occupational health and safety of the environment.

In conclusion, the **B09 Mining Support Service Activities** industry is impacted by various stakeholders, policies, and regulations, and there is a need for collaboration among all stakeholders to ensure the industry's sustainable growth and development.

4.3 Occupational Structure (OS)

The Occupational Structure (OS) refers to the aggregate distribution of occupations in society, defined by skill level, economic function, or social rank. The OS for groups B091 and B099 were developed from the Focus Group Discussion (FGD1, FGD2 and FGD3) with the panel of experts from the B09 industry.

Table 4.2 summarizes the overall number of job titles in B09 group. 12 job areas managed to be listed during the FGD, with 47 overall job titles were identified, 10 critical job titles which were also relevant to industrial revolution within the industries in the Mining Support Service Activities.

Based on the FGDs with the panel of experts, there are 12 major areas involved in the **B09 Mining Support Service Activities** industry.

Critical jobs were also included which are jobs which involves specific skills, work processes or technologies that are needed by the industry (TalentCorp, 2022). These are jobs which are skilled, sought-after and strategic jobs. This are different from **Jobs in Demand** which are the jobs and job areas which have a high manpower shortage.

Table 4.2: Overall Job Areas and Titles in B09: Mining Support Service Activities

Occupational Structure (OS)	**Total Identified Job Areas**	**Total Identified Job Titles**	**Total Job Titles Relevant to Industrial Revolution**	**Total Critical Job & Relevant to Industrial Revolution**
B091: Support Activities for Petroleum and Natural Gas Extraction - Oil & Gas Extraction / Refinery process Off Shore (Platform) & on FLNG Tanker	8	30	12	10
B099: Support Activities for Other Mining and Quarrying	4	17	8	0
TOTAL	**12**	**47**	**20**	**10**

4.4 Group 091: Support Activities for Petroleum and Natural Gas Extraction

The findings in this section are obtained from the Focus Group Discussions and Interviews will cover Group 091: Support Activities for Petroleum and Natural Gas Extraction, under Division B09 of MSIC 2008. The following objectives are discussed:

Objective 2: To identify the job areas, job titles and job classifications according to the definitions and levels of NOSS in B09

Objective 3: To identify the responsibilities and job descriptions for each job title

Objective 4: To identify the critical job and the job description for B09 related to current developments in the industry

Objective 5: To analyse the competency needed to address the demand and supply of the industry in Malaysia

4.4.1 Objective 2: To identify the job areas, job titles and job classifications according to the definitions and levels in B09 .

4.4.1.1 Job Areas for B091: Support Activities for Petroleum and Natural Gas Extraction

The group B091: Support Activities for Petroleum and Natural Gas Extraction comprises of eight (8) major job areas that are essential support service activities for mining and quarrying were identified and defined during the FGD. The job areas are as follows:

1. O&G Geoscience Site Prospecting	Process for determining the potential petroleum reservoirs for drilling hydrocarbons based on the earth's surface data through traditional prospecting methods such as geological observations.
2. O&G Engineering Site Prospecting	Process for determining potential sites for efficient and cost-effective production at potential petroleum reservoir sites which were identified through traditional prospecting methods.
3. O&G Test Drilling Processes	The drilling process after exploration to determine the exact site for well construction. This includes directional drilling and redrilling, "spudding in", derrick erection in site, repairing and dismantling, pumping of wells, plugging and abandoning wells
4. O&G Well Casing Operations	The process of casing to maintain the well's structural integrity, preventing it from caving in or collapsing due to the high pressure and unpredictable geological conditions encountered during drilling and production.
5. O&G Well Cementing Operations	Cementing process is to remove any drilling fluids in the well and to avoid any mixture from the water underneath and the oil that will be drilled. Both well casing and cementing runs together during the well drilling.
6. O&G Fluid Services	The process of pumping the mud and other fluids during the drilling process to clear the wells of rocks and other fragments,

		and to extract samples for analysis for oil production. This process ensures the well pressure is maintained and prevents blowouts and other dangerous situation.
7.	O&G Liquefaction and Regasification Operations	The process of liquefaction and regasification of natural gas for purpose of transport, done at the mine site. This process is specific to offshore liquefaction and regasification operation e.g. FLNG.
8.	O&G Fire Fighting Services (Onshore)	Firefighting services for onshore refineries is provided by a firefighting rescue team. However, the first responders are the personnel themselves (the Emergency Response Team (ERT)) who are required to act before the in-house firefighting team arrives. (Firefighting services on the platform is done by the personnel on the platform and no service providers are involved).

O&G Site Prospecting was divided into two areas which are O&G Geoscience Site Prospecting and O&G Engineering Site Prospecting as the responsibilities of the jobs in these areas differ. O&G Geoscience Site Prospecting focuses on prospecting based on geological observations and do not include seismic surveying which is under division M71, while O&G Engineering Site Prospecting focuses on the engineering aspects of prospecting. As a result, the job titles in these job areas are at the executive level and there are no job titles at the middle skilled level.

4.4.1.2 Job areas and Occupational Structure for B091: Support Activities for Petroleum and Natural Gas Extraction

The OS of the B091 group is tabulated, presented, and summarised from Table 4.3 to Table 4.5, which present the overall job areas and job title. In the table are also shown critical job titles (marked with *), job titles relevant to Industrial Revolution (marked with **) as well as critical job titles which are relevant to the Industrial Revolution (marked with ***), as identified during FGD3. The mapping of existing NOSS to the job titles was tabulated in Table 4.6.

The occupation is considered critical if they are skilled, sought-after, and strategic (TalentCorp, 2022). Critical jobs are jobs which involves specific skills, work processes or technologies that are needed by the industry. The critical jobs were identified through the FGD session. According to TalentCorp (2022), sought-after means that demand for an occupation or job title exceeds the supply of appropriately qualified workers. This may occur despite efforts on the part of employers to satisfy the demand. Jobs in demand are jobs which are not easily filled.

In the OS, the Site Manager designs the overall exploration strategy for the O&G Site Prospecting, which is divided into Geoscience and Engineering Site Prospecting. The job titles in these areas are only at the executive level and there are no job titles at the middle skilled level. In addition, the Drilling Superintendent, Senior Drilling Engineer and Senior Drilling Engineer are responsible for the drilling processes in preparation of the well design,

which comprises three job areas: Test Drilling Processes, Well Casing and Cementing Operations.

O&G Fire Fighting Services is a job area for onshore services. The Emergency Response Team (ERT)) in both onshore and offshore are required to take immediate action. However, the firefighting services on the offshore platform is done by the personnel due to the urgent nature of such emergencies and the remote locations, there are no external service providers.

The OS excludes the processes related to geophysical, geologic and seismic surveying as it is covered in Division M 71: Architectural and engineering activities; technical testing and analysis; Group 711: Architectural and engineering activities and related technical consultancy, Item 71103: Land surveying services. Hence, the **exploration services** in connection with petroleum or gas extraction is limited to the traditional prospecting methods, such as making geological observations at prospective sites, which is the initial phase of exploration.

The OS excludes areas such as **Offshore Platform Design**, **Pipeline Fabrication** as these are related to Engineering design and is covered in Division M 71: Architectural and engineering activities; technical testing and analysis, Group 711: Architectural and engineering activities and related technical consultancy. In addition, **Asset Inspection**, **Instrument & Control Services** and **O&G Quality, Health, Safety and Environment** (QHSE) are covered in Division M 71: Architectural and engineering activities; technical testing and analysis, Group 712: Technical testing and Analysis. Hence, these job areas are not within the scope of B09.

As for **Liquefaction and Regasification Operations**, it is limited to the process of liquefaction and regasification of natural gas for purpose of transport, done at the mine site. The LNG technology is an environmentally-sensitive way to develop natural gas resources. PETRONAS' first floating liquefied natural gas (LNG) facility, PFLNG SATU is in offshore Sarawak. Offshore refineries, such as PFLNG SATU are designed for water-depths between 70 metres to 200 metres deep and a processing capacity of 1.2 million tonnes per annum (mtpa) with 145 crew onboard (PETRONAS (2016, 15 May). The job area focuses on the Offshore Refineries such as PFLNG SATU, as it is done at the mine site. The "liquefaction and regasification of natural gas for purpose of transport, done off the mine site via pipeline" is covered in Division C19: Manufacture of Coke and Refined Petroleum, Products, Group 192: Manufacture of refined petroleum products, Item 19201: *Manufacture of refined petroleum products* in the MSIC 2008. This refers to LNG in the Oil and Gas industry from Onshore Refineries e.g. MLNG, Bintulu Sarawak, and is not in the scope of B09.

The job titles are related to the industrial revolution as digital technologies have influenced the field. Robotics, remote operations and Internet of Things (IoT) are influencing the field. Applications that capture real-time data such as DRTOS [Drilling Real Time Operations System] for real-time software and hardware platform that enable different parties to make use of drilling operations data are being used. Remote Operations Vehicles (ROV) are also used extensively. PETRONAS has been innovating technology solutions, which will be discussed in the later section (PETRONAS Technology Ventures Sdn Bhd, 2023).

Table 4.3. Occupational Structure for B091 for Support Activities for Petroleum and Natural Gas Extraction

JOB AREAS	O&G ENGINEERING SITE PROSPECTING	O&G GEOSCIENCE SITE PROSPECTING	O&G TEST DRILLING PROCESSES	O&G WELL CASING	O&G CEMENTING OPERATIONS
Level 8	NJT	NJT	NJT	NJT	NJT
Level 7	Site Manager		Drilling Superintendent		
Level 6	Senior Petroleum Engineer***	Senior Geoscience***	Senior Drilling Engineer***		
Level 5	Petroleum Engineer***	Geoscience***	Drilling Engineer***		
Level 4	NJT	NJT	Senior Derrickman	Senior Casing Technician	Senior Cementing Operator
Level 3	NJT	NJT	Derrickman	Casing Technician	Cementing Operator
Level 2	NJT	NJT	Roughneck		NJT
Level 1	NJT	NJT	NJT	NJT	NJT

JOB AREAS	O&G FLUID SERVICES	O&G LIQUEFACTION AND REGASIFICATION OPERATIONS	O&G FIRE FIGHTING SERVICES (ONSHORE)
Level 8	NJT	NJT	NJT
Level 7	Pump Superintendent	Superintendent	Chief Fire Officer
Level 6	Senior Pump Engineer***	Senior Operations Engineer***	Leading Fireman
Level 5	Pump Engineer***	Operations Engineer***	Fire Station Officer
Level 4	Senior Pump Technician**	Panel Operator Technician	Fireman
Level 3	Pump Technician**	Field Operator	NJT
Level 2	Pump Operator	NJT	NJT
Level 1	NJT	NJT	NJT

*Critical Jobs **Jobs related to technology and industrial revolution ***Critical Jobs related to technology and industrial revolution NJT: No Job Title

Table 4.4. Summary of Job Titles in B091

Job Area	**Job Level**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
O&G Engineering Site Prospecting	NJT	NJT	NJT	NJT	1	1	1	NJT
O&G Geoscience Site Prospecting	NJT	NJT	NJT	NJT	1	1		NJT
O&G Test Drilling Processes	NJT	1	1	1	1	1	1	NJT
O&G Well Casing Operations	NJT		1	1				NJT
O&G Well Cementing Operations	NJT	NJT	1	1				NJT
O&G Fluid Services	NJT	1	1	1	1	1	1	NJT
O&G Liquefaction and Regasification Operations	NJT	NJT	1	1	1	1	1	NJT
O&G Fire Fighting Services (Onshore)	NJT	NJT	NJT	1	1	1	1	NJT

Table 4.5. Summary of Job Titles at Each level in B091

	Job Level							
Details	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Identified Job Titles (Per Level)	0	2	5	6	6	6	5	0
Total Identified Job Titles	**30**							
Critical Job Titles (Per Level)	0	0	0	0	5	5	0	0
Total Critical Job Titles	**10**							
Job Titles Relevant to Technology & The Industrial Revolution (Per Level)	0	0	1	1	5	5	0	0
Job Titles Relevant to Technology & The Industrial Revolution (Total)	**12**							

Table 4.6. Occupational Structure for B091 Mapping Current OS with Existing NOSS

JOB AREAS	O&G ENGINEERING SITE PROSPECTING	O&G GEOSCIENCE SITE PROSPECTING	O&G TEST DRILLING PROCESSES	O&G WELL CASING	O&G CEMENTING OPERATIONS
Level 8	NJT	NJT	NJT	NJT	NJT
Level 7	Site Manager		Drilling Superintendent		
Level 6	Senior Petroleum Engineer***	Senior Geoscience***	Senior Drilling Engineer***		
Level 5	Petroleum Engineer***	Geoscience***	Drilling Engineer***		
Level 4	NJT	NJT	Senior Derrickman	Senior Casing Technician	Senior Cementing Operator
Level 3	NJT	NJT	Derrickman	Casing Technician	Cementing Operator
Level 2	NJT	NJT	Roughneck		NJT
Level 1	NJT	NJT	NJT	NJT	NJT

JOB AREAS	O&G FLUID SERVICES	O&G LIQUEFACTION AND REGASIFICATION OPERATIONS	O&G FIRE FIGHTING SERVICES (ONSHORE)
Level 8	NJT	NJT	NJT
Level 7	Pump Superintendent	Superintendent	Chief Fire Officer
Level 6	Senior Pump Engineer***	Senior Operations Engineer***	Leading Fireman
Level 5	Pump Engineer***	Operations Engineer***	Fire Station Officer *Fire Rescue and Hazmat Supervision (Oil, Gas & Petrochemical) OG-024-5:2014*
Level 4	Senior Pump Technician**	Panel Operator Technician	Fireman *Fire Rescue and Hazmat Supervision (Oil, Gas & Petrochemical) OG-024-4:2014*
Level 3	Pump Technician**	Field Operator	NJT
Level 2	Pump Operator	NJT	NJT
Level 1	NJT	NJT	NJT

**Critical Jobs **Jobs related to technology and industrial revolution ***Critical Jobs related to technology and industrial revolution NJT: No Job Title*

4.4.2 Objective 3: To identify the responsibilities and job descriptions for each job title

4.4.2.1 Job Responsibilities for B091

This findings from the focus group discussions (FGD) with the panel of experts from the industry, interviews with experts from the industry and document analysis was used to determine the responsibilities and job descriptions in order to address Objective 3.

Occupational responsibility (OR) is the duty or obligation to satisfactorily perform or complete a task (assigned by someone or created by one's own promise or circumstances) that one must achieve and for which failure has a penalty. The OR describes the primary scope of work for the job titles listed in the Occupational Structure (OS).

In this section, the operational responsibilities (OR) for all job titles in the B091 are described and discussed according to their respective job areas and levels. The job titles that are primarily responsible for the main functions within these industries will be explained in further detail.
The OR will serve as the future reference for the development of the National Occupational Skills Standard (NOSS) for Group B091: Support Activities for Petroleum and Natural Gas Extraction for occupation under the MSIC 2008. The OR for the job titles in this study are tabulated in Table 4.7 and Table 4.8.

Table 4.7: Occupational Responsibilities for Job Areas in B091 (Part 1)

JOB AREAS	O&G ENGINEERING SITE PROSPECTING	O&G GEOSCIENCE SITE PROSPECTING	O&G TEST DRILLING PROCESSES	O&G WELL CASING	O&G CEMENTING OPERATIONS
Level 8	NJT		NJT	NJT	NJT
Level 7	**Site Manager** • Design a comprehensive exploration strategy based on data analysis for advanced petroleum engineering and geoscience research. • Provide expert guidance and decision-making for exploration projects. • Critically analyse, evaluate and synthesize new, complex and abstract ideas and current critical issues based on the geological research done. • Manage resources and timeline for entire oil and gas operations.		**Drilling Superintendent** • Develop the program and strategy for managing the engineering team for preparation of Well Design and Drilling in accordance with the necessary approvals or authorities. • Implement and monitor the test drilling program • Provide expert guidance on all drilling and well construction activities at the well-site. • Manage and coordinating Emergency Response Team actions to ensure all tasks and duties have been delegated to ensure proper action, during incidents. • Identify and deal with team and individual signs of stress during incidents. • Lay down and maintain effective lines of communication with the Emergency Response Teams, the Central Emergency Control Room and others.		
Level 6	**Senior Petroleum Engineer** • Make decision to determine resource potential from analysis of well-logging results (records of the geological formations located by drilling	**Senior Geoscience** • Evaluate the potential for oil and gas reserves or prospects in specific areas based on the thorough analysis of data such as well logs and core samples.	**Senior Drilling Engineer** • Design directional well paths (horizontally or multi-laterally, as appropriate to the situation. . • Design the conceptual field development plans. • Design the drilling programmes, taking account of desired production flow rates. • Evaluate the commercial viability of the well and monitors progress during drilling. • Make decision based on engineering analysis on site and recommends necessary actions.		

JOB AREAS	O&G ENGINEERING SITE PROSPECTING	O&G GEOSCIENCE SITE PROSPECTING	O&G TEST DRILLING PROCESSES	O&G WELL CASING	O&G CEMENTING OPERATIONS
	boreholes) to ascertain resource potential. • Ascertain extraction risks in exploration areas (e.g. potential for earthquakes.) • Provide advice to technical staff on potential of sites for exploration. • Solve problems at the site based on progress and records of the site.	• Interpret complex geological and geophysical data to identify optimal drilling locations and potential reservoirs. • Estimate reservoir size, fluid properties, and production potential from detailed reservoir characterization studies. • Apply latest advancements in geological exploration and presentation/ simulation techniques, tools, and software to enhance efficiency and accuracy in analysis and interpretation.	• Ensure environmental protection standards are adhered to and compliant with local governments legislative requirements.		

JOB AREAS	O&G ENGINEERING SITE PROSPECTING	O&G GEOSCIENCE SITE PROSPECTING	O&G TEST DRILLING PROCESSES	O&G WELL CASING	O&G CEMENTING OPERATIONS
Level 5	**Petroleum Engineer** • Design methods of extraction of oil and gas safely and efficiently using specialist computer applications and mathematical models. • Make decision in suitable equipment for making analysis and maintaining the equipment. • Monitor and evaluate the performance of extraction sites from the analysis of geological data during extraction.	**Geoscience** • Develop exploration strategies and plans in collaboration with multidisciplinary teams, including engineers, geophysicists, and drilling specialists. • Evaluate and monitor reservoir performance through the analysis of production data and geological models • Ensure compliance with health, safety, and environmental regulations throughout all geological operations. • Generate accurate geological maps, cross-sections, and	**Drilling Engineer** • Undertake engineering design and the planning of wells as well as development work. • Design and selects well-head equipment suitable for drilling at the site. • Monitor the well to ensure the safety and good maintenance of well operations during test drilling. • Makes decision based on engineering analysis of data on site and recommends necessary actions.		

