
**CRITICAL OCCUPATIONS LIST (MyCOL) 2022/2023:
SECTORS DEEP DIVE FOR THE MALAYSIA NATIONAL
SKILLS REGISTRY (MyNSR)**

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MINISTRY OF HUMAN RESOURCES

TalentCorp
GROUP OF COMPANIES

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Executive Summary

Published annually since 2015, the Critical Occupations List (MyCOL) is a report commissioned by the Government of Malaysia through the Eleventh Malaysia Plan (11MP) to monitor skills imbalances and to provide a platform for the coordination of human capital development policies. The Critical Skills Monitoring Committee (CSC) – chaired by two agencies; Talent Corporation Malaysia Berhad (TalentCorp) and the Institute of Labour Market Information and Analysis (ILMIA) – was mandated to produce the report, leveraging on TalentCorp's relationship with industry players and ILMIA's access to labour market information.

The MyCOL defines critical occupations according to three main criteria: skilled, sought-after, and strategic. Through the identification of critical and hard-to-fill occupations, the MyCOL aims to draw the attention of policymakers to mitigate the underlying issues as a way to effectively assist the growth of Malaysia's economy. An occupational shortage list helps the synchronisation of workforce development policies and the needs of the demand side by monitoring the industries, occupations, and the in-demand skills. This is not only unique to Malaysia; as many as 16 OECD countries have been producing a shortage list for the reference of their government in mitigating skills gaps and other labour-related policy loopholes. Over the years, the MyCOL has also leveraged on the methodologies and applications of these reports to improve the existing approaches.

Under the Twelfth Malaysia Plan, MyCOL's role is enhanced where a comprehensive and dynamic national skills framework, the Malaysia National Skills Registry (MyNSR), will be developed and act as a reference for occupation with skills standards to assist in policy coordination and enhance human capital planning by the government, agencies, businesses, and the general public. As the 7th edition of the study, the MyCOL 2022/2023 will supplement the development of the MyNSR by focusing on three selected MyNSR pilot sectors: construction, manufacturing (food processing), and aerospace.

A rigorous analysis of quantitative and qualitative evidence was conducted by combining the following approaches:

a) Top-down approach

This approach provides the basis for determining whether or not an occupation is sought-after by identifying shortages. It generates objective evidence of the current labour market that is comparable over time and across occupations. This evidence,

which draws on multiple quantitative data sources such as Malaysia's labour force survey and administrative data and relies on multiple indicators of whether an occupation is in shortage, provides initial evidence of whether an occupation is sought-after by employers. These indicators can also offer guidance about which occupations are strategic in line with Malaysia's economic development and growth plans.

b) Bottom-up approach

This approach complements the top-down approach to generate additional evidence. The bottom-up approach functions in building an evidence base directly from stakeholders that, in conjunction with top-down information, allows for a systematic assessment of which occupations merit inclusion on the MyCOL. The second function is to build contextual knowledge about the occupations and sectors to allow the CSC to better interpret indicators, better communicate decisions, and plan monitoring efforts between MyCOL rounds. This bottom-up approach involves a Call for Evidence (CfE) survey of employers and consultations with employers and industry associations. The CfE asks a wide range of employers about occupations they deem to be in shortage to generate as complete a picture as possible of employers' hiring challenges. Consultations are an opportunity to collect information similar to that gathered by the CfE, but also allow for the collection of additional contextual information that can aid in the interpretation of the CfE and of the top-down evidence.

c) Dovetailing

A dovetailing process is used to integrate evidence from the top-down and bottom-up approaches to develop the final shortage list. When used together, the top-down and bottom-up components combine objective and contextualised indicators of the degree to which a skilled occupation is sought-after and strategic. The use of both sources of information allows for robust justifications for an occupation's inclusion on the MyCOL.

The MyCOL 2022/2023 included 37 occupations in total. This represents 8% of the 454 non-military 4-digit occupations in the Malaysian Standard Classification of Occupations (MASCO) 2020. Most of these occupations are skilled occupations at the managerial, professional, and associate professional levels. Approximately 30% of the occupations included in the MyCOL 2022/2023 are semi-skilled occupations, such as craft and trades workers, and plant and machine operators and assemblers. Nine occupations appeared on the MyCOL for the first time in the 2022/2023 edition.

Over time, the MyCOL has undergone changes to include important and relevant aspects, as well as incorporate lessons learnt from the previous rounds of the MyCOL. The evolution of the MyCOL takes into account the expansion of data sources, improvement of calculation of the indicators of shortage, and the expansion of coverage of the stakeholders consulted in the bottom-up process. The evolution of MyCOL is reflected in the table below.

	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2022/2023
Occupations covered	Skilled (MASCO 1-3)	Skilled and semi-skilled (MASCO 1-8)	Skilled and semi-skilled (MASCO 1-8)	Skilled and semi-skilled (MASCO 1-8)	Skilled and semi-skilled (MASCO 1-8)	Skilled and semi-skilled (MASCO 1-8)
# of top-down indicators	6	11	14	14	11	12
# of top-down data sources considered	2	9	10	10	5	4
# of top-down data sources used	2	3	4	4	3	3
# sector covered	10	18	18	18	18	3
Call-for-Evidence (CfE)	Sample of 678	Sample of 32,000	Sample of 