JOB AREAS	O&G ENGINEERING SITE PROSPECTING	O&G GEOSCIENCE SITE PROSPECTING	O&G TEST DRILLING PROCESSES	O&G WELL CASING	O&G CEMENTING OPERATIONS
		models to aid in decision-making and resource estimation			
Level 4	NJT	NJT	**Senior Derrickman** • Secure the foundation and the connection between the pipes at the well. • Monitor the pressure, density, concentration based on the gauge reading • Adjust pumps and drilling based on the reading of the gauges. • Monitors and records the mud volume and density and makes adjustments	**Senior Casing Technician** • Maintain the safe operation of all equipment for casing running tools and machinery. • Identify operational issues related to building, operating, and dismantling drilling rig equipment to be solved	**Senior Cementing Operator** • Calculate the amount of cement mix and additives required, using the depth, pressure, volume of cement required and specific purpose in their calculations. • Troubleshoot problems faced when using the cementing equipment • Monitor to ensure maintenance and repair is done, as required. • Maintain the bulk equipment and bulk plant. • Train Cementing Operator in the proper performance of pre-trip and post-trip vehicle inspections and

JOB AREAS	O&G ENGINEERING SITE PROSPECTING	O&G GEOSCIENCE SITE PROSPECTING	O&G TEST DRILLING PROCESSES	O&G WELL CASING	O&G CEMENTING OPERATIONS
					associated paperwork and/or reports.
Level 3	NJT	NJT	**Derrickman** • Secure the connection and alignment between the pipes. • Transport drills and services rigs, and set up pipes under terrain surface or on the lower deck. • Maintain drilling equipment like drilling rig diesel motors, mud systems of the pumps • Optimize drilling tools, chemical mix mud, cements and additives, and transmissions. • Calculate oil and mud volume and density for reporting.	**Casing Technician** • Operate different casing running tools and machinery, such as power tongs, elevators, control panels, power slips, and hydraulic power units. • Able to build, operate, and dismantle drilling rig equipment.	**Cementing Operator** • Operate cement pumping and mixing equipment, such as blenders, liquid additive metering systems, centrifugal pumps and data acquisition systems. • Implements the rigging-up and rigging-down of cementing service equipment on work locations • Transport equipment to and from the well location, safety rig • Operate the equipment for day-to-day inspections • Service and maintain equipment for operations.

JOB AREAS	O&G ENGINEERING SITE PROSPECTING	O&G GEOSCIENCE SITE PROSPECTING	O&G TEST DRILLING PROCESSES	O&G WELL CASING	O&G CEMENTING OPERATIONS
Level 2	NJT	NJT	**Roughneck** • Able to connect and disconnect joints of drill pipe, control the drilling machinery, and monitor drilling mud. • Maintain the drilling equipment and ensuring that it is in good working order. • Clean, lubricate, and repair machinery, as well as conduct regular inspections to identify potential issues before they become major problems. • Adhere to safety policies and practices to avoid hazardous materials and potential dangers in their working environment, such as gas leaks, fires, and equipment failures. • Maintain a clean and organized work area to reduce the risk of accidents and injuries.		NJT
Level 1	NJT	NJT	NJT	NJT	NJT

Table 4.8: Occupational Responsibilities for Job Areas in B091 (Part 2)

JOB AREAS	O&G FLUID SERVICES	O&G LIQUEFACTION AND REGASIFICATION OPERATIONS	O&G FIRE FIGHTING SERVICES (ONSHORE)
Level 8	NJT	NJT	NJT
Level 7	**Pump Superintendent** • Design and coordinates the planning, and operations strategies while obtaining all necessary approval or authority from the company. • Develop strategies to ensure adherence to project schedules and budgets • Design a schedule to maintain resources to align with productivity.	**Superintendent** • Develop the program and strategy to maintaining a safe and efficient workover operations. • Develop and implements complex and high-value programs for Liquefaction and Regasification operations • Design strategies to manage the Liquefaction and Regasification operations according to the budget, time and productivity.	**Chief Fire Officer** • Plan and direct the establishment and implementation of a competent fire and rescue emergency response. • Develop operational strategies for all areas under the jurisdiction of the designated refinery, in accordance with National and International standards. • Conduct effective fire risk management programs to identify the various hazards and take the necessary measures to ensure the fire department response meets the current and future needs to manage those identified risks.
Level 6	**Senior Pump Engineer** • Coordinate with project managers to align pump activities with overall project goals.	**Senior Operations Engineer** • Monitor projects to ensure pre-determined objectives concerning quality, technical specifications, reliability, schedule and budget are achieved.	**Leading Fireman** • Perform duties as a crew commander and integral part of a team responding to fires, rescues and other emergency situations to

JOB AREAS	O&G FLUID SERVICES	O&G LIQUEFACTION AND REGASIFICATION OPERATIONS	O&G FIRE FIGHTING SERVICES (ONSHORE)
	• Design for pump operations to ensure that it is always updated to industry regulations and guidelines, for safety, and environmental protection. • Monitor to ensure that any actions and operations comply with applicable standards, permits, and legal requirements.	• Evaluate project progress and recommends to management any schedule changes, cost and resource adjustments that are required to meet company objectives. • Obtain, oversee, integrate and coordinate internal and external resources necessary to ensure materials and equipment are delivered on time. • Implement project work consistent with the Company's safety and procurement policies and programs.	prevent escalation as quickly as possible. • Participate in drills and exercises within the community developing competencies as individual and as a team to the benefit of the community and within a safe working environment. • Assist the Sub Officer to direct and guide the shift in the performance of routine and non-routine duties, including emergency operations, exercises, drills, emergency vehicle operation and preparedness activities.
Level 5	**Pump Engineer** • Maintain accurate records of pump operations, maintenance activities, and any incidents or repairs. • Generate reports detailing pump performance, maintenance schedules, and inventory of spare parts.	**Operations Engineer** • Develop and incorporates applicable Standards, Procedures, and State/Federal statutory requirements into Gas systems designs. • Incorporates process safety procedures into the project work flow as required. • Define work methods, lead and manage systems upgrades for	**Fire Station Officer** • Provide safe work atmosphere to all employees regarding health and safety of workers. • Provide the updated rules and regulations of health and safety to all employees in organization. • Train employees on health and safety regulations as well as

JOB AREAS	O&G FLUID SERVICES	O&G LIQUEFACTION AND REGASIFICATION OPERATIONS	O&G FIRE FIGHTING SERVICES (ONSHORE)
	• Collaborate with other operators, technicians, and supervisors as part of a team. • Performing tests on new pumps to ensure they are operating correctly before they are installed into the system	implementation of new technologies to ensure reliability and efficiency. • Ensures all project work is conducted in a manner consistent with the Company's safety and procurement policies and programs.	professional training related to industry, to ensure that they are able to use the safety equipment • Review risk assessment for all work equipment regularly. • Perform regular inspections on health and safety. • Maintain the equipment (fire alarm, fire extinguishers) and other safety clothing
Level 4	**Senior Pump Technician** • Diagnose and escalate issues such as pump inefficiency, motor failures, clogged pipes, or leaks. • Perform scheduled routine maintenance tasks such as lubrication, cleaning, and replacing worn-out parts. • Maintain accurate records of pump operations, maintenance activities, and any incidents or repairs. • Generate reports detailing pump performance,	**Panel Operator Technician** • Read and analyse specifications, schedules, logs, and test results to determine changes to equipment controls required to produce specified product. • Make observations on instruments, gauges, and meters to verify conformance to specified quality and quantity of product. • Inspect equipment and listens for automated warning signals to determine location and nature of	**Fireman** • Use sophisticated firefighting and rescue equipment. • Inspect and maintain equipment between uses, regularly • Promote fire safety through talks, advice and training sessions. • Inspect building for fire safety and enforcing safety standards • Perform practice drills. • Work closely with police and ambulance service personnel. • Undertake physical and academic training.

JOB AREAS	O&G FLUID SERVICES	O&G LIQUEFACTION AND REGASIFICATION OPERATIONS	O&G FIRE FIGHTING SERVICES (ONSHORE)
	maintenance schedules, and inventory of spare parts.	malfunction, such as leaks and breakage. • Repair, lubricate, and maintain equipment or reports malfunctioning equipment to supervisor to schedule needed repairs. • Compile and record operating data, instrument readings, documents, and results of laboratory analyses.	
Level 3	**Pump Technician** • Inspect and monitor pump systems, including pumps, motors, valves, and associated equipment, regularly • Perform routine maintenance tasks such as lubrication, cleaning, and replacing worn-out parts. • Identify the causes of the problem faced and implement appropriate corrective actions. • Perform equipment monitoring and maintenance.	**Field Operator** • Inspect equipment to ensure that it is working properly and takes measures to prevent accidents. • Inspect and repair pipelines, valves, and other equipment used in Liquefaction and Regasification operations. • Maintains equipment such as pumps, motors, pipes, valves, gauges, and meters to ensure that it is working properly.	NJT

JOB AREAS	O&G FLUID SERVICES	O&G LIQUEFACTION AND REGASIFICATION OPERATIONS	O&G FIRE FIGHTING SERVICES (ONSHORE)
	• Able to take appropriate actions to mitigate risks and minimize damage in the event of pump failures, leaks, or other emergencies	• Record production data such as oil and gas production levels, storage tank levels, and pipeline pressures. • Implement safety procedures to prevent accidents or injuries. • Respond to emergency situations such as fires, explosions, mechanical breakdowns, and spills.	
Level 2	**Pump Operator** • Operate and control various types of pumps to ensure the efficient and reliable flow of liquids or gases. • Able to start and stop pumps, adjust flow rates and pressures, and monitor performance indicators to maintain optimal pump operation. • Adhere to safety protocols and procedures to prevent accidents, injuries, and environmental hazards. Ensure that equipment is	NJT	NJT

JOB AREAS	O&G FLUID SERVICES	O&G LIQUEFACTION AND REGASIFICATION OPERATIONS	O&G FIRE FIGHTING SERVICES (ONSHORE)
	properly grounded, valves are secured, and safety devices are functional. • Able to communicate with relevant personnel, and may assist in containment or clean-up efforts.		
Level 1	NJT	NJT	NJT

4.4.3 Objective 4: To identify the critical job and the job description for B09 related to current developments in the industry

4.4.3.1 Critical Jobs

The critical jobs were identified based on the FGD3. The occupation is considered critical if it is skilled and strategic to the industry. The panel of experts agreed that **Petroleum Engineers, Senior Petroleum Engineers, Senior Geoscience** and **Geoscience** for **O&G Engineering Site Prospecting** and **O&G Geoscience Site Prospecting** are critical jobs. This is because for sustainability of the industry, the potential of new areas needs to be explored for possible reservoirs of petroleum crude and natural gas for the future.

Similarly, **Senior Drilling Engineers** and **Drilling Engineers** are critical jobs. The process of locating potential sites includes **O&G Test Drilling Processes**, **O&G Well Casing** and **O&G Cementing Operations.** The drilling engineers need to ensure safe processes are in place during the testing of the potential of the site for well construction, up to the pumping and abandonment of the wells.

In addition, the panel of experts agreed that the jobs for **Superintendent**, **Senior Operations Engineer**, and **Operations Engineer** for **O&G Liquefaction and Regasification Operations** are critical. This is important to ensure the efficiency and safety of the processes. This process is specific to offshore, such as in the Floating Liquid Natural Gas (FLNG). Natural gas is an important source of sustainable and clean energy for the future and needs to be considered.

However, the jobs of **Fluid Engineers** and **Fluid Technicians** for **O&G Fluid Services** is not considered critical jobs. Although these jobs may be important, there does not seem to be an urgent need for these jobs. In addition, there seems to be a sufficient number of talents in this area and there are many qualified in this area.

The experts considered **O&G Fire Fighting Services** for onshore as not being critical jobs. This is because each personnel have been specifically trained in firefighting as emergencies, should they arise, would be sudden and needs to be mitigated immediately with hardly any time to call for back-up. This is even more urgent offshore, as access is limited and hence, this responsibility offshore falls on the Drilling Superintendent. The ERT onshore is also important as they are responsible to take action before the in-house firefighting team arrives. For onshore O&G Fire Fighting Services, it is usually provided as a service (e.g. CEFS Response (Central Emergency & Fire Services Response) in Kerteh, Terengganu). Timing is crucial during emergencies and all personnel are equipped with fire safety trainings, with fire drills conducted every 2 weeks while on the platform. Hence, the jobs in this area, are not considered critical jobs. There are also sufficient number of talents in this area.

4.4.3.2 Emerging Skills

The findings on the emerging skills are based on the analysis of experts' opinions to identify the emerging skills and technologies in the industry.

In order to identify the current developments in the industry, the emerging skills were identified. Emerging skills are skills that are expected to be important to the industry in the near future based on recent events, trends, government policies, or research. This would include the technology revolution and issues of sustainability.

According to the experts, the future emerging skills that affect productivity of jobs in the Support Activities for Petroleum and Natural Gas Extraction are:

(1) Drawing / designing 3D
(2) Digital skills
(3) Designing artificial intelligent
(4) Design / Apply Robotics and Electronics

(1) Drawing / designing 3D

In the oil and gas industry, drawing and designing in 3D are particular important skills as providing possible plant layouts in design and creating plant 3D CAD models with modification and revision, as well as drawing and modelling geological structures.

(2) Digital skills

Digital skills are also required as digital tools are employed in almost all the processes to increase efficiency, using real time data for decision-making, for workplace safety and to minimize the carbon footprint of the industry. Applications that capture real-time data such as DRTOS [Drilling Real Time Operations System] for real-time software and hardware platform that enable different parties to make use of drilling operations data are being used. Hence, workers need to be familiar with technology and systems interfaces as input and monitoring may be done.

(3) Designing artificial intelligent

With the digital transformation for innovation, skills for **designing artificial intelligence** (AI), which is important for control of processes, with sensors to monitor and assist in making decisions. This is especially important to process the large amounts of data collected.

(4) Design / Apply Robotics and Electronics

Designing and applying robotics and electronics, for the automation of formerly traditional tasks such as painting. Robotics, remote operations and Internet of Things (IoT) are influencing the field. Remote Operations Vehicles (ROV) are also used extensively.

4.4.3.3 Occupations related to Technology

As for occupations related to technology, the experts noted the technologies in the industry to perform the jobs are as follows:

(1) Cybersecurity
(2) Internet of Things (IoT)
(3) System Integration
(4) Additive Manufacturing (3D Printing)

(1) Cybersecurity

For all the technology advancement to be implemented, a **secure cybersecurity** processes and infrastructure needs to be in place first. Hence, this is an important area of focus. In O&G organizations, cybersecurity is emphasised and all workers need to be aware of it.

(2) Internet of Things (IoT)

The **Internet of Things (IoT)** has been the focus as the need for automation and robotics for more efficient and safe processes. The integration of data for decision-making extends to the seamless use of machines for production.

(3) System Integration

With automation and IoT, the need for linkage among the different computing systems and software applications, or **systems integration**, is important to ensure smooth and efficient processes.

(4) Rapid prototyping

Rapid prototyping is for prototyping designs at various stages in an iterative manner, which is important for innovative designs and testing out new and innovative solutions.

These findings are in line with PETRONAS use of innovative technology. PETRONAS has categorised the innovative technology solutions affecting the field in the following areas:

(1) Digital, automation and robotic solutions e.g.. Secure Personnel Online Tracking (SPOT), Visual AI Solutions (AISC), UT Drone for Inspection at Height and PETRONAS Proprietary Technical Applications (TECH AppTM)
(2) Contaminant Removal and Management eg. Sep-iSYSTM: Integrated Separator Technology Under Low Pressure System, Sep-iSYSTM: Cyclonic Sand Removal Technology
(3) Material Integrity eg. Vibration Clamp and Non-Metallic Pipe (NMP)
(4) Process Solutions eg. Liquid Recovery System (LRS) and iCON (Process Simulation Software)
(5) Carbon, Capture, Utilisation & Storage (CCUS) eg. PN-1™: Multifibre Membrane for CO_2 Removal and Geopolymer Cement and Intelligent Circulation while Drilling (iCWD)
(6) Others eg. Systems such as Intelligent Circulation while Drilling (iCWD)
(PETRONAS Technology Ventures Sdn Bhd, 2023).

4.4.4 Objective 5: To analyse the competency needed to address the demand and supply of the industry in Malaysia

4.4.4.1 Jobs in Demand

The experts' opinion on the manpower shortage for the jobs in the industry was obtained. There was consensus on the high manpower shortage for certain jobs according to the expert's opinion. **Jobs in Demand** are the jobs and job areas which have a high manpower shortage which differ from critical jobs which refer to jobs which are skilled, sought-after and strategic jobs.

The panel of experts during the FGD3, deliberated on the jobs in demand for each job area of the OS. The jobs in demand are tabulated from Table 4.9 to Table 4.11, which present the overall job titles.

1 O&G Engineering Site Prospecting and O&G Geoscience Site Prospecting

Table 4.9: Jobs in Demand for O&G Engineering Site Prospecting and O&G Geoscience Site Prospecting

JOB AREAS	O&G ENGINEERING SITE PROSPECTING	O&G GEOSCIENCE SITE PROSPECTING
Level 8	NJT	
Level 7	Site Manager	
Level 6	Senior Petroleum Engineer*	Senior Geoscience*
Level 5	Petroleum Engineer***	Geoscience*
Level 4	NJT	NJT
Level 3	NJT	NJT
Level 2	NJT	NJT
Level 1	NJT	NJT

The jobs for Senior Petroleum Engineer, Petroleum Engineer, Senior Geoscience and Geoscience are in demand as there are few talents graduating in these areas at this moment.

2 O&G Test Drilling Processes, Well Casing and Cementing Operations

Table 4.10: Jobs in Demand for O&G Test Drilling Processes, Well Casing and Cementing Operations

JOB AREAS	O&G TEST DRILLING PROCESSES	O&G WELL CASING	O&G CEMENTING OPERATIONS
Level 8	NJT	NJT	NJT
Level 7	Drilling Superintendent		
Level 6	Senior Drilling Engineer***		
Level 5	Drilling Engineer***		
Level 4	Senior Derrickman	Senior Casing Technician	Senior Cementing Operator

JOB AREAS	O&G TEST DRILLING PROCESSES	O&G WELL CASING	O&G CEMENTING OPERATIONS
Level 3	Derrickman	Casing Technician	Cementing Operator
Level 2	Roughneck		NJT
Level 1	NJT	NJT	NJT

The jobs for Senior Drilling Engineer, and Drilling Engineer, are in demand according to the experts.

3 O&G Fluid Services and O&G Liquefaction and Regasification Operations.

Table 4.11: Jobs in Demand for O&G Fluid Services and O&G Liquefaction and Regasification Operations.

JOB AREAS	O&G FLUID SERVICES	O&G LIQUEFACTION AND REGASIFICATION OPERATIONS
Level 8	NJT	NJT
Level 7	Pump Superintendent	Superintendent
Level 6	Senior Pump Engineer***	Senior Operations Engineer***
Level 5	Pump Engineer***	Operations Engineer***
Level 4	Senior Pump Technician**	Panel Operator Technician
Level 3	Pump Technician**	Field Operator
Level 2	Pump Operator	NJT
Level 1	NJT	NJT

The jobs in demand are for Senior Operations Engineer, and Operations Engineer, are in demand according to the experts.

4 O&G Fire Fighting Services (Onshore)

Table 4.12: Jobs in Demand for O&G Fire Fighting Services

JOB AREAS	O&G FIRE FIGHTING SERVICES (ONSHORE)
Level 8	NJT
Level 7	Chief Fire Officer
Level 6	Leading Fireman
Level 5	Fire Station Officer
Level 4	Fireman
Level 3	NJT
Level 2	NJT
Level 1	NJT

None of the jobs in Firefighting services are in demand according to the experts.

4.4.4.2 Related Issues

Accordingly, the experts' opinions on the key issues affecting the workforce of the industry for Support Activities for Petroleum and Natural Gas Extraction was determined from the FGD3. The key issues that affected the workforce are as follows:

(1) Insufficient number of skilled workers
(2) Insufficient number of certified workers
(3) Underpayment of wages leads to high turnover
(4) Talent Gap among graduate
(5) Adaptation to technological changes
(6) Poor facilities and amenities for workers offshore.

4.4.4.3 Competency in Demand

In the OECD Learning Framework 2030, in order to develop the competencies, one needs to take action to develop knowledge, skills, attitudes and values (OECD 2018). Hence, in order to identify the competencies required in the industry, the areas of expertise, competencies in terms of knowledge, skills and attributes were determined.

The competences for Support Activities for Petroleum and Natural Gas Extraction were determined during the FGD3.

Knowledge

Accordingly, the experts' opinions on the Knowledge important to perform jobs for Support Activities for Petroleum and Natural Gas Extraction was determined from the FGD3.

Knowledge important to perform jobs for Oil & Gas support are as follows:

(1) Design
(2) Human Resource
(3) Public safety and Security
(4) Administration and Management
(5) Physics
(6) Mathematics and Statistics
(7) Chemistry

Knowledge of design techniques, tools, and principals involved in production of precision technical plans, blueprints, drawings, and models. This is considered important area of knowledge as the engineers and technicians need to be able to produce designs.

(1) Human Resource

Knowledge of principles and procedures for personnel recruitment, selection, training, compensation and benefits, labour relations and negotiation, and personnel information systems.

This is considered important as the workers need to be aware of their benefits when working offshore, as well as to know the benefits for their team members.

(2) Public safety and Security

Knowledge of relevant equipment, policies, procedures, and strategies to promote effective local, state, or national security operations for the protection of people, data, property, and institutions. In the O&G industry, every member of the team needs to know the safety procedures and needs to be able to be a first responder at the scene during an incident.

(3) Administration and Management

Knowledge of business and management principles involved in strategic planning, resource allocation, human resources modelling, leadership technique, production methods, and coordination of people and resources. Working in teams in an efficient manner is important for this area.

(4) Physics

Knowledge and prediction of physical principles, laws, their interrelationships, and applications to understanding fluid, material, and atmospheric dynamics, and mechanical electrical, atomic and sub-atomic structures and processes. All the engineering and technical disciplines require this knowledge.

(5) Mathematics and Statistics

Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications. Many of the jobs require calculations to be done.

(6) Chemistry

Knowledge of the chemical composition, structure, and properties of substances and of the chemical processes and transformations that they undergo. This includes uses of chemicals and their interactions, danger signs, production techniques, and disposal methods. The knowledge particular to hydrocarbons is needed.

Knowledge on Human Resource as well as Administration and Management were considered important when deal with the team members for the tasks and activities. The experts from the FGD3 were of the opinion that these knowledge was important at every job level as all the staff needed to know human resource, and administration and management.

Skills

In the OECD (2018) Learning Framework 2030, a broad range of skills will be required including **cognitive and meta-cognitive skills** (e.g. critical thinking, creative thinking, learning to learn and self-regulation); **social and emotional skills** (e.g. empathy, self-efficacy and collaboration); and **practical and physical skills** (e.g. using new information and communication technology devices) which are needed to engage with the world.

As for Skills to perform the jobs for Oil & Gas support, the experts agreed that the skills are as follows:

(1) Self-improvement
(2) Leadership
(3) Coordination
(4) Critical thinking
(5) Judgement and decision-making
(6) Quality control
(7) Trouble shooting
(8) Communication
(9) Time Management
(10) Active Learning
(11) Systems Analysis
(12) Complex Problem Solving
(13) Instructional strategies
(14) Performance measures
(15) Mentoring
(16) Writing workplace documents
(17) Equipment Monitoring

The elaboration of the skills are as follows:

(1) Self-improvement

Monitoring/Assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action.

(2) Leadership

Motivating, developing, and directing people as they work, identifying the best people for the job.

(3) Coordination

Adjusting actions in relation to others' actions

(4) Critical thinking

Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, or approaches to problems.

(5) Judgement and decision-making

Considering the relative costs and benefits of potential actions to choose the most appropriate one

(6) Quality control

Conducting tests and inspections of products, services, or processes to evaluate quality or performance.

(7) Trouble shooting

Determining causes of operating errors and deciding what to do about it

(8) Communication

Talking to others to convey information effectively.

(9) Time Management

Managing one's own time and the time of others

(10) Active Learning

Understanding the implications of new information for both current and future problem-solving and decision-making

(11) Systems Analysis

Determining how a system should work and how changes in conditions, operations, and the environment will affect outcomes.

(12) Complex Problem Solving

Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.

(13) Performance measures

Identifying measures or indicators of system performance and the actions needed to improve or correct performance, relative to the goals of the system.

(14) Mentoring

Teaching others how to do something.

(15) Writing workplace documents.

Understanding written sentences and paragraphs in work-related documents.

(16) Equipment Monitoring

Watching gauges, dials, or other indicators to make sure a machine is working properly

The list includes **technical skills** to perform the jobs such as Performance measures and equipment monitoring as well as **cognitive skills** such as problem solving, **social and emotional skills** such as communication, and **practical skills** such as time management.

Details on these skills would vary according to the job areas and can be seen in the Occupational Descriptions for B091(see Appendix 4.3).

Attribute/ Attitude

As for attributes to perform the jobs for Oil & Gas support services, the experts agreed on the attributes are as follows:

(1) Teamwork

(2) Professionalism
(3) Work Ethics
(4) Initiative and innovation
(5) Self-management/ independent
(6) Analytical thinking
(7) Career-management (career path and individual development, succession planning)
(8) Attention to details
(9) Self-learning
(10) Dependability (Trustworthy & Reliable)
(11) Agility (Ability to think and understand quickly)
(12) Major changes in traditional training and new skills requirements

Existing NOSS

Currently, there are 34 NOSS that has been developed that are categorized under B091 group in MySPIKE. However, mapping to the existing job areas have shown that only two (2) NOSS related to the job areas, as shown in Table 4.6. The NOSS are mapped under divisions related to M 71: Architectural and engineering activities; technical testing and analysis; Division B06: Extraction of Crude Petroleum and Natural Gas, and Division F43: Specialized Construction Activities. In addition, one of the NOSS for firefighting services does not map to any job title. The details in the mapping is shown in Table 4.13.

Table 4.13: Mapping of Existing NOSS to Job Areas in MSIC 2008

Name and NOSS Code	O&G Job Area	Explanation
1. Pengurusan Operasi & Penyelenggaraan Paip / B091-001-5:2017	Pipeline Fabrication	Engineering design is covered under Division M 71: Architectural and engineering activities; technical testing and analysis, Group 711: Architectural and engineering activities and related technical consultancy
2. Penyeliaan Operasi & Penyelenggaraan Paip / B091-001-4:2017	Pipeline Fabrication	
3. Pengurusan Rekabentuk Perpaipan (Minyak & Gas) / OG-022-5:2013	Pipeline Fabrication	
4. Rekabentuk Perpaipan (Minyak & Gas) / OG-022-4:2013	Pipeline Fabrication	
5. Piping Drafting (Oil & Gas) / OG-022-3:2013	Pipeline Fabrication	
6. Operasi Fabrikasi dan Pemasangan Paip Minyak & Gas / OG-035-3:2016	Pipeline Fabrication	
7. Operasi Fabrikasi dan Pemasangan Paip Gas Domestik / OG-035-2:2016	Pipeline Fabrication	

Name and NOSS Code	O&G Job Area	Explanation
8. Rekabentuk Struktur Luar Pesisir Pantai (Oil & Gas) / OG-020-5:2012	Offshore Platform Design	Pipeline design is covered under Division M 71: Architectural and engineering activities; technical testing and analysis, Group 711: Architectural and engineering activities and related technical consultancy
9. Rekabentuk Struktur Luar Pesisir Pantai (Oil & Gas) / OG-020-4:2012	Offshore Platform Design	
10. Lukisan Kejuruteraan Teknikal Struktur (Oil & Gas) / OG-020-3:2012	Offshore Platform Design	
11. Pengurusan Penyelenggaraan Instrumentasi dan Kawalan (Pesisiran Pantai) / B091-002-5:2018	Instrument & Control Services	Instrumentation and Control services is covered under Division M 71: Architectural and engineering activities; technical testing and analysis, Group 712: Technical testing and Analysis.
12. Pengurusan Penyelenggaraan Instrumentasi dan Kawalan (Pesisiran Pantai) / B091-002-4:2018	Instrument & Control Services	
13. Penyelenggaraan Instrumen (Pesisiran Pantai)(Minyak, Gas & Petrokimia) / OG-017-3:2013	Instrument & Control Services	
14. Penyelenggaraan Instrumen (Pesisiran Pantai)(Minyak, Gas & Petrokimia) / OG-017-2:2013	Instrument & Control Services	
15. Penyelenggaraan Instrumen (Pesisiran Pantai)(Minyak, Gas & Petrokimia) / OG-017-1:2013	Instrument & Control Services	
16. Penyeliaan Penyelenggaraan Mekanikal (Pesisiran Pantai) / OG-018-3:2013	Mechanical Services	Mechanical services is covered under Division B06: Extraction of Crude Petroleum and Natural Gas, Group 061: Extraction of Crude Petroleum & Group 062: Extraction of natural gas.
17. Penyelenggaraan Mekanikal (Pesisiran Pantai) / OG-018-2:2013	Mechanical Services	
18. Penyelenggaraan Mekanikal (Pesisiran Pantai) / OG-018-1:2013	Mechanical Services	
19. Operasi Kawalan Dokumen Teknikal / OG-029-3:2014	Mechanical Services	
20. Pentadbiran Dokumen Kejuruteraan (Minyak, Gas & Petrokimia) / OG-031-4:2014	Mechanical Services	
21. Penyelenggaraan Elektrik(Pesisiran Pantai)(Minyak, Gas & Petrokimia) / OG-019-3:2013	Electric Field Services	Electrical Field services is covered under Division F43: Specialized

Name and NOSS Code	O&G Job Area	Explanation
22. Penyelenggaraan Elektrik(Pesisiran Pantai)(Minyak, Gas & Petrokimia) / OG-019-2:2013	Electric Field Services	Construction Activities, Group 432 Electrical, plumbing and other construction installation activities
23. Penyelenggaraan Elektrik(Pesisiran Pantai)(Minyak, Gas & Petrokimia) / OG-019-1:2013	Electric Field Services	
24. Pengurusan Operasi Kapal Sokongan Pesisiran Pantai / OG-025-5:2016	Marine Services	Marine services is covered under Division B06: Extraction of Crude Petroleum and Natural Gas
25. Koordinasi Operasi Kapal Sokongan Pesisiran Pantai / OG-025-4:2016	Marine Services	
26. Operasi Kapal Sokongan Pesisiran Pantai / OG-025-3:2014	Marine Services	
27. Operasi Pengeluaran (Pesisiran Pantai) / OG-021-3:2013	Marine Services	
28. Operasi Pengeluaran (Pesisiran Pantai) / OG-021-2:2013	Marine Services	
29. Operasi Pengeluaran (Pesisiran Pantai) / OG-021-1:2013	Marine Services	
30. Pengurusan Dokumen Kejuruteraan (Minyak, Gas & Petrokimia) / OG-031-5:2014	Subsea Services	Marine services is covered under Division B06: Extraction of Crude Petroleum and Natural Gas
31. Perkhidmatan Sokongan Hayat Dasar Laut / OG-037-3:2016	Subsea Services	
32. Fire, Rescue and Hazmat Management (Oil, Gas & Petrochemical) / OG-024-5:2014	Fire Fighting Services (onshore)	B091: Support Activities for Petroleum and Natural Gas Extraction
33. Fire Rescue and Hazmat Supervision (Oil, Gas & Petrochemical) / OG-024-4:2014	Fire Fighting Services (onshore)	
34. Fire Rescue and Hazmat Operation (Oil, Gas & Petrochemical) / OG-024-3:2014	Fire Fighting Services	Does not map on to any Job title in the OS

The shift in focus from petroleum to LNG means that workers will need new skills. Hence, there is a need to develop and reexamine the existing NOSS documents, especially for the critical job titles listed in the OS.

For the critical jobs in this area, the competences needed can be found in the Job Descriptions (see Appendix 4.3).

4.5 Group 099: Support Activities for Other Mining and Quarrying

The findings in this section are obtained from the Focus Group Discussions and Interviews will cover Group 099: Support Activities for Other Mining and Quarrying, under Division B09 of MSIC 2008. The following objectives are discussed:

Objective 2: To identify the job areas, job titles and job classifications according to the definitions and levels of NOSS in B09
Objective 3: To identify the responsibilities and job descriptions for each job title
Objective 4: To identify the critical job and the job description for B09 related to current developments in the industry
Objective 5: To analyse the competency needed to address the demand and supply of the industry in Malaysia

4.5.1 Objective 2: To identify the job areas, job titles and job classifications according to the definitions and levels of NOSS in B09

4.5.1.1 Job Areas for B099: Support Activities for Other Mining and Quarrying

The group B099: Support Activities for Other Mining and Quarrying comprises of four (4) major job areas that are essential support service activities for mining and quarrying were identified and defined by the experts during the FGD. The job areas are as follows:

1. Mineral Exploration Services	The process of identifying new mineral resources (reconnaissance) and evaluation of the extractive operations for economic mining to determine its feasibility.
2. Mine & Quarry Planning Services	The process of mineral evaluation and development includes the planning for the extraction and the plan for mineral and quarry development. The planning includes the operational aspects from the extraction, handling, storage and placement of the mineral
3. Mine & Quarry Palong Cleaning Services	The cleaning of *palong* which was used to separate the heavier density mineral from the sand.
4. Blasting Services	Blasting services as required for smaller mines and quarry.

4.5.1.2 Job areas and Occupational Structure for B099

The OS of the B099 group is tabulated, presented, and summarised from Table 4.14 to Table 4.15, which present the overall job areas and job title. In the table are also shown critical job titles (marked with *), job titles relevant to Industrial Revolution (marked with **) as well as critical job titles

which are relevant to the Industrial Revolution (marked with ***), as identified during the FGD2 and FGD3.
Occupation is considered critical if they are skilled, sought-after, and strategic (TalentCorp, 2022). Critical jobs are jobs which involves specific skills, work processes or technologies that are needed by the industry. The critical jobs were identified through the FGD session. According to TalentCorp (2022), sought-after means that demand for an occupation or job title exceeds the supply of appropriately qualified workers. This may occur despite efforts on the part of employers to satisfy the demand. Jobs in demand are jobs which are not easily filled.

Mining engineer is not considered a critical job by the experts even though it is in the Critical Occupations List (TalentCorp, 2021). This is most likely because in B09, mining is a support service for mining and quarrying. In addition, there has been a steady number of graduates from Universiti Sains Malaysia since the year 2000 with Bachelors of Mineral Resource Engineering with who could be employed as Mining Engineers. Hence, Mining Engineer is not a critical job according to the panel. On the other hand, **Mining Technicians** and **Senior Mining Technicians** were considered critical jobs as there were not many qualified with Diploma in Mining.

Mine and quarry *palong* cleaning services are required for the palong which was used to separate unwanted materials from the minerals. The cleaners would be trained and supervised on the cleaning of the *palong*.

Blasting services is a support service provided for smaller mines and quarries on request. In larger quarries this may be part of the mining activity but for smaller mines and quarries which require blasting to be conduct three to four times a year, it is a support service. The service can only be provided by a **shotfirer**, licenced by JMG and Polis Diraja Malaysia (PDRM). The Blasting Technician assists the shotfirer.

Many of the job titles are related to the industrial revolution as new technologies are beginning to influence the field. The jobs areas related to **Mineral Exploration** and **Mine and Quarry Planning** are applying technologies for modelling virtual environments, and for autonomous and remote operations. In the area of Blasting Services, the use of "electronic detonators" would be used by Blasting engineers in the future.

The OS excludes **Mine Surveying** as it is covered in Division M 71: Architectural and engineering activities; technical testing and analysis; Group 711: Architectural and engineering activities and related technical consultancy, Item 71103: Land surveying services. In addition, **Mine Environmental Services**, **Mine Occupational Safety and Health (OSH) Services**, **NR-REE Radiation Protection Services** and **Mineral Laboratory Services** are job areas that are covered in Division M 71: Architectural and engineering activities; technical testing and analysis; Group 712: Technical testing and Analysis. Hence, these job areas are not within the scope of B09.

Table 4.14 Occupational Structure for B099 for Support Activities for Other Mining and Quarrying

	DIVISION B09: MINING SUPPORT SERVICE ACTIVITIES*			
	GROUP 099: SUPPORT ACTIVITIES FOR OTHER MINING AND QUARRYING			
JOB AREAS	**MINERAL EXPLORATION SERVICES**	**MINE & QUARRY PLANNING SERVICES**	**MINE & QUARRY PALONG CLEANING SERVICES**	**BLASTING SERVICES**
Level 8	NJT	NJT	NJT	NJT
Level 7	Principal Geologist**	Mining Project Leader**	NJT	NJT
Level 6	Senior Geologist **	Senior Mining Engineer**	NJT	NJT
Level 5	Geologist**	Mining Engineer**	NJT	Blasting Engineer
Level 4	Senior Geological Technician / Mine Supervisor**	Senior Mining Technician*	NJT	Chief Shotfirer
Level 3	Geological Technician**	Mining Technician*	Palong Cleaning Supervisor	Shotfirer
Level 2	Soil Investigation Drilling Operator**	NJT	Palong Cleaner	Blasting Technician and or Driller
Level 1	NJT	NJT	NJT	NJT

*Critical Jobs **Jobs related to technology and industrial revolution ***Critical Jobs related to technology and industrial revolution
NJT: No Job Title

Table 4.15. Summary of Job Titles in B099

Job Area	**Job Level**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Mineral Exploration Services	NJT	1	1	1	1	1	1	NJT
Mine & Quarry Planning Services	NJT	NJT	1	1	1	1	1	NJT
Mine & Quarry Palong Cleaning Services	NJT	1	1	NJT	NJT	NJT	NJT	NJT
Mine Blasting Services	NJT	1	1	1	1	NJT	NJT	NJT

Table 4.16. Summary of Job Titles at Each level in B099

	Job Level							
Details	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Identified Job Titles (Per Level)	0	3	4	3	3	2	2	0
Total Identified Job Titles	**17**							
Critical Job Titles (Per Level)	0	0	1	1	0	0	0	0
Total Critical Job Titles	**2**							
Job Titles Relevant to Technology & The Industrial Revolution (Per Level)	0	1	1	1	1	2	2	0
Job Titles Relevant to Technology & The Industrial Revolution (Total)	**8**							

4.5.2 Objective 3: To identify the responsibilities and job descriptions for each job title

4.5.2.1 Job Responsibilities for B099

This findings from the focus group discussions (FGD) with the panel of experts from the industry, interviews with experts from the industry and document analysis was used to determine the responsibilities and job descriptions in order to address Objective 3.

Occupational responsibility (OR) is the duty or obligation to satisfactorily perform or complete a task (assigned by someone or created by one's own promise or circumstances) that one must achieve and for which failure has a penalty. The OR describes the primary scope of work for the job titles listed in the Occupational Structure (OS).

In this section, the operational responsibilities (OR) for all job titles in the B099 are described and discussed according to their respective job areas and levels. The job titles that are primarily responsible for the main functions within these industries will be explained in further detail.
The OR will serve as the future reference for the development of the National Occupational Skills Standard (NOSS) for Group B099: Support Activities for Other Mining and Quarrying occupation under the MSIC 2008. The OR for the job titles in this study are tabulated from Table 4.17 until Table 4.18.

Table 4.17: Occupational Responsibilities for Mineral Exploration Services and Mine & Quarry Planning Services

JOB AREAS	MINERAL EXPLORATION SERVICES	MINE & QUARRY PLANNING SERVICES
Level 8	**NJT**	**NJT**
Level 7	**Principal Geologist** 1. Identify opportunities for implementation of mining projects. 2. Define and implement strategies for new tenements for future business expansion, increasing certainty of tenure and permitted activities for surrounding land. 3. Design exploration targets and lead geophysical remote sensing, seismic and drilling programs for mineral exploration and resource development. 4. Propose and design research and development, investigations through universities, research institutions and consultants to improve orebody knowledge. 5. Deliver the geological and resource modelling for resource estimation and the related budgets.	**Mining Project Leader** 1. Identify the planning for the mining and quarrying production activities. 2. Propose and design mining and quarrying plans for the development and production activities 3. Design the planning activities to ensure the statutory responsibility for safety and environmental impact are in place. 4. Oversee the planning of the acquisition and installation, maintenance and storage of mining plant and equipment.
Level 6	**Senior Geologist** 1. Conduct projects and research to examine and prospect for mineral deposits. 2. Undertake exploration and provide technical direction to Geology Operations team 3. Conduct exploration activities to identify, define and obtain legal title to an economically viable mineral deposit. 4. Define the strategies for the design, management and execution of the exploration programme.	**Senior Mining Engineer** 1. Design and coordinate mine development operations. 2. Develop plans to take into account statutory responsibilities for safety and environmental impact in the designs 3. Develop the acquisition and installation plans, as well as plans for the maintenance and storage of mining plant and equipment
Level 5	**Geologist** 1. Examine and prospect for mineral deposits. 2. Identify, define and obtain legal title to an economically viable mineral deposit. 3. Design and execute the exploration programme.	**Mining Engineer** 1. Design mine development operations to consider safety and environmental impact 2. Conduct the acquisition and installation, maintenance and storage of mining plant and equipment

JOB AREAS	MINERAL EXPLORATION SERVICES	MINE & QUARRY PLANNING SERVICES
	4. Analyse, interpret and model of all data including; geological logging, assays, geochemistry, mineralogy using specific software.	
Level 4	**Senior Geological Technician/ Mine Supervisor** 1. Involve with drilling contractor to ensure they comply with all safety standards and meet their key performance indicators 2. Coordinate grade control and exploration drilling activities. 3. Prepare mineral resource reporting. 4. Conduct geometallurgical sampling in projects with collaboration with the metallurgical teams. 5. Involve in mine planning and developing processing strategies for optimised blending to achieve product specifications. 6. Provide input into the various geology projects across site (i.e. exploration, metallurgy, hydrology).	**Senior Mining Technician** 1. Able to design of mine development operations 2. Able to install, conduct maintenance of mining plant and storage equipment
Level 3	**Geological Technician** 1. Perform exploration drilling activities. 2. Prepare mineral resource reporting. 3. Involve in Geometallurgical sampling projects. 4. Involve in various geology projects across site (i.e. exploration, metallurgy, hydrology).	**Mining Technician** Implement the mine development operations Implement installation and maintenance of mining plant
Level 2	**Soil Investigation Drilling Operator** 1. Operate a variety of drills during mineral exploration or soil testing. 2. Conduct drilling activities. 3. Conduct sampling across site.	
Level 1	**NJT**	**NJT**

Table 4.18: Occupational Responsibilities for Mine & Quarry Palong Cleaning Services & Mine Blasting Services

JOB AREAS	MINE & QUARRY *PALONG* CLEANING SERVICES	MINE BLASTING SERVICES
Level 8	NJT	NJT
Level 7	NJT	NJT
Level 6	NJT	NJT
Level 5	NJT	**Blasting Engineer** 1. Inspect the sites that are sensitive to blasting impacts or subjected to specific requirements to gather as much information as necessary. 2. Analyse the information and the requirements for consideration of blasting site. 3. Design the blasting parameter and the blasting system to be used. 4. Implement necessary actions to be taken to minimise blasting impacts and to prevent flyrock. 5. Design the blasting parameter, blasting system and safety requirements for the implementation of blasting 6. Monitor the blasting process. 7. Evaluate and record the results of blasting
Level 4	NJT	**Chief Shotfirer** 1. Perform inspection of the site to be blasted 2. Prepare the blasting parameters, safety requirements and safety procedures for implementing blasting. 3. Design safety procedures and security of explosives handling 4. Monitor the blasting process and obtain data for reporting the blasting result to the blasting engineer.
Level 3	**Palong Cleaning Supervisor** 1. Involve in ensuring the cleaning of *palong*. 2. Maintain a safe and clean environment for mining activities.	**Shotfirer** 1. Conduct inspection of the site to be blasted 2. Instruct the driller to drill according to the design and records nature of drilling in the drill log 3. Analyse the drill log and seek the advice of chief shotfirer if changes in blasting parameter are required

JOB AREAS	MINE & QUARRY *PALONG* CLEANING SERVICES	MINE BLASTING SERVICES
		4. Implement the security plan for safe handling of explosives and safety procedures 5. Collects data to monitors and report the blasting process to the chief shotfirer.
Level 2	**Palong Cleaner** 1. Involve in the cleaning the *palong*. 2. Able to use suitable equipment for cleaning.	**Blasting Technician** 1. Able to be involved in the blasting activities with instructions from shotfirer. 2. Able to follow the safety procedures on security and safe handling of explosives
Level 1	**NJT**	**NJT**

4.5.3 Objective 4: To identify the critical job and the job description for B09 related to current developments in the industry

The findings are the analysis of experts' opinions from the Focus Group Discussions. The purpose was to identify the critical jobs and the emerging skills and technologies in the industry.

4.5.3.1 Emerging skills

In order to identify the current developments in the industry, the critical and emerging skills were identified. Emerging skills are skills that are expected to be important to the industry in the near future based on recent events, trends, government policies, or research. This would include the technology revolution and issues of sustainability.

According to the experts during the FGD, the future emerging skills that affect the productivity of jobs in the mining and quarrying support industry are:

(1) Digital skills
(2) Design/ Utilize software for autonomous technology, machine learning, data automation, and Internet of things (IoT)
(3) Design / Apply Robotics and Electronics
(4) Designing virtual environments
(5) Applying virtual reality to training and design, Designing simulations

The findings are confirmed during the FGD as follows:

(1) Digital skills

Basic digital skills to input data and monitor the mine operations are essential and the jobs in this will require basic digital skills such as being able to use tablets and mobile devices. In Mine and Quarry Planning Services, digital skills are required.

(2) Utilize software for autonomous technology, machine learning, data automation, and Internet of things (IoT)

As a result of big data and automation, the analysis of data is used for Internet of Things. Communication and decision making with machines based on data collected during the processes.

(3) Apply Robotics and Electronics

Robotics to address some of the dirty and dangerous jobs and the use of autonomous technology such as drones will be required in this job areas. In the area of Blasting Services, the use of "electronic detonators" are to be used for the future.

(4) Designing virtual environments and simulations.

Mineral Exploration requires the use of technologies such as design skills for modelling and designing virtual environments.

Digital skills seem to be the most important skill according to the experts. This is relevant as technology is prevalent in all areas of work. All workers need to have basic digital skills for using mobile apps on tablets or the mobile phones in order to report the processes and information during the mining support activities. In addition, autonomous technologies for **IoT** and **automation** will be important in the future to address work in the "dirty, dangerous and difficult" environment. Hence, **robotics** would be an area to consider for the future.

Designing virtual environments and **designing simulations** are also important areas, as "modelling" the real time environment is required for computerised data for decision making. These virtual environments and simulations would be the result of input from workers at the site.

4.5.3.2 Occupations related to Technology

As for the technology that is influencing the Mining and Quarrying Support industry/ job area, the experts were asked which technologies affected the industry and jobs. These were:

(1) Simulations (Real time data for Virtual Models)
(2) Cloud Computing, and
(3) Internet of Things.

Simulations were already being used in occupations that require real time data to be used for generating models. This would be used in Mineral Exploration and Mine and Quarry Planning. In order for data to be transferred, **cloud computing** services are essential. In addition, **IoT** allows for more seamless operations and automation.

4.5.4 Objective 5: To analyse the competency needed to address the demand and supply of the industry in Malaysia

4.5.4.1 Jobs in Demand

The experts' opinion on the manpower shortage for the jobs in the industry are reported according to areas. **Jobs in Demand** are the jobs and job areas which have a high manpower shortage which differ from critical jobs which refer to jobs which are skilled, sought-after and strategic jobs.

The panel of experts during the FGD3, deliberated on the jobs in demand for each job area of the OS. The jobs in demand for each job area of the OS is tabulated, presented, and summarised from Table 4.19 to Table 4.20, which present the overall job titles.

1. Mineral Exploration and Mine & Quarry Planning Services

Table 4.19: : Jobs in Demand for Mineral Exploration and Mine & Quarry Planning Services

JOB AREAS	MINERAL EXPLORATION SERVICES	MINE & QUARRY PLANNING SERVICES
Level 8	NJT	NJT
Level 7	Principal Geologist	**Mining Project Leader**
Level 6	Senior Geologist	Senior Mining Engineer
Level 5	Geologist	Mining Engineer
Level 4	Senior Geological Technician / Mine Supervisor	Senior Mining Technician
Level 3	Geological Technician	Mining Technician
Level 2	Soil Investigation Drilling Operator	NJT
Level 1	NJT	NJT

The jobs in Mineral Exploration Services were not considered high in demand as the experts agree that there was sufficient talent to address the demand. This was confirmed during FGD3. However, in Mine and Quarry Planning Services, there was a demand for **Mining Project Leader** job. This was because the Mining Project Leader is a high-level job with responsibilities and experience which may be difficult to fill.

2. **Mine & Quarry *Palong* Cleaning Services and Blasting Services**

Table 4.19: : Jobs in Demand for Mine & Quarry *Palong* Cleaning Services and Blasting Services

JOB AREAS	MINE & QUARRY PALONG CLEANING SERVICES	BLASTING SERVICES
Level 8	NJT	NJT
Level 7	NJT	NJT
Level 6	NJT	NJT
Level 5	NJT	Blasting Engineer
Level 4	NJT	Chief Shotfirer
Level 3	Palong Cleaning Supervisor	Shotfirer
Level 2	Palong Cleaner	Blasting Technician and or Driller
Level 1	NJT	NJT

4.5.4.2 Related Issues

Accordingly, the experts' opinions on the key issues affecting the workforce of the industry for Mining & Quarry support was determined was determined from the FGD3. However, only one item was accepted by consensus, which is "Insufficient number of skilled workers".

4.5.4.3 Competency in Demand

In the OECD Learning Framework 2030, in order to develop the competencies, one needs to take action to develop knowledge, skills, attitudes and values (OECD 2018). Hence, in order to identify the competencies required in the industry, the areas of expertise, competencies in terms of knowledge, skills and attributes were determined.

For areas of expertise high in demand, the experts considered the following:

(1) Occupational Safety and Health Monitoring
(2) Environmental Monitoring
(3) Project Management.

However, when radiation monitoring was asked, the response from the panel in the FGD indicated that radioactive materials did not seem to be important as the "majority of sites do not deal with radioactive equipment, material or mineral".

Competency for mining was determined in terms of Knowledge, Skills and Aptitude.

4.5.4.4 Knowledge

For Knowledge important to perform jobs for Mining & Quarry support, Mine & Quarry Planning Services and Legislation were considered important. The knowledge required are as follows:

(1) Mine & Quarry Planning Services
(2) Legislation related to mining and quarrying
(3) Mineral Exploration services
(4) Occupational Safety and Health Monitoring
(5) Radiation Monitoring
(6) Environmental Monitoring.

4.5.4.5 Skills

In the Organization for Economic Cooperation and Development (OECD) (2018) Learning Framework 2030, a broad range of skills will be required including **cognitive and meta-cognitive skills** (e.g. critical thinking, creative thinking, learning to learn and self-regulation); **social and emotional skills** (e.g. empathy, self-efficacy and collaboration); and **practical and physical skills** (e.g. using new information and communication technology devices) which are needed to engage with the world.

As for Skills to perform the jobs for Mining & Quarry support only, the experts agreed during the FGD that the skills are as follows:

(1) Time management
(2) Interpersonal communication
(3) Leadership
(4) Problem-solving skills
(5) Technology and Equipment use
(6) Agile Mindset, and
(7) Planning and organising

This includes **technical skills** such as being able to use technology tools and equipment to perform the jobs, as well as **cognitive skills** such as problem solving skills, **social and emotional skills** such as interpersonal communication, and **practical skills** such as time management.

Details on these skills would vary according to the job areas and can be seen in the Occupational Descriptions (see Appendix 4.3).

4.5.4.6 Attribute/ Attitude

As for attributes to perform the jobs for Mining & Quarry support only, the experts agreed during the FGD that the attributes are as follows:

(1) Professionalism
(2) Work Ethics
(3) Team work
(4) Dependability (Trustworthy & Reliable)
(5) Proper Etiquette in social situations
(6) Agility (Ability to think and understand quickly)
(7) Analytical thinking
(8) Stress management
(9) Self-management/ independent
(10) Career-management (career path and individual development, succession planning)
(11) Attention to details
(12) Multi-tasking/ Flexibility
(13) Self-learning

Existing NOSS

Currently, there are no NOSS developed under B099 group. Hence, there is a need to develop NOSS documents to address the critical job titles listed in the OS.

For the critical jobs in this group, the competences needed can be found in the Job Descriptions (see Appendix 4.3).

4.6 Conclusion

In conclusion, Chapter 4 provides a comprehensive analysis of the occupational structure, responsibilities, and descriptions of various job titles. The findings from the focus group discussions provide a detailed understanding of the job market and the skills that are in demand. The critical competencies and skills related to IR and technology were also identified, highlighting the importance of technologies in today's job market. The emerging skills highlights the need for continuous professional development to stay ahead in the constantly changing job market. Overall, the research findings in Chapter 4 provide valuable insights for job seekers, employers, and policy makers, and contribute to the ongoing discourse on the future of work and skill development.

CHAPTER V

DISCUSSION, RECOMMENDATION AND CONCLUSION

5.1 Introduction

The objective of this chapter is to provide a comprehensive discussion, recommendations, and conclusion based on the findings of the study on the Occupational Structure (OS) for the Support Activities for Mining. This study aimed to establish the OS based on MSIC 2008, by examining job areas, job titles, and determine Occupational Responsibilities (OR) for the main work activities and tasks for each job title, determine the Occupational Descriptions (OD) for each job title in demand. In addition, based on the proposed OS, critical job titles in the Support Activities for Mining are identified and the competency to address the demand and supply of the industry is discussed.

To achieve these objectives, document analysis, focus group discussions and interviews was employed. The findings of this study will provide insights into the occupational structure, responsibilities, and descriptions for the Support Activities for Mining sector, which can be used to guide workforce planning, training and development, recruitment and retention, and other human resource management practices.

This chapter will present a discussion of the study's key findings, including the establishment of the occupational structure, responsibilities, and descriptions for each objective.

5.2 Discussion

The discussions are organised and reported according to the objectives of the study.

5.2.1 Objective 1: To identify the previous studies with the needs of the current and future needs of the industry

The is an increase in the economic growth in the mining sector. This is attributed to the increased investments in the mining industry. Although there is a **decrease in the output for crude oil**, the **demand for natural gas has increased**, resulting in an increased production in natural gas. At the same time, there is a **need for minerals such as rare earth elements** (REE) in manufacturing of wind turbine magnets, and rechargeable batteries as the emphasis remains on sustainable and green energy practices.

The **increased economic growth** and **increase in production** indicates that **more workers and talents are required in the industry**. Initially, there may be sufficient workers but as the growth continues, skilled talents in the processes such as for natural gas extraction and other minerals such as rare earth elements, may not may not meet the demands of the industry. Hence, preparations for training workers needs to be provided. In addition, some workers such as those trained for crude oil extraction may need to be retrained and reskilled for liquified natural gas production.

There is more emphasis on preservation of the environment and natural resources for **environmental sustainability**. However, workers may not have sufficient skills and training for the adoption of sustainability standards in the industry. Hence, workers require skills to support activities related to the application of green technology principles, the circular economy and urban mining concepts in the future.

At the same time, **technologies** such as robotics, automation and other digital technologies are influencing the processes in the industry to ensure safe and efficient processes are in place. However, this needs **high level of digital literacy skills** to operate remote vehicles, machine automation and integrated systems. The acceptance that the digital transformation is currently affecting the future of work and an open mindset to developing new capacities in this area. In general, talents who are able to provide efficient, sustainable and green practices in mining seem to be in demand in the future.

5.2.2 Objective 2: To identify the job areas, job titles and job classifications according to the definitions and levels in B09

The occupation structure of an industry is critical to determines the efficiency of the industry. This is because understanding the various job areas, titles, and levels within an industry provides valuable insight into the skills and competencies required to perform these jobs, and the level of expertise required for different roles. Occupational Structure (OS) for each group of B091: Support Activities for Petroleum and Natural Gas Extraction and B099: Support Activities for Other Mining and Quarrying was developed through Focus Group Discussions (FGD) with industry experts.

The study identified a total of 12 job areas and 47 job titles in the Support Activities for Mining sector across all groups.

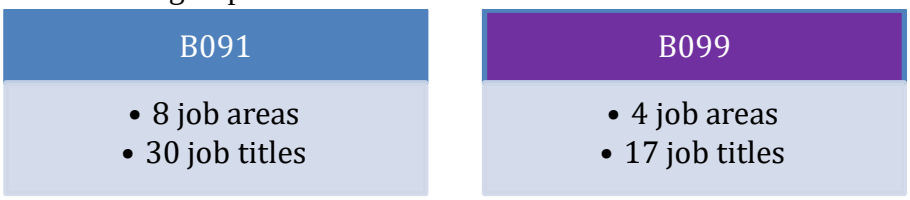


Figure 5.1: Number of Job Areas and Job Titles for B09 Group

The number of job areas and titles identified for each group reflects the unique nature of the Support Activities for Mining and Quarrying sector and the specific skill sets required for each job area. The primary job areas are related to services in the upstream areas. In summary, there is a wide range of job opportunities in the support activities, with various job levels and areas of expertise to explore.

The occupational structure is important for providing insights on the levels and composition of the workforce. For policy makers, this is useful for formulating future plans and policies for the future while for industry players, it could be used to improve their competitiveness and meet the changing demands of the market.

5.2.3 Objective 3: To identify the responsibilities and job descriptions for each job title

The responsibilities of a job are crucial for determining the efficiency and competitiveness of the industry. Knowing the tasks, duties, and responsibilities associated with different jobs provides valuable insights into the skills and competencies required for these jobs.

The OR developed for 12 job areas and 47 job titles are described in Table 4.7 to Table 4.8 for Group B091: Support Activities for Oil & Gas Extraction occupations and in Table 4.17 to Table 4.18 for Group B099: Support Activities for Other Mining and Quarrying occupations. These OR will serve as the future reference for the development of the National Occupational Skills Standard (NOSS) for B09 Support Activities for Mining occupations under the MSIC 2008. The analysis of the OR provides a comprehensive overview of the occupational responsibilities of the industry and provide insights into the skills and competencies required for different roles. This provides information for industry players and decision makers who may use it in improving their competitiveness to meet the changing demands of the market. This information is also relevant for job seekers who wish to understand the requirements for different positions within the industry (Talent Corp, 2022).

The occupational description (OD) section provides a detailed overview of the responsibilities, knowledge, skills, and attributes required for a job. The aim of the OD is to give individuals and organizations a clear understanding of the role and its requirements, which will aid in evaluating the suitability of potential candidates. Hence, it is helpful for individuals seeking to enter this industry, as it highlights the necessary knowledge, experience, and competencies for success. Having a comprehensive understanding of the job through the OD will ensure that the right person is matched with the right position, leading to increased job satisfaction, performance, and success for both the individual and the organization.

There are a total of 9 overall jobs in demand under the B09 Support Activities for Mining with (B091 – 8 jobs in demand, B099 – 1 job in demand). The data from the Jobs in demand showed that there is a relatively high demand for skilled workers in B091 in the Oil and Gas support activities, especially for Petroleum Engineers, Geoscience, Drilling Engineers and Operations Engineers. Most of the jobs in demand are at Level 5 and above. There is a shortage of qualified candidates to fill these roles, which could lead to increased competition among employers for top talent. This may also be due to the low number of graduates who choose to specialise in these areas. Hence, it is recommended that higher education institutions need to do more to promote courses related to petroleum engineering and related areas.

Additionally, it may suggest that there are opportunities for individuals interested in pursuing a career in this field, as there are a significant number of jobs currently available. Overall, this information could be useful for both employers and job seekers to understand the current state of the job market in this industry and make informed decisions based on the demand for specific job roles.

As the jobs in demand in the industry is due to several factors such as lack of talents with the required certification and lack of suitable working conditions, such as possibilities of going

offshore (Talent Corp, 2022), there is a need for companies and academic institutions to work together to provide practical experience, relevant skills training, and career growth opportunities (Valiente, Zancajo, and Jacokis, 2020). In addition, academic institutions could promote the opportunities available in this job areas. The competencies in demand for knowledge, skills and aptitudes highlight the competencies required for candidates seeking to enter the industry.

5.2.4 Objective 4: To identify the critical job and the job description for B09 related to current developments in the industry

The critical jobs and job description is developed for each group of B091: Support Activities for Petroleum and Natural Gas Extraction and B099: Support Activities for Other Mining and Quarrying from the Occupational Structure (OS).

Technology seems to have influenced the industry. For B099: Support Activities for Other Mining and Quarrying, Cloud Computing and Internet of Things were deemed as important and received consensus by experts in the Focus Group Discussion 2 and 3 as most jobs were influenced by the Industrial Revolution. Designing simulations and virtual environments (or modelling) is important for Mineral Exploration Services.

As for critical jobs, the Focus Group Discussions indicated that critical jobs were for Technicians under Mining and Quarry Planning Services. Hence, more opportunities for training technicians in these areas are needed in the industry.

In B091: Support Activities for Petroleum and Natural Gas Extraction, technology also affects the jobs. Modelling and 3D designs as well as designing for Artificial Intelligence and Robotics are important. Automation and Remote Operation Vehicles are being used for jobs related to sub-sea activities and will be extensively used. Hence, talents with capabilities need to be developed. Basic digital skills are needed for almost all job levels, and skills for modelling designs, and applying systems integration as well as internet of things are highly needed as was identified during the Focus Group Discussion 2. The Industrial Revolution would have an impact on the industry with several technologies impacting the sector.

The high manpower shortage was identified for many of the jobs in many job areas. Hence there seems to be a high demand in this section. Identifying critical job titles within an industry is important as these positions play a crucial role in determining the success and competitiveness of the industry. Understanding the skills and competencies required for critical jobs can provide valuable insights into the industry's talent needs and help to inform workforce development initiatives.

The issues in the B091 group were related to **insufficient number of skilled** and **competent** workers who were **certified** workers. The **talent gap** was also identified as an issue. Hence to address the talent shortage in the B091 industry, there is a need to develop sufficient skilled workers and provide certification. Companies need to focus on providing practical experience, relevant skills training, and career growth opportunities for their employees. In addition,

sufficient compensation and better facilities are required for their employees. This may improve employee retention and attract new talent.

5.2.5 Objective 5: To analyse the competency needed to address the demand and supply of the industry in Malaysia

Knowing which competencies are important in an industry can help with planning and improving the industry. Understanding the skills, knowledge and abilities that are in high demand within the industry provides valuable insights into the talent needs of the industry.

In terms of specific competencies, there seemed to be different competencies needed for B091 and B099. However, health and safety seem to be a common competency required as for knowledge. This is even more important when considering the dangerous environment for Oil and Gas where fires could easily be ignited due to the flammable fumes.

In B091 Support Activities for Petroleum and Natural Gas Extraction, the specific competencies which experts identified were related to Health, Safety And Environment, O&G Site Exploration and O&G FLNG Tanker. The increasing demand and production for LNG has indicated that competencies related to the FLNG Tanker is an emerging area as LNG is a cleaner source of energy, and a new area of knowledge for workers. In addition, knowledge in Physics, Mathematics and Statistics, and Chemistry were also considered important. However, Knowledge on Human Resource as well as Administration and Management were also considered for dealing with the team members. In some organizations, every staff at all levels needed to know human resource, and administration and management.

Occupational Safety and Health Monitoring seemed to be an area that experts agreed was important for B099 Mining and Quarrying Support Activities besides Knowledge of Mine and Quarry Planning Services, Legislation related to mining and quarrying, followed by Mineral Exploration services and Occupational Safety and Health Monitoring were considered important. Planning the mine and quarry is essential for ensuring the sustainability and feasibility of mining and quarrying activities. Mining and quarrying are governed by legislations from several organizations and hence, this is considered an important knowledge area. Similarly, mineral exploration services is important to ensure new mineral sources are discovered and mined in a profitable manner.

For B091, **technical skills** are needed to perform the jobs such as Performance measures and equipment monitoring. These skills are important to cope with sudden changes in the environment for support activities related to petroleum and natural gas extraction.

Cognitive skills such as systems analysis and complex problem solving were important to the experts. This is in line the need for systematic and logical thinking required in support activities related to petroleum and natural gas extraction. **Social and emotional skills** such as communication and leadership are valued by the experts and are important when working in teams in dangerous situations. **Practical skills** such as time management and keeping up with

the performance measures is an important quality as well in a competitive and fast-paced working environment.

For B099, **technical skills** such as being able to use technology tools and equipment to perform the jobs is considered important. **Cognitive skills** such as Agile Mindset, problem solving and Planning and Organising skills are important for resolving issues at the mine. Being adaptive with an agile mindset is important to cope with changes in the field while being systematic and detail in planning and organising is important for support activities in mining and quarrying. **Social and emotional skills** such as interpersonal communication, and leadership are important for interacting with the staff and project team as well as with external service providers. **Practical skills** such as time management is valued as timely production ensures a successful mining and quarrying support service for the operations.

For B091, attributes valued by the industry were team work and Professionalism. In addition, **Work Ethics, Initiative and innovation** and **Self-management/ independence** were also important attributes for B099. This is because employers valued staff who tool initiate and were willing to work independently, take initiative and change in this fast-moving career. **Analytical thinking** and **Attention to Details** were also accepted by the experts as workers needed to make fast decisions based on analytical thinking. Career-management (career path and individual development, succession planning) and Self-Learning were also accepted and is perhaps emerging technologies influencing the work in the Oil and Gas industry, as planning for the future is an important aspect. Agility and being able to cope with major changes in traditional training and new skills requirements were also considered important.

For B099, attributes valued by the industry were **Professionalism**, **Work Ethics**, and **Team Work.** Being dependable (trustworthy and reliable) as well as having **Proper Etiquette** in social situations and **Agility** (Ability to think and understand quickly). **Agility** and **analytical** thinking were important especially as the workers needed to be able to analyse and make decisions quickly in cases of emergency. They had to pay **Attention to Details** and be able to be flexible and multi-task at their jobs. Providing support services to the Mining and quarrying industry is stressful and **stress management** was also considered important. This is followed by **self-management/ independence** and **Career-management** (career path and individual development, succession planning). At the same time, they needed to continuously improve themselves as new and emerging areas are influencing the jobs and self-learning is an important attribute.

Some attributes were common in both B091 and B099. **Teamwork, Professionalism** and **Work Ethics** were common attributes needed in both these groups. This is because in the activities for support in both groups, the workers had to be professional and work in multi-disciplinary teams. **Self-management and being independent** was also common in both groups as well as **Analytical thinking** and **Attention to details**. Being adaptive to change was another common attribute as workers needed **Agility**. **Self-learning** was another common attribute as emerging technologies influence the industry.

Hence, in order to increase the competencies in this sector, appropriate training needs to be provided for the knowledge, skills and attributes in both groups. Besides identifying the appropriate work tasks, emphasis on the Core abilities to develop attributes needed by the industry. Existing staff may need to develop **new competencies** especially with new minerals and LNG to address the competencies in demand in these new areas. Training will need to be conducted to **upskill** and **reskill** staff.

This information gives us a better understanding of the talent the industry needs. This is useful for people who work in the industry and want to be more competitive, and for people looking for jobs in the industry to know what knowledge, skills and attributes that they should have. This information is valuable for industry players and decision makers who are looking to improve their competitiveness (UNIDO, 2022) and meet the changing demands of the market, as well as for job seekers who want to understand the requirements for critical positions within the industry.

5.3 Recommendations

The Occupational Framework (OF) informs the industry on human capital development requirements for a specific sector and will be a reference for the industry's future plans to develop skilled workers and certify Malaysians in the B09 sector. This is in line with the increased economic importance of this field in Malaysia and for ensuring Malaysia's global competitiveness.

The Occupational Structure (OS) was created by incorporating feedback from focus group discussions and it highlights the various job areas, job titles, and career paths based on competency levels. During the development of the OS, the challenges in the B09 industries in Malaysia were identified. Taking these findings into consideration, several recommendations are proposed.

(1) **The need to incorporate new emerging trends in the sector.** This is because new trends related to sustainability, green practices and emerging technologies are influencing the sector. Technologies such as Internet of Things and 3D Modelling are specifically needed for the industry. In addition, new and emerging digital skills such as basic programming and using Artificial Intelligence are required.

(2) **Higher education institutions need to develop talents for the industry .** The critical jobs are needed for the industry to continue production. There are critical jobs which are also in demand, such as Petroleum Engineers. The existing talents are leaving the workforce, due to age and also higher renumerations elsewhere, which leaves a gap in the workforce. Hence, it is recommended that higher education institutions be engaged to promote the programs that are offered related to these jobs. This could encourage the development of more talents in the industry.

(3) **Programs for upskilling talents at training institutes.** Critical jobs which are in demand such as for mining technicians. There is also a lack of talent in these areas as there

only a few institutions providing training programs for technicians. Hence, it is recommended programs for upskilling talents such as for technicians be offered. This is in line with the development of new technologies and the industrial revolution. In addition, training institutes could collaborate with higher education institutions for this purpose.

Hence, it is recommended that the Department of Skills Development, Human Resource Ministry considers the following:

1. **Review the division of the existing National Occupational Skills Standards (NOSS) for B09 in MySPIKE.** There are 34 existing NOSS for the B09 sector in MySPIKE specific for group B091. However, based on the research findings, 31 of these NOSS are not for the B09 division in MSIC 2008 (see Table 4.13). The mapping shows that only 2 NOSS are relevant to the job areas for B09 division (Fire, Rescue and Hazmat Management (Oil, Gas & Petrochemical) / OG-024-5:2014 and Fire Rescue and Hazmat Supervision (Oil, Gas & Petrochemical) / OG-024-4:2014), while the others are related to different divisions. In addition, one NOSS is no more relevant to the OS (Fire Rescue and Hazmat Operation (Oil, Gas & Petrochemical) / OG-024-3:2014) as no job title exists at this level.
2. **Review and update the existing National Occupational Skills Standards (NOSS) for Fire Fighting Services (onshore)**. The existing NOSS needs to be reviewed and updated as new technologies for firefighting are being used. New trends related to sustainability, green practices and emerging technologies are influencing the sector.
3. **Develop National Occupational Skills Standards (NOSS) for critical jobs:** There are 45 job titles at all levels that currently have no NOSS and 10 of these job titles are critical jobs and related to the industrial revolution. Hence, new NOSS needs to be developed for the remaining job titles to ensure a standardized set of skills, knowledge and competencies required for each occupation within the sector but will also be helpful for universities and TVET training institutions to review their existing curriculum and align it with industry needs.

5.4 Conclusion

The OS for B09 Support Services for Mining has identified **12 job areas** and **47 job titles** that possess distinct occupational structures, duties, and descriptions. These job titles are significant for the industry's transformation and essential job areas. The study also identifies the emerging skills and competencies required to support the growth of the industry. These findings will serve as a foundation for the development of the National Occupational Skills Standard (NOSS) document. The existing NOSS should be reviewed and the NOSS for critical job and job in demand to be developed.

The B09 Occupational Framework can provide valuable insights for stakeholders on the current and future trends in the B09 industries. This includes information on emerging technologies, sustainability and green practices, new trends in mining and quarrying production and in oil and gas extraction. This information can help stakeholders to anticipate changes in the industry.

In addition, the B09 Occupational Framework can help stakeholders to identify and address gaps and inefficiencies in the industry. For example, it can highlight areas where there is a shortage of skilled workers or where there are barriers to entry for new workers. This information can be used to develop targeted initiatives and policies to address these issues.

Additionally, the B09 Occupational Framework can be used to support workforce planning and development. It can provide insights on the supply and demand for various occupations within the B09 industries, which can inform decisions around hiring, training, and succession planning.

Finally, the B09 Occupational Framework can provide a common language and understanding among stakeholders, which can facilitate collaboration and innovation within the industry. In addition, the framework can provide valuable insights on industry trends and help identify gaps and inefficiencies. It can also support workforce planning and development, and facilitate collaboration and innovation among stakeholders.

REFERENCES

Abenov, T., Franklin-Hensler, M., & Larrat, T. (2023, February 14). *Mining industry employment and talent challenges*. McKinsey. Retrieved from https://www.mckinsey.com/industries/metals-and-mining/our-insights/has-mining-lost-its-luster-why-talent-is-moving-elsewhere-and-how-to-bring-them-back

Adler, M., & Ziglio, E. (1996). *Gazing into the oracle: The Delphi method and its application to social policy and public health*. London: Kingsley.

Alkadiri, R. (2022, February). *Top risks facing the oil and gas industry in 2022 - and what you can do about it*. KPMG. Retrieved from https://kpmg.com/xx/en/home/insights/2022/04/top-risks-facing-the-oil-and-gas-industry-in-2022.html

Armstrong, L. A. (2021). *Artificial Intelligence and Robotics in the Oil Industry: Will it Take My Job?* Paper presented at the SPE Middle East Oil & Gas Show and Conference, November 2021. Paper Number: SPE-204643-MS. DOI:10.2118/204643-MS

Battu, H., & Zakariya, Z. (2015). Overskilling and Overeducation in Malaysia. *Discussion Paper in Economics, 15* (20). University of Aberdeen: Business School.

BERNAMA. (2021, April 22). *Malaysia to become important hub for mineral industry development.* MIDA. Retrieved from https://www.mida.gov.my/mida-news/malaysia-to-become-important-hub-for-mineral-industry-development/

BERNAMA. (2018, July 11). OMO 1958 amended. Retrieved from https://www.newsarawaktribune.com.my/omo-1958-amended/

Brown, J., & Washburn, S. G. (2019). Assessing supply, demand and professional development needs of employees in water related careers. *Career and Technical Education Research, 44*(3), 15-36.

Burclaff, N. (2022, August 7). *Research Guides: Oil and Gas Industry: A Research Guide: Industry Controversies*. Library of Congress Research Guides. Retrieved from https://guides.loc.gov/oil-and-gas-industry/controversies

Business Today Editorial. (2023, February 15). Minister: Malaysia's probable petroleum reserves at 6.9 billion barrels, about 61% In Sarawak. *BusinessToday*. Retrieved from https://www.businesstoday.com.my/2023/02/15/minister-malaysias-probable-petroleum-reserves-at-6-9-billion-barrels-about-61-in-sarawak/

Clark, N., Austin, Z., & Saha, S. (2022). *Tech Trends 2022 Oil and Gas Industry*. Deloitte Development LCC

Constable, T. (2020, May 13). *Mineral Sands*. Mineral Council of Australia. Retrieved from https://minerals.org.au/resources/mineral-sands/

CROWE Malaysia. (2022). *Mining*. Mining. Retrieved from https://www.crowe.com/my/industries/oil-and-gas_energy-and-mining/mining

CROWE Malaysia. (2022). *Oil & Gas, Energy and Mining*. Retrieved from https://www.crowe.com/my/industries/oil-and-gas_energy-and-mining

Department of Mineral and Geoscience Malaysia (DMGM) (2021). *Malaysian Minerals Yearbook 2021*. Ministry of Energy and Natural Resources.

Department of Minerals and Geoscience Malaysia & Kementerian Sumber Asli, Alam Sekitar dan Perubahan Iklim. (2022). *Laporan Tahunan 2021* (1st ed.), Vol. 1. The Department of Minerals and Geoscience Malaysia. Retrieved from https://www.jmg.gov.my/hub-informasi/laporan-jabatan/126-laporan-tahunan

Department of Skill Development. (2021). *Occupational Framework B06: Extraction Crude Petroleum and Natural Gas*. Department of Skills Development Ministry of Human Resources, Malaysia. Retrieved from https://www.dsd.gov.my/images/perkhidmatan/NOSS/OF/B06.pdf

Department of Skills Development. (2009). *Occupational Job Structures for The Mining Industry Sector*. Department of Skills Development, Ministry of Human Resources, Malaysia. Retrieved from https://www.dsd.gov.my/images/analisis-bidang-pekerjaan-oa/2.%20oa-industri%20perlombongan.pdf

Department of Statistics Malaysia. (2011). *The Malaysia Standard Industrial Classification (MSIC) search engine system*. e-MSIC 2008. Retrieved from https://msic.stats.gov.my/bi/carianInteraktif.php?validation_rule=&validation_code=2&section=B&division=09&group1=091&class1=0910&item1=

Department of Statistics Malaysia. (2022, October 2). *e-MSIC 2008 V 1.0*. e-MSIC 2008 V 1.0. Retrieved from https://msic.stats.gov.my/bi/carianInteraktif.php

Department of Statistics Malaysia. (2023, March 16). *Department of Statistics Malaysia*. Retrieved from https://www.dosm.gov.my/portal-main/release-content/6d8f5dd2-8ba9-11ed-96a6-1866daa77ef9

Department of Statistics Malaysia & Ministry of Economy. (2023, March 16). *Annual Economic Statistics of the Mining and Quarrying Sector*. Mining and Quarrying. Retrieved from https://www.dosm.gov.my/portal-main/release-content/6d8f5dd2-8ba9-11ed-96a6-1866daa77ef9#:~:text=Performance%20of%20Mining%20and%20Quarrying,with%20a%20value%20of%20RM30.

Department of Statistics Malaysia & Ministry of Economy. (2023, September 15). *Mining of Petroleum and Natural Gas statistics Second Quarter 2023*. Retrieved from https://www.dosm.gov.my/uploads/release-content/file_20230914203458.pdf.

Dictionary of Sociology. . Retrieved from Encyclopedia.com: https://www.encyclopedia.com/social-sciences/dictionaries-thesauruses-pictures-and-press-releases/occupational-structure

Dubrule, O. (2001, March). Achievements and challenges in petroleum geostatistics. *Petroleum Geoscience*, *7*(s), s1-s7. DOI:10.1144/petgeo.7.S.S1

Economic Planning Unit, Prime Minister's Department (2021). *National OGSE Industry Blueprint 2021-2030 Abridged Report*. Prime Minister's Department

Economic Planning Unit, Prime Minister's Department (2022). *National Energy Policy: 2022-2040*. Prime Minister's Department

Endeavor Business Media. (2019, December 2). Worldwide Reserves and Production. *Oil & Gas Journal*. Retrieved from https://www.ogj.com/ogj-survey-downloads/worldwide-production/document/14287591/worldwide-reserves-and-production

Ernst & Young (2019). *The Future of Work: The Changing Skills Landscape for Miners: A report for the Minerals Council of Australia*. Ernst & Young, Australia

Gankhuyag, U., & Gregoire, F. (2018). *Managing mining for sustainable development: a sourcebook.* United Nations Development Programme. Retrieved from https://www.undp.org/publications/managing-mining-sustainable-development

Global Dolomite Market (October, 2023). Global Dolomite Market Size, Share, and COVID-19 Impact Analysis, By Product (Agglomerated, Calcined, and Sintered), By Application (Construction, Agriculture, Ceramics and Glass, Iron and Steel, Others), and By Region (North America, Europe, Asia-Pacific, Latin America, Middle East, and Africa), Analysis and Forecast 2022 – 2032. *Spherical Insights.* Retrieved from https://www.sphericalinsights.com/reports/dolomite-market

Hansmann, T., Tan, K. T., Zhou, Y. & Loh, Y. W. (2023). *Harnessing volatility: Technology transformation in oil and gas.* Mc Kinsey & Company

Hashmicro. (2022, August 3). Here are 3 Biggest Problems in Facing the Oil and Gas Industry. *HashMicro*. Retrieved from https://www.hashmicro.com/blog/top-3-biggest-challenges-facing-the-oil-and-gas-industry/

Indeed. (2022, October 2). *Mining support services jobs*. Indeed find jobs. Retrieved from https://au.indeed.com/q-mining-support-services-jobs.html?vjk=1f857b9c39a51b90

Jabatan Keselamatan dan Kesihatan Pekerjaan. (n.d.). *Pelan Tindakan Penambahbaikan Keselamatan dan Kesihatan Pekerjaan di Sektor Perlombongan dan Pengkuarian.* Ministry of Human Resources. Retrieved from https://www.dosh.gov.my/index.php/presentation-slides/bengkel-compliance-support-sebaran-kajian-bagi-sektor-perlombongan-dan-pengkuarian/1485-modul-latihan-lombong-dan-kuari/file

Jabatan Mineral dan Geosains. (2021). *Industrial Mineral Production Statistics and Directory of Producers in Malaysia*. Jabatan Mineral dan Geosains.

Jabatan Mineral dan Geosains Malaysia. (2022). *Laporan Tahunan 2021* (U. D. Hussin, Ed.). Jabatan Mineral dan Geosains Malaysia, Kementerian Tenaga dan Sumber Asli.

Jabatan Mineral dan Geosains Malaysia & Ministry of Energy and Natural Resources. (2021). *Directory of Mineral-based Industries in Malaysia 2021*. Jabatan Mineral dan Geosains Malaysia.

Jones, H., & Twiss, B. C. (1978). *Forecasting technology for planning decision*. London: MacMillan Press. DOI:10.1007/978-1-349-03134-4

Kementerian Tenaga dan Sumber Asli. (2021). *Kerangka Pelan Transformasi Industri Mineral Negara 2021-2030* (1st ed.). Kementerian Tenaga dan Sumber Asli.

Malaysia Green Technology and Climate Change. (2012). *Green Practice Guidelines for Mining Sector*. MGTC.

Malaysian Green Technology and Climate Change Corporation (MGTCCC). (2022). *Green practices guideline for mining sector*. MGTCCC

Malaysian Investment Development Authority. (n.d.). *Oil and Gas*. MIDA. Retrieved from https://www.mida.gov.my/industries/services/oil-and-gas/

Malaysian Investment Development Authority (MIDA) (2022). *Sustainable investments for growth, Malaysian Investment Performance Report 2022.* MIDA

Malaysian Investment Development Authority (MIDA) (2021). *Powering resilience, Malaysian Investment Performance Report 2022.* MIDA.

Malaysia Petroleum Resources Corporation (MPRC) (2021) *OGSE100: FY2021 Top 100 OGSE Companies in Malaysia*. MPRC

Malaysian Qualifications Agency. (2017). *Malaysia Qualification Framework* (2nd ed.). Malaysia Qualification Agency. Retrieved from https://www.mqa.gov.my/new/document/mqf/2021/MQF%20Ed%202%2002102019%20updated%2017022021.pdf

Maloney, W. (2021, March 10). Challenges And Trends For The Oil And Gas Industry. *Forbes*. Retrieved from https://www.forbes.com/sites/uhenergy/2021/03/10/challenges-and-trends-for-the-oil-and-gas-industry/?sh=22576488167f

Markets and Markets. (n.d.). Mining Support Activities Market Research Reports & Consulting from Markets and Markets. *Markets and Markets*. Retrieved from https://www.marketsandmarkets.com/mining-support-activities-market-research-195.html

McKinsey's Global Energy & Materials Practice. (2020, October). The mine-to-market value chain: A hidden gem. *Global Energy & Materials Practice*. Retrieved from https://www.mckinsey.com/~/media/McKinsey/Industries/Metals%20and%20Mining/Our%20Insights/The%20mine%20to%20market%20value%20chain%20A%20hidden%20gem/The-mine-to-market-value-chain-A-hidden-gem-vF.pdf

Ministry of Economy Malaysia (2023), *National Energy Transition Roadmap: Energising the nation, powering our future*. Retrieved from https://www.ekonomi.gov.my/sites/default/files/2023-09/National%20Energy%20Transition%20Roadmap_0.pdf

Ministry of Human Resources (2020). *MASCO: Malaysia Standard Classification of Occupations 2020*. Ministry of Human Resources

Nair, K. (2023, June 29). Experts: New talent needed for transition to renewable energy. The Star. Retrieved from https://www.thestar.com.my/news/nation/2023/06/29/experts-new-talent-needed-for-transition-to-renewable-energy#:~:text=In%20order%20to%20achieve%20a,would%20require%20200%2C000%20new%20jobs.

Observatory of Economic Complexity. (n.d.). *Crude Petroleum in Malaysia: OEC*. The Observatory of Economic Complexity. Retrieved from https://oec.world/en/profile/bilateral-product/crude-petroleum/reporter/mys#subnational-data

Oil & Gas Advancement (November 3, 2023). Productivity Boost In Oil And Gas Sector Thanks To Robotics. *New, Upstream.* Retrieved from https://www.oilandgasadvancement.com/news/productivity-boost-in-oil-and-gas-sector-thanks-to-robotics/

OilandGasJobSearch.com. (n.d.). *The Energy Outlook 2021 Annual Report*. Brunel International. Retrieved from https://hiring.oilandgasjobsearch.com/hubfs/2021%20Energy%20Outlook%20Report.pdf?hsLang=en

Organization for Economic Cooperation and Development (OECD) (n.d.) . *Core competency framework human resource management*. Paris, France: OECD. Retrieved from https://www.oecd.org/careers/OECD-Core-Competency-Framework.pdf

OECD (2018) Learning Framework 2030. Paris, France: OECD

Pesuruhjaya Penyemak Undang-undang. (n.d.). *Undang-undang Malaysia Akta 652* (2006th ed.). Pesuruhjaya Penyemak Undang-undang.

Petroliam Nasional Berhad. (2022). *PETRONAS Integrated Report 2021*. PETRONAS

PETRONAS (2016, 15 May,). PETRONAS' First Floating LNG Facility, PFLNG Satu Sets Sail to Malaysia. *Media Release*. Retrieved from https://www.petronas.com/media/media-releases/petronas-first-floating-lng-facility-pflng-satu-sets-sail-malaysia#:~:text=Designed%20for%20water %2Ddepths%20between,preferred%20and%20reliable%20LNG%20supplier

PETRONAS Technology Ventures Sdn Bhd. (2023). *Technology Solutions*. [Brochure] . PETROLIAM NASIONAL BERHAD (PETRONAS).

Petroliam Nasional Berhad (PETRONAS) (2023). *PETRONAS Activity Outlook 2024-2026*. Retrieved from https://www.petronas.com/sites/default/files/uploads/content/2023/PETRONAS%20Activity%20Outlook%202024-2026.pdf

Pill, J. (1971). The Delphi method: Substance, context, a critique and annotated bibliography. *Socio Economic Planning Science, 5*, 57-71.

Richey, R. C., & Klein, J. (2007). *Design and Development Research: Methods, Strategies, and Issues.* Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Siraj, S., & Ali, A. (2008). Principals' projections on the Malaysian secondary school future curriculum. *International Education Studies, 1*, 61–78.

TalentCorp. (2021, December 30). *Critical occupations list 2020/2021*. TalentCorp. Retrieved from https://www.talentcorp.com.my/clients/TalentCorp_2016__7A6571AE-D9D0-4175-B35D-99EC514F2D24/contentms/img/Documents /COL%202020-2021_Occupation%20Report_FINAL.pdf

Tayebi-Khorami M, Edraki M, Corder G & Golev A. (2019). Re-Thinking Mining Waste through an Integrative Approach Led by Circular Economy Aspirations. *Minerals*, *9*(5), 286. DOI:10.3390/min9050286

United Nation Offices. (n.d.). *Sustainable Development Goals*. United Nations in Malaysia, Singapore and Brunei Darussalam. Retrieved from https://malaysia.un.org/en/sdgs

United Nations Development Programme, World Economic Forum, & Columbia Center on Sustainable Investments. (2016, November 8). *Mapping Mining to the SDGs: An Atlas*. United Nations Development Programme. Retrieved from https://www.undp.org/publications/mapping-mining-sdgs-atlas

Upadhyay, A., Laing, T., Kumar, V. & Dora, M (2021). Exploring barriers and drivers to the implementation of circular economy practices in the mining industry, *Resources Policy, 72*, 102037. DOI:10.1016/j.resourpol.2021.102037.

Xavier, L. H., Giese, E. C., Ribeiro-Duthie, A. C. & Freitas Lins, F. A. (2021). Sustainability and the circular economy: A theoretical approach focused on e-waste urban mining. *Resources Policy*, *74*, 101467. DOI:10.1016/j.resourpol.2019.101467

6Wresearch (August, 2022). Malaysia Silica Market Outlook: Analysis, COVID-19 IMPACT. *Companies, Trends, Growth, Size, Forecast, Value, Revenue, Industry & Share***.** Retrieved from https://www.6wresearch.com/industry-report/malaysia-silica-market-outlook

APPENDIX 3.1

B09: SUPPORT ACTIVITIES FOR OTHER MINING AND QUARRYING
PROTOCOL FOR THE FOCUS GROUP DISCUSSION 1

The Focus group discussion comprises three parts: the opening, the discussion and the closing. The session will start with an opening to introduce the purpose of the session, and end with a closing to enable participants to give final input.

No.	Session	Description
1	**The Opening**	1. Introduction to the team of consultants. 2. The purpose of the FGD is explained (i.e. To develop the occupational framework for B090 group which comprises the following: a) Occupational Structure (OS) for the B090 group that consist of job area, job titles and job levels, Job Description and Critical Job Titles; b) Definition and Occupational responsibilities for all job areas. 3. The context, inclusion and exclusion criteria are elaborated for B09 Item: 09101 Oil and gas extraction service activities provided on a fee or contract basis 09102 Oil and gas field fire fighting services **Includes:** (a) exploration services in connection with petroleum or gas extraction (e.g. traditional prospecting methods, such as making geological observations at prospective sites) (b) directional drilling and redrilling, "spudding in", derrick erection in site, repairing and dismantling, cementing oil and gas well casings, pumping of wells, plugging and abandoning wells (c) liquefaction and regasification of natural gas for purpose of transport, done at the mine site (d) draining and pumping services, on a fee or contract basis (e) test drilling in connection with petroleum or gas extraction **Excludes** (a) service activities performed by operators of oil or gas fields, see 0610, 0620 (b) specialized repair of mining machinery, see 33120 (c) liquefaction and regasification of natural gas for purpose of transport, done off the mine site, see 19201 (d) geophysical, geologic and seismic surveying, see 71103

<table>
<tr><th>No.</th><th>Session</th><th>Description</th></tr>
<tr><td></td><td></td><td>
Item:
09900 Support activities for other mining and quarrying

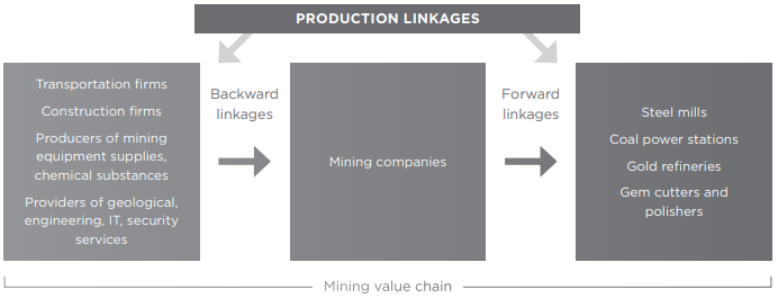
Includes:
(a) support services on a fee or contract basis, required for mining and quarrying activities of divisions 05, 07 and 08
(b) exploration services (e.g. traditional prospecting methods, such as taking core samples and making geological observations at prospective sites)

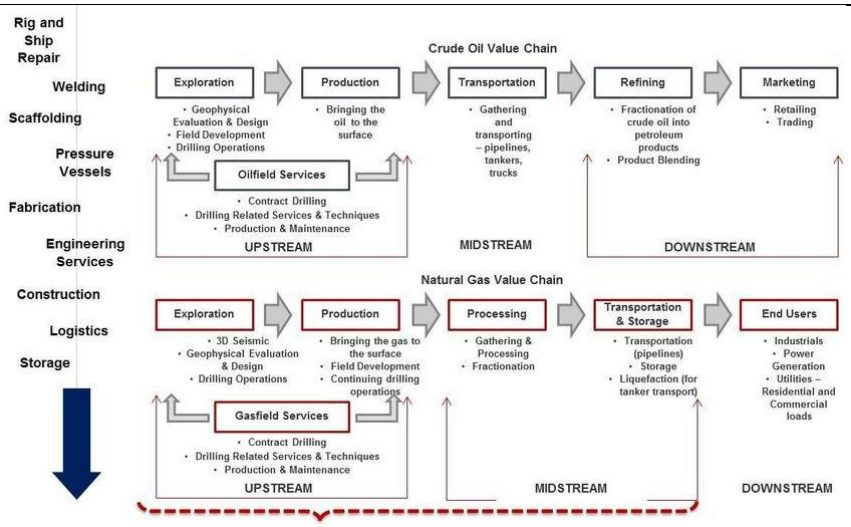
(c) draining and pumping services, on a fee or contract basis
(d) test drilling and test hole boring
(e) cleaning services e.g. cleaning of ‘palong’

Excludes:
(a) operating mines or quarries on a contract or fee basis, see divisions 05, 07 or 08
(b) specialized repair of mining machinery, see 33120
(c) geophysical surveying services, on a contract or fee basis, see 71103

4. Ground Rules for the discussion is elaborated as follows:
a. Participation in the focus group is voluntary.
b. It is all right to abstain from discussing specific topics if you are not comfortable.
c. All responses are valid—there are no right or wrong answers.
d. Please respect the opinions of others even if you do not agree.
e. Try to stay on topic; we may need to interrupt so that we can cover all the material.
f. Speak as openly as you feel comfortable.
g. Avoid revealing very detailed information about your personal health.
h. Help protect others’ privacy by not discussing details outside the group
i. Leave your position “jacket” outside the room.
j. We work as a team for the benefit of the nation.

(https://www.uml.edu)
</td></tr>
<tr><td>2.</td><td>The discussion</td><td>The discussion and contribution among panel members will focus on the occupational structure (OS) and job description (JD)</td></tr>
</table>

No.	Session	Description
3	**Mining & Quarrying**	**a. <u>Support activities for other mining and quarrying</u>** FIGURE ES5. PRODUCTION LINKAGES IN THE MINING VALUE CHAIN  Brainstorming during the FGD would involve determining the occupation needs for the industry (NR-REE; Bauxite & Tin & Quarrying) to answer the question: 1. What is the occupational structure required (OS) for B090 based on the **Backward production linkages** in the value chain? 2. Facilitator to take note on the following inclusion areas in the MSIC: a. support services on a fee or contract basis, required for mining and quarrying activities of divisions 05, 07 and 08 b. exploration services (e.g. traditional prospecting methods, such as taking core samples and making geological observations at prospective sites) c. draining and pumping services, on a fee or contract basis? d. test drilling and test hole boring e. cleaning services e.g. cleaning of 'palong' 3. What are the job responsibilities and descriptions (JD) for each job title?
4	**Oil & Gas**	**<u>b. Support activities for petroleum and natural gas extraction</u>** **<u>09101 Oil and gas extraction service activities provided on a fee or contract basis</u>** **<u>09102 Oil and gas field fire fighting services</u>**

No.	Session	Description
		 Brainstorming during the FGD would involve determining the occupations needs for the support activities in the Oil and Gas industry to answer the question: 1. What is the occupational structure required (OS) for B090 based on the **Upstream processes and linkages** in the value chain? 2. Facilitator to take note on the following inclusion areas in the MSIC: (a) exploration services in connection with petroleum or gas extraction (e.g. traditional prospecting methods, such as making geological observations at prospective sites) (b) directional drilling and redrilling, "spudding in", derrick erection in site, repairing and dismantling, cementing oil and gas well casings, pumping of wells, plugging and abandoning wells (c) liquefaction and regasification of natural gas for purpose of transport, done at the mine site (d) draining and pumping services, on a fee or contract basis (e) test drilling in connection with petroleum or gas extraction 3. What is the occupational structure required (OS) for B090 based the **midstream production** in the Oil & Gas industry B090? 4. What are the job responsibilities and descriptions (JD) for each job title?
5.	**Closure**	Is there any areas which need improvement? How can the Occupational Structure be improved?

APPENDIX 3.2

B09: SUPPORT ACTIVITIES FOR OTHER MINING AND QUARRYING
PROTOCOL FOR INTERVIEWS & SITE VISITS WITH EXPERTS

1. The purpose of the interview is explained (.ie. To verify and improve on the following:

   a) Occupational Structure (OS) for the B090 group that consist job area, job titles and job levels, Job Description and Critical Job Titles;

   b) Definition and Occupational responsibilities for all job areas.

2. The context, inclusion and exclusion criteria are elaborated for B09.

3. The expert would be shown the Occupational Structure, Occupational Description and Occupational Responsibilities developed during the FGD1. Any queries would be explained.

   a) What is your area of expertise and experience?

   b) Does the occupational structure (OS) for B090 reflect the industry ?

   c) In your opinion and experience, what other job areas and job titles should be included?

   d) Is the job responsibility for the job title adequate?

APPENDIX 3.3

B09: SUPPORT ACTIVITIES FOR OTHER MINING AND QUARRYING
PROTOCOL FOR FOCUS GROUP DISCUSSION 2 WITH EXPERT PANEL

No.	Session	Description
1	**The opening**	(1) An introduction to the team of consultants. (2) The purpose of the FGD is explained (i.e. To verify and develop the occupational framework for B090 group which comprises the following: a) Occupational Structure (OS) for the B090 group that consist of job area, job titles and job levels, Job Description and Critical Job Titles; b) Definition and Occupational responsibilities for all job areas. c) To determine the competency needed to address the demand and supply of the industry
2.	**The discussion**	The discussion and contribution among panel members will focus on: a) What are the needs for the skills and competences in the industry? b) How can the job descriptions for jobs relevant to technology and sustainable mining be determined? c) What are the critical jobs?
3.	**Closure**	Is there any areas which needs to be added?

APPENDIX 3.4

UNIVERSITI MALAYA

Dorothy DeWitt <dorothy@um.edu.my>

Acceptance of Paper Presentation at ICSED 2023

ZAMZAMI ZAINUDDIN . <zamzami@um.edu.my> Mon, Sep 4, 2023 at 7:55 PM
To: Dorothy DeWitt <dorothy@um.edu.my>
Cc: icsed 2023 <icsed.2023@gmail.com>

Dear Dr. Dorothy DeWitt,

We are delighted to inform you that your abstract, ***"Development Of Occupational Framework (OF) For the Mining Support Services Activities (B09) in Malaysia Based On MSIC 2008,"*** has been accepted for presentation at **The International Conference on Sustainability Education Development 2023 (ICSED 2023)**.

Your abstract was thoroughly reviewed using the **Blind Review** method, and we are pleased to inform you that it has been selected for presentation at the conference. Your research will significantly contribute to the conference's objectives and theme.

Please make a note of the following essential details regarding your presentation:

Conference	: The International Conference on Sustainability Education Development 2023 (ICSED 2023)
Mode	: Hybrid (Physical and online)
Date	: October 25-26, 2023
Venue	: Faculty of Education, University of Malaya, Malaysia
Website	: https://umevent.um.edu.my/icsed2023

We kindly request that you prepare a presentation based on your paper to share your findings, insights, and recommendations with the conference participants. You will be allocated a specific time slot, and further details regarding the presentation schedule will be communicated closer to the conference dates.

We congratulate you again on accepting your paper and look forward to participating in ICSED 2023. Your contribution will undoubtedly enrich the conference and promote discussions on sustainable education development. Please do not hesitate to contact us with any questions or further information.

We eagerly await your presentation and wish you every success in your preparations.

Regards,
Chair of ICSED 2023

--

UNIVERSITI MALAYA

Dr. Zamzami Zainuddin
Faculty of Education, University of Malaya (UM), Malaysia
PhD in Education, The University of Hong Kong (HKU), HK
https://umexpert.um.edu.my/zamzami.html
Scopus | ResearcherID | Google Scholar | Researchgate | LinkedIn

---

Latest publications (SSCI):

Zainuddin, Z. (2023). Integrating ease of use and affordable gamification-based instruction into a remote learning environment. *Asia Pacific Education Review*, 1-12.

APPENDIX 4.1

CASE STUDY: SUPPORT SERVICES FOR MINING ACTIVITIES RELATED TO SILICA QUARRYING

Silica is also referred to as "silica sand" and "quartz sand," is industrial sand and gravel with high silicon dioxide (SiO2) content. Silica is used in glassmaking; for foundry, abrasive, and hydraulic fracturing (frac) applications and for many other industrial uses (USGS, 2023). In most cases, silica mining uses open pit or dredging mining methods and except for temporarily disturbing the immediate area while mining operations are active, it usually has limited environmental impact (USGS, 2023).

The context:

The silica quarrying site specifically selected for the observation of the processes related to the mining activities was made possible by Yusri Holdings Legacies at their mining site in Serdang, Kedah. The state land is managed by KOSADA.

Date: 29th August 2023

Methodology: Interviews and Observations at Site of Quarry. (Interview Protocol attached)

Experts and Stakeholders:

1. En. Affendi Md Yusri, Director, Yusri Holdings Legacies
2. En Abdul Aziz Md Noor, Senior Executive, Koperasi Kakitangan Sada Kedah Berhad (KOSADA).
3. En. Micheal Ban, Abanco Mining Works.

Findings:

The silica quarrying site was a former disused tin mine. The silica obtained is of high quality and suitable for the making of glass and solar panels.

Activities in supporting the quarrying of silica:

1. The silica is tested for quality. Samples are sent to a chemical laboratory locally to be tested. Different parts of the mine have silica of different quality. The potential buyer of the silica may also do their chemical testing independently to determine the quality of the silica at their own laboratories.
2. Quarrying and separation of silica.
    a. There is no need for crushing the silica as the extraction is from sand remnants (tailings) from the former tin mine.
    b. Abanco Mining Works does the process of “cleaning” the sand, which is to separate the silica from the heavier sand containing fine iron ore. Due to the size of the iron particles in the sand, it is undesirable and currently, not profitable for extraction. The “palong” is used to separate the silica from the lower quality and heavier sand with iron content. This lower quality sand sinks in the “palong” and the fine silica is separated for transport.

    c. The water used after the washing is collected in a containment pond, and is filtered through five other ponds. At the final pond it is clear water.
3. Locally used and Export. The silica is sold to glass manufacturing factories in Butterworth, Penang and the balance is exported to foreign buyers, through the Butterworth port.
4. Environmentally safe processes. The quarrying and separation seem to use environmentally efficient process. The water used for the separation process at the palong is recycled from the ponds. There are no chemicals, and the waste water nor sand does not reach the rivers. *Jabatan Mineral & Geosains Kedah* will occasionally come to observe and test for environmental pollution.
5. Occupational Safety. The workers did not use protective masks at the site. There did not seem to be any dust as it had rained the night before. However, we were informed that on days which were windy and dusty, masks were used so as to protect the workers' health.
6. Rehabilitation Planning. The silica separation would probably continue for two years. After which, the land-owners would plan for the rehabilitation of the land. The suggestions were to use the water catchment areas for fishing ponds, or agriculture such as poultry farming or even palm oil plantation.
7. Abanco Mining Works staff has 11 workers who are the operators who have been trained in the process of silica separation, operating the dredges, and the transport within the quarry to support the quarrying activities.

Conclusion:

The support activities for silica quarrying is the cleaning and washing of sand requires operators who are skilled in the processes of separation. In addition, chemical testing services is required for determining the quality of the silica obtained. Responsible quarrying and separation processes ensures the environmental quality is maintained.

References:

USGS (2023). Silica Statistics and Information. Retrieved from https://www.usgs.gov/centers/national-minerals-information-center

Photos:

Mr. Micheal Ban and his staff, “Palong” Operator, En. Abdul Aziz Md Noor, En. Affendi Md Yusri, & Dr Dorothy DeWitt at the silica quarrying site in Kedah.

Silica Quarrying site

Sand Washing

Palong to separate the silica from the lower grade sand.

Containment ponds

INTERVIEW PROTOCOL

1. Can you describe the mining support service you provide?
2. How many workers do you have and their responsibilities? What is the highest level of expertise? Are they local workers?
3. Do you ensure the health and safety of your staff? How is compliance met?
4. Are the processes environmentally safe? What would you say is the impact of your activity to the environment?

APPENDIX 4.2

CASE STUDY: SUPPORT SERVICES FOR MINING ACTIVITIES AT LION MINING SDN BHD

Lion Mining Sdn Bhd is a company under the Lion Group and is focused on the prospecting exploration and mining of tin deposits in Malaysia. An area of 1,913 acres is being developed in Kuala Langat, Selangor to extract and produce tin, sand, ilmenite (Amang) and silica sand for supply to tin smelters, glass manufacturers, Industrialized Building Systems (IBS), amongst others.

Lion Mining has a total of 635 staff which includes executive and managerial staff, to technicians at various levels and general workers. In addition, there are contractors who operate the trucks and excavators at the site.

The context:
Lion Mining Sdn Bhd holds a Proprietary Mining License (PML) from the Selangor state government and an Operational Mining Scheme (OMS) from Jabatan Mineral & Geosains (JMG), Selangor / Wilayah Persekutuan Kuala Lumpur to carry out mining activities at their land in Kuala Langat, Selangor. This mining site was selected as it is the largest alluvial tin deposit in Malaysia. The purpose of the mine visit was for the observation of the processes to support the alluvial mining activities.

Date: 8th November 2023

Methodology: Interviews and Observations at the Mine site.

Experts and Stakeholders:

1. Mr Lee Weng Lan, Senior General Manager
2. Mr Yip Foo Weng, General Manager, Mineral Resource and Exploration (Certified Geologist)
3. Mr Oh Teik Soo, Operations Manager
4. Mr Mohamad Faizul Shahudi, Senior Manager, Technical
5. Dr Chow Yeong Kang, HSE Manager
6. En Lokman Ahmad, Operation Manager
7. Pn. Puteri
8. Human Resource Officers: Mr Tony Siew and Puan Siti Hawa

Findings:
The tin mining site was formerly an oil palm plantation and is now the largest open-pit alluvial mining site in Malaysia. The site yields minerals such as tin ore, silica sand, ilmenite. Activities in supporting the mining:

1. Mineral exploration: Exploration activities comprising geological mapping and Banka drilling were carried out to evaluate and establish the tin resources before mining planning and feasibility study were conducted. Two phases of Banka drilling were undertaken; the first phase was in the 1970s and the later check and confirmatory

phase was done in 2013. Banka drilling which is the drilling method for sampling alluvial mineral deposit such as the tin ore in Lion Mining Sdn Bhd areas. The drilling involved collection of ground samples, comprising mainly clay, sandy clay, clayey sand, gravels and sand at section intervals and determination by means of panning and chemical assaying of the mineral contents or grades of these samples. The minerals consist of cassiterite (SnO_2) and amang (collective name for heavy minerals such as ilmenite, zircon, monazite, xenotime, etc).

The exploration and evaluation works had quantified an economic tin ore resource down to the depth of 60-75 meters. Sand resources were also been quantified and evaluated for production of construction sand and silica sand.

The gestation period from exploration to mining was long due to the weakening of tin price in the tin price in mid 1980s and change of land ownership and other land related matters.

2. Mine Planning: The mineral exploration results enabled the company to determine suitable Mining method for extraction of the minerals. The open-pit mining and an innovative cutter suction dredge (CSD) were selected. The land previously being part of the riverbed of Kuala Langat River is an important source of tin and alluvial mining is suitable for extraction of the mineral ores.
3. Mine surveying: The mine survey measures existing or planned workings to assist with the design and planning of mine operation. The survey is critical to the design, planning and safety of alluvial mining.
4. Environmental monitoring: There are no chemicals used during the mining process and the water used for the separation process is recycled as much as possible. However, when there is a need, water is pumped from Sungai Langat with the approval of the relevant authority to be used for the processing plants, eg. Tin Shed plant and Silica Plants.
5. Occupational Safety and Health Monitoring: The company takes the safety and health of their workers seriously. There are reminders of the safety procedures displayed prominently.

   As the alluvial mining process is operating at greater depth, there are possible dangers of landslides which needs constant monitoring and maintenance.
6. Laboratory Testing: the Company has its own laboratory to test the samples of tin ore, sand and silica sand. In addition, it is a requirement that the samples be sent to JMG's Laboratory in Perak for official testing for tin ore and silica sand export. Potential buyers of the minerals may also request independent companies to do the chemical testing of the minerals.
7. Cleaning activities at the Palong. Palongs are still being used for washing the mineral. The Palong is used to separate the heavier tin ore, which settles near the "rifle" with sand being washed to the tail of the Palong.

   "Jigging" is used to separate the mineral particles based on their different densities and is aided by different frequencies.
8. Rehabilitation Planning. Rehabilitation of the mining land is a requirement after mine closure. The mine is expected to operate for at least another 10 years. The Company is required to make a deposit to the government to ensure that mine rehabilitation will be undertaken.

9. The Company pays a royalty to the government for mining. In addition, permits are required for mineral exports such as silica.
10. The Company hopes that special incentives could be extended to ensure the sustainability of the industry, such as reduced electricity tariffs, government-funded training for engineers and technicians for mining industries.
11. The Company aims to be the biggest tin mine in Malaysia and among the top 10 in the world.

Conclusion:
The support activities for tin mining included mine exploration, planning and surveying in the initial stages. Continuous monitoring which includes geotechnical surveying, environmental and safety, as well as laboratory testing are the activities to support the mining of tin.

References:

The Lion Group. https://www.liongroup.com.my/corporate.php

Photos:

Meeting the Management team from Lion Mining

The Open-Pit Mine at Lion Mining

The team at the mining site

Safety notices prominently displayed.

The Palong to separate the tin ore, which sinks and is contained in the “rifles”

A jig which uses a certain frequency to separate the minerals

The washed tin ore, which would be further refined using magnetic separators

Bags of tin ore which would be sent to the smelters to produce pure tin ingots.

INTERVIEW PROTOCOL

5. What are the mining support services?
6. How many workers do you employ and their responsibilities? What is the highest level of expertise? Are they local workers?
7. Do you ensure the health and safety of your staff?
8. Are the processes environmentally safe? What would you say is the impact of your activity to the environment?

APPENDIX 4.3

OCCUPATIONAL DESCRIPTION (OD)

MSIC Group: B091
AREA: O&G SITE PROSPECTING
LEVEL: 6 (Senior Petroleum Engineer)

Responsibilities:

- Interpret well-logging results (records of the geological formations located by drilling boreholes) to ascertain resource potential.
- Ascertain extraction risks, such as an area's potential for earthquakes.
- Manage projects and keeping accurate records of problems and progress.
- Liaise with and advising managerial and technical staff, including geologists and contractors.
- Provide advance guidance in decision-making for prospecting activities.
- Maintain company processes and procedures related to prospecting execution.
- Responsible for the integrity of the work produced by the team.

Knowledge:

- Advance Petroleum Engineering
- Advance with detailed engineering and design work procedures and processes of prospecting activities.
- Latest technology development used in the field.
- Education and Training.
- Administration.
- Production and Processing.
- Experience in International Projects.

Skills:

- Able to read and understand contractual documentation.
- Able to effectively communicate with and lead engineers and non-engineers.
- Administration and Management skills.
- Public Safety and Security.
- Leadership skills.
- Expert in using analytical tools and reporting to higher management.

Attributes (Attitude/ Safety/ Environment):

- Leadership
- Judgement and decision-making
- Communication
- Complex Problem Solving
- Mentoring
- Systems Analysis
- Critical thinking
- Career-management

MSIC Group: B091
AREA: O&G SITE PROSPECTING
LEVEL: 5 (Petroleum Engineer)

Responsibilities:

- Design methods of extracting oil and gas safely and efficiently using specialist computer applications and mathematical models.
- Select and maintain analysing equipment.
- Supervise extraction sites.
- Analyse geological data.
- Monitor and evaluating the performance of extraction sites.
- Report directly to Senior Petroleum Engineer.
- Provide guidance in decision-making for prospecting activities.
- Maintain company processes and procedures related to prospecting execution.
- Responsible for the integrity of the work produced by the team.

Knowledge

- Petroleum Engineering
- Understand detailed engineering and design work procedures and processes of prospecting activities.
- Latest technology development used in the field.
- Education and Training.
- Administration.
- Production and Processing.

Skills

- Able to read and understand contractual documentation.
- Able to effectively communicate with and lead engineers and non-engineers.
- Administration and Management skills.
- Public Safety and Security.
- Expert in using analytical tools and reporting to higher management.

Attributes (Attitude/ Safety/ Environment)

- Leadership
- Judgement and decision-making
- Communication
- Problem Solving
- Systems Analysis
- Critical thinking
- Career-management

MSIC Group: B091
AREA: O&G SITE PROSPECTING
LEVEL: 6 (Senior Geoscience)

Responsibilities:

- Conduct a thorough analysis of geological data, including well logs and core samples to evaluate the potential for oil and gas reserves in specific areas or prospects.
- Interpret complex geological and geophysical data to identify optimal drilling locations and potential reservoirs.
- Conduct detailed reservoir characterization studies to estimate reservoir size, fluid properties, and production potential.
- Stay updated with the latest advancements in geological exploration techniques, tools, and software to enhance efficiency and accuracy in analysis and interpretation.
- Prepare technical reports and presentations summarizing geological findings and recommendations for management and stakeholders.
- Maintain company processes and procedures related to prospecting execution.
- Responsible for the integrity of the work produced by the team.

Knowledge:

- Advance Geoscience Engineering
- Advance with detailed engineering and design work procedures and processes of prospecting activities.
- Latest technology development used in the field.
- Education and Training.
- Administration.
- Production and Processing.
- Experience in International Projects.

Skills

- Able to read and understand contractual documentation.
- Able to effectively communicate with and lead engineers and non-engineers.
- Administration and Management skills.
- Public Safety and Security.
- Leadership skills.
- Expert in using analytical tools and reporting to higher management.

Attributes (Attitude/ Safety/ Environment)

- Leadership
- Judgement and decision-making
- Communication
- Complex Problem Solving
- Mentoring
- Systems Analysis
- Critical thinking
- Career-management

MSIC Group: B091
AREA: O&G SITE PROSPECTING
LEVEL: 5 (Geoscience)

Responsibilities

- Collaborate with multidisciplinary teams, including engineers, geophysicists, and drilling specialists, to develop exploration strategies and plans.
- Evaluate and monitor reservoir performance through the analysis of production data and geological models.
- Ensure compliance with health, safety, and environmental regulations throughout all geological operations.
- Generate accurate geological maps, cross-sections, and models to aid in decision-making and resource estimation.
- Report directly under Senior Geoscience.
- Maintain company processes and procedures related to prospecting execution.
- Responsible for the integrity of the work produced by the team.

Knowledge

- Geoscience Engineering
- Understand with detailed engineering and design work procedures and processes of prospecting activities.
- Latest technology development used in the field.
- Education and Training.
- Administration.
- Production and Processing.

Skills

- Able to read and understand contractual documentation.
- Able to effectively communicate with and lead engineers and non-engineers.
- Administration and Management skills.
- Public Safety and Security.
- Leadership skills.
- Expert in using analytical tools and reporting to higher management.

Attributes (Attitude/ Safety/ Environment)

- Leadership
- Judgement and decision-making
- Communication
- Complex Problem Solving
- Mentoring
- Systems Analysis
- Critical thinking
- Career-management

MSIC Group: B091
AREA: O&G TEST DRILLING PROCESSES
LEVEL: 6 (Senior Drilling Engineer)

Responsibilities:

- Establish and administer drilling and service contracts.
- Design and select well-head equipment.
- Design directional well paths (horizontally or multi-laterally, as appropriate).
- Contribute to conceptual field development design.
- Work with multidisciplinary professionals to evaluate the commercial viability of the well and monitor progress during drilling.
- Obtain relevant data, carrying out engineering analysis on site and recommending necessary actions and writing up reports.
- Monitor the daily progress of well operations.
- Draw up drilling programmes, taking account of desired production flow rates.
- Adhere to environmental protection standards, in some cases through direct discussion with local governments to ensure compliance with legislative requirements.
- Extend training and technical support to junior engineers.

Knowledge

- Drilling Engineering
- Advance with detailed engineering and design work procedures and processes of drilling activities.
- Latest technology development used in the field.
- Education and Training.
- Administration.
- Production and Processing.
- Experience in International Projects.

Skills

- Able to read and understand contractual documentation.
- Able to effectively communicate with and lead engineers and non-engineers.
- Administration and Management skills.
- Public Safety and Security.
- Leadership skills.
- Expert in using analytical tools and reporting to higher management.

Attributes (Attitude/ Safety/ Environment)

- Leadership
- Judgement and decision-making
- Communication
- Complex Problem Solving
- Mentoring
- Systems Analysis

- Critical thinking
- Career-management

MSIC Group: B091
AREA: O&G TEST DRILLING PROCESSES
LEVEL: 5 (Drilling Engineer)

Responsibilities

- Coordinate and supervise the work of the drilling team.
- Prepare well data sheets.
- Undertake engineering design and the planning of wells (including development work).
- Monitor the daily progress of well operations.
- Monitor safety and ensuring the good maintenance of the well.
- Keep track of current daily costs, comparing actual costs with expenditure proposals and recommending cost-effective changes.

Knowledge

- Drilling Engineering
- Known to detailed engineering and design work procedures and processes of drilling activities.
- Latest technology development used in the field.
- Education and Training.
- Administration.
- Production and Processing.

Skills

- Able to read and understand contractual documentation.
- Able to effectively communicate with and lead engineers and non-engineers.
- Administration and Management skills.
- Public Safety and Security.
- Leadership skills.
- Expert in using analytical tools and reporting to higher management.

Attributes (Attitude/ Safety/ Environment)

- Leadership
- Judgement and decision-making
- Communication
- Problem Solving
- Mentoring
- Systems Analysis
- Critical thinking
- Career-management

MSIC Group: B091
AREA: O&G FLUID SERVICES
LEVEL: 6 (Senior Pump Engineer)

Responsibilities

- Always updated on industry regulations and guidelines related to pump operation, safety, and environmental protection.
- Ensure that any actions and operations comply with applicable standards, permits, and legal requirements.
- Coordinate with project managers to align pump activities with overall project goals.
- Monitoring the daily progress of well operations.
- Monitoring safety and ensuring the good maintenance of the well.
- Keeping track of current daily costs, comparing actual costs with expenditure proposals and recommending cost-effective changes.

Knowledge

- Fluid Engineering
- Advance with detailed engineering and design work procedures and processes of pumping activities.
- Latest technology development used in the field.
- Education and Training.
- Administration.
- Production and Processing.
- Experience in International Projects.

Skills

- Able to read and understand contractual documentation.
- Able to effectively communicate with and lead engineers and non-engineers.
- Administration and Management skills.
- Public Safety and Security.
- Leadership skills.
- Expert in using analytical tools and reporting to higher management.

Attributes (Attitude/ Safety/ Environment)

- Judgement and decision-making
- Communication
- Problem Solving
- Mentoring
- Systems Analysis
- Critical thinking
- Career-management

MSIC Group: B091
AREA: O&G FLUID SERVICES
LEVEL: 5 (Pump Engineer)

Responsibilities

- Maintain accurate records of pump operations, maintenance activities, and any incidents or repairs.
- Generate reports detailing pump performance, maintenance schedules, and inventory of spare parts.
- Work as part of a team, collaborating with other operators, technicians, and supervisors.
- Perform tests on new pumps to ensure they are operating correctly before they are installed into the system.

Knowledge

- Fluid Engineering
- Known with detailed engineering and design work procedures and processes of pumping activities.
- Latest technology development used in the field.
- Education and Training.
- Administration.
- Production and Processing.

Skills

- Able to read and understand contractual documentation.
- Able to effectively communicate with and lead engineers and non-engineers.
- Administration and Management skills.
- Public Safety and Security.
- Leadership skills.
- Expert in using analytical tools and reporting to higher management.

Attributes (Attitude/ Safety/ Environment)

- Leadership
- Judgement and decision-making
- Communication
- Problem Solving
- Mentoring
- Systems Analysis
- Critical thinking
- Career-management

MSIC Group: B091
AREA: O&G LIQUEFACTION AND REGASIFICATION OPERATIONS
LEVEL: 6 (Senior Operation Engineer)

Responsibilities

- Participate in the communication of project plans through presentations to LNG management.
- Oversee and ensure projects meet pre-determined objectives concerning quality, technical specifications, reliability, schedule and budget.
- Obtain, oversee, integrate and coordinate internal and external resources necessary to ensure materials and equipment are delivered on time.
- Monitor project progress and recommends to management any schedule changes, cost and resource adjustments that are required to meet company objectives.

Knowledge

- Gas Engineering
- Advance with detailed engineering and design work procedures and processes of Liquefaction and Regasification operations.
- Latest technology development used in the field.
- Gas engineering principles, practices, and standards, such as fluid mechanics thermodynamics, combustion, gas processing, and gas quality.
- Education and Training.
- Administration.
- Production and Processing.
- Experience in International Projects.

Skills

- Able to read and understand contractual documentation.
- Able to effectively communicate with and lead engineers and non-engineers.
- Administration and Management skills.
- Public Safety and Security.
- Leadership skills.
- Expert in using analytical tools and reporting to higher management.

Attributes (Attitude/ Safety/ Environment)

- Leadership
- Judgement and decision-making
- Communication
- Problem Solving
- Mentoring
- Systems Analysis
- Critical thinking
- Career-management

MSIC Group: B091
AREA: O&G LIQUEFACTION AND REGASIFICATION OPERATIONS
LEVEL: 5 (Operation Engineer)

Responsibilities

- Develop / incorporate applicable Standards, Procedures, and State/Federal statutory requirements into Gas systems designs.
- Incorporate process safety procedures into the project work flow as required.
- Solid working knowledge of oil and gas processing, methods and equipment.
- Define work methods, lead and manage systems upgrades, reliability and efficiency lead new technologies implementation.
- Ensure all project work is conducted in a manner consistent with the Company's safety and procurement policies and programs.
- Participate in the communication of project plans through presentations to LNG management.

Knowledge

- Gas Engineering
- Known with detailed engineering and design work procedures and processes of Liquefaction and Regasification operations.
- Latest technology development used in the field.
- Gas engineering principles, practices, and standards, such as fluid mechanics thermodynamics, combustion, gas processing, and gas quality.
- Education and Training.
- Administration.
- Production and Processing.

Skills

- Able to read and understand contractual documentation.
- Able to effectively communicate with and lead engineers and non-engineers.
- Administration and Management skills.
- Public Safety and Security.
- Leadership skills.
- Expert in using analytical tools and reporting to higher management.

Attributes (Attitude/ Safety/ Environment)

- Leadership
- Judgement and decision-making
- Communication
- Problem Solving
- Mentoring
- Systems Analysis
- Critical thinking
- Loyalty
- Career-management

MSIC Group: B099
AREA: Mine & Quarrying Planning Services
LEVEL: 7 (Mining Project Leader)

Job Responsibilities

- Identify the planning for the mining and quarrying production activities.
- Propose and design mining and quarrying plans for the development and production activities
- Design the planning activities to ensure the statutory responsibility for safety and environmental impact are in place.
- Oversee the planning of the acquisition and installation, maintenance and storage of mining plant and equipment.

Knowledge

- Knowledge of government practices, policies, practices and regulation
- Project management

Skills:

- Management skills
- Planning and organising
- Time management
- Interpersonal communication
- Leadership
- Problem-solving skills
- Aptitude for Technology and Equipment
- Agile Mindset, and

Attributes:

- Professionalism
- Work Ethics
- Team work
- Dependability (Trustworthy & Reliable)
- Proper Etiquette in social situations
- Agility (Ability to think and understand quickly)
- Analytical thinking
- Stress management
- Self-management/ independent
- Career-management (career path and individual development, succession planning)
- Attention to details
- Multi-tasking/ Flexibility
- Self-learning

MSIC Group: B099
AREA: Mine & Quarrying Planning Services
LEVEL: 4 (Senior Mining Technician)

Job Responsibilities

- Assist in the designing of mine development operations
- Assist in the acquisition and installation, maintenance and storage of mining plant and equipment
- Knowledge
- Knowledge of mobile and stationary mine equipment operations and clean-up.
- Knowledge of maintenance on mobile and stationary mine equipment.
- Safety guidelines related to the use and maintenance of equipment operations and occupational safety and health
- Knowledge of environmental policies and procedures
- Project management

Skills:

- Able to operate, clean-up and conduct regular maintenance on mine equipment.
- Able to communicate in writing and verbally with individuals and small groups of employees.
- Able to read and interpret technical manuals to complete work assigned
- Time management
- Interpersonal communication
- Leadership
- Problem-solving skills
- Aptitude for Technology and Equipment
- Agile Mindset, and
- Planning and organising

Attributes:

- Professionalism
- Work Ethics
- Team work
- Dependability (Trustworthy & Reliable)
- Proper Etiquette in social situations
- Agility (Ability to think and understand quickly)
- Analytical thinking
- Stress management
- Self-management/ independent
- Career-management (career path and individual development, succession planning)
- Attention to details
- Multi-tasking/ Flexibility
- Self-learning

MSIC Group: B099
AREA: Mine & Quarrying Planning Services
LEVEL: 3 (Mining Technician)

Job Responsibilities

- Assist in the mine development operations
- Assist in installation and maintenance of mining plant
- Knowledge
- Knowledge of mobile and stationary mine equipment operations and clean-up.
- Knowledge of maintenance on mobile and stationary mine equipment.
- Safety guidelines related to the use and maintenance of equipment operations and occupational safety and health
- Knowledge of environmental policies and procedures
- Project management

Skills:

- Able to operate, clean-up and conduct regular maintenance on mine equipment.
- Able to communicate in writing and verbally with individuals and small groups of employees.
- Able to read and interpret technical manuals to complete work assigned
- Time management
- Interpersonal communication
- Leadership
- Problem-solving skills
- Aptitude for Technology and Equipment
- Agile Mindset, and
- Planning and organising

Attributes:

- Professionalism
- Work Ethics
- Team work
- Dependability (Trustworthy & Reliable)
- Proper Etiquette in social situations
- Agility (Ability to think and understand quickly)
- Analytical thinking
- Stress management
- Self-management/ independent
- Career-management (career path and individual development, succession planning)
- Attention to details
- Multi-tasking/ Flexibility
- Self-learning

ANNEX : LIST OF CONTRIBUTORS

B09: SUPPORT ACTIVITIES FOR OTHER MINING AND QUARRYING OCCUPATIONAL FRAMEWORK DEVELOPMENT COMMITTEE

Researchers

No	Name	Title	Organization
1	Professor Dr Norlidah Alias	Lead Researcher	UPUM Sdn. Bhd.
2	Ts. Ihsanulfitri Zahedi	Project Manager	UPUM Sdn. Bhd.
2	Dr Dorothy DeWitt	Researcher	UPUM Sdn. Bhd.
3	Mohd Shukri Md Hassim	Research Assistant	UPUM Sdn. Bhd.
4	Emran Bin Hamidi	Proof Reader	UPUM Sdn. Bhd.

List of Expert Panel & In-Depth Interview

No	Name	Position	Company	Years of Experience	Field
1	Ir. Ismail Musa	Principal Engineer	Petronas	23	Oil & Gas
2	Murtaza Hassan	Head, People Strategy & Rewards	Sapura Energy Berhad	10	Oil & Gas
3	Aiman Naufal	HR & Admin Executive	MR Technology Sdn. Bhd.	5	Oil & Gas
4	Mohd Hafiz Adam	Executive Mechanical Rotating	Pengerang Power Sdn Bhd	20	Oil & Gas
5	Kamarul Hisyam	Manager Mechanical	Pengerang Power Sdn Bhd	17	Oil & Gas
6	Haria Irman Djuli	Manager Operations & Maintenance Competency	Petronas	26	Oil & Gas
7	Nurlili Elilza A. Jalil	Head Subsurface Capability	Petronas	25	Oil & Gas
8	Jeffri B. Nasir	Manager	Petronas	14	Oil & Gas
9	Zainuri Bawan	Manager	Petronas	30	Oil & Gas
10	Khairul Hakimi bin Awang	Manager	Petronas	14	Oil & Gas

No	Name	Position	Company	Years of Experience	Field
11	Daliainie Mat Saaid	Manager	Petronas	15	Oil & Gas
12	Albert Chan Kim Tee	Pengurus Sumber Manusia & Pentadbiran	Malaysia Smelting Corporation Bhd	33	Mining & Quarrying
13	Mimi Afzan binti Afza	VP People and Culture	Lynas Malaysia Sdn Bhd	33	Mining & Quarrying
14	Liew Ban Hing	Manager	Ang Cheng Ho Quarry Sdn Bhd	17	Mining & Quarrying
15	Affendi Md Yusri	Pengarah	Yusri Holdings Legacies	5	Mining & Quarrying
16	Wong Shee Kin	Manager	Malaysia Quarries Association	14	Mining & Quarrying
17	Ahmad Ashraf Abdul Ghafar	Pengurus Teknikal	Dewan Perlombongan Malaysia	11	Mining & Quarrying
18	Hj Mustapha Mohd Lip	Advisor	Institut Kuari Malaysia Berhad	40	Mining & Quarrying
19	Dato’ Sia Hok Kiang	Executive Chairman	Malaco Mining Sdn Bhd	32	Mining & Quarrying
20	Razali Harun	Principal Consultant DOE Consultant	REM Consultant Sdn Bhd	14	Mining & Quarrying
21	Azli AB.	Land Surveyor	The Land Surveyor Consultant	15	Mining & Quarrying
22	Abdul Aziz Md Noor	Senior Executive	Koperasi Kakitangan Sada Kedah Berhad (KOSADA)	20	Mining & Quarrying
23	Micheal Ban	Proprietor	Abanco Mining Works.	17	Mining & Quarrying

OCCUPATIONAL FRAMEWORK TECHNICAL COMMITTEE FOR ASSESSMENT

JAWATANKUASA TEKNIKAL PENILAIAN KERANGKA PEKERJAAN

(JTPOF 1) – 12th September 2023

No.	Name	Position	Organisation
1.	Khadijah binti Isaak	Principal Assistant Director	Jabatan Pembangunan Kemahiran (Chairman)
2.	Nazrul Hilmi bin Mohammad	Senior Assistant Director	Jabatan Pembangunan Kemahiran (Secretariat)
3.	Dr. Muhamad Noorul Anam bin Mohd Norddin	Associate Professor, Faculty of Chemical and Energy Engineering	Universiti Teknologi Malaysia (UTM)
4.	Dr. Hasrinah binti Hasbullah	Senior Lecturer, Faculty of Chemical and Energy Engineering	Universiti Teknologi Malaysia (UTM)
5.	Mohammad Nazri bin Tamby	Project Development Manager	Malaysia Smelting Corporation Bhd.
6.	Nur Surya binti Ab Razak	Senior Assistant Director, Industrial Production and Construction Statistics Division	Department of Statistics Malaysia (DOSM)
7.	Ts. Kodsiah binti Mohd Juzad	Industrial Relation Officer, Human Resources Policy Branch	Ministry of Human Resources
8.	Mohd Fairuz Iqbal bin Mohd Akbar	Director, MIDA Perak	Malaysian Investment Development Authority (MIDA)

OCCUPATIONAL FRAMEWORK TECHNICAL COMMITTEE FOR ASSESSMENT

JAWATANKUASA TEKNIKAL PENILAIAN KERANGKA PEKERJAAN

(JTPOF 2) – 10th January 2024

No.	Name	Position	Organisation
1.	Khadijah binti Isaak	Principal Assistant Director	Jabatan Pembangunan Kemahiran (Chairman)
2.	Nazrul Hilmi bin Mohammad	Senior Assistant Director	Jabatan Pembangunan Kemahiran (Secretaria)t
3.	Dr. Muhamad Noorul Anam bin Mohd Norddin	Associate Professor, Faculty of Chemical and Energy Engineering	Universiti Teknologi Malaysia (UTM)
4.	Dr. Hasrinah binti Hasbullah	Senior Lecturer, Faculty of Chemical and Energy Engineering	Universiti Teknologi Malaysia (UTM)

No.	Name	Position	Organisation
5.	Nur Surya binti Ab Razak	Senior Assistant Director, Industrial Production and Construction Statistics Division	Department of Statistics Malaysia (DOSM)
6.	Ts. Kodsiah binti Mohd Juzad	Industrial Relation Officer, Human Resources Policy Branch	Ministry of Human Resources
7.	Nurul Syakira binti Mohd Roslan	Manager, Capability Planning	Petronas Carigali Sdn. Bhd.
8.	Ahmad Danial bin Abdullah	Senior Human Resource and Admin Manager	Rahman Hydraulic Tin Sdn. Bhd.
9.	Muhamad Riduan bin Jamaludin	Senior Engineer	Menteri Besar Incorporated (MBInc) Perak
10.	Yushafidi bin Yusof	Senior Manager, Non-PTP Capability Management	Petronas Carigali Sdn. Bhd.
11.	Zool Hilmi Mohamad Ashari	Principal Assistant Director	Jabatan Pembangunan Kemahiran

INTERNAL TECHNICAL COMMITTEE, DEPARTMENT OF SKILLS DEVELOPMENT

JAWATANKUASA TEKNIKAL DALAMAN* (JTD), *JABATAN PEMBANGUNAN KEMAHIRAN

No.	Name	Position	Division/Centre
1.	Ts. Yuslan bin Yasok	Deputy Director, Occupational Standards Branch	Occupational Standards and TVET Curriculum Division (BSPKTVET)
2.	Ts. Dr. Sulaiha binti Ali	Deputy Director, TVET Curriculum Branch	Occupational Standards and TVET Curriculum Division (BSPKTVET)
3.	Dr. Zool Hilmi bin Mohamed Ashari	Principal Assistant Director, Policy Planning (PD1) Unit	Planning, Development and International Division (PPA)
4.	Dr. Fairus Atida binti Said	Senior Assistant Director, Prior Attainment Recognition (PPT) Unit	Competency Certification Division (BPK)
5.	Dr. Sarizal bin Md Ani	Coordinator, CIAST Satellite Campus (CSC) Selandar	Centre of Instructor and Advanced Skill Training (CIAST)
6.	Dr. Muhamad Azuddin bin Hassan	Research Coordinator, Research and Innovation (R&I) Unit	Centre of Instructor and Advanced Skill Training (CIAST)

OCCUPATIONAL FRAMEWORK DEVELOPMENT SECRETARIAT
OCCUPATIONAL FRAMEWORK MANAGEMENT UNIT, OCCUPATIONAL STANDARDS AND TVET CURRICULUM DIVISION (BSPKTVET), DEPARTMENT OF SKILLS DEVELOPMENT (JPK)

No.	Name	Position
1.	Khadijah binti Isaak	Principal Assistant Director
2.	Ahmad Azran bin Ranaai	Senior Assistant Director
3.	Ts. Nor Aini binti Abdullah	Senior Assistant Director
4.	Nazrul Hilmi bin Mohammad	Senior Assistant Director
5.	Wan Suraini binti Wan Yusoff	Skills Development Officer

Department of Skills Development
Ministry of Human Resources
Level 7-8, Block D4, Complex D,
Federal Government Administrative Centre
62530 Putrajaya, Malaysia
Tel : 603-8886 5589
Fax : 603-8889 2423
Email : jpk@mohr.gov.my
Website : https://www.dsd.gov.my

OCCUPATIONAL FRAMEWORK
MSIC B09
SECTION B : MINING AND QUARRYING
DIVISION 09 : MINING SUPPORT SERVICE ACTIVITIES

2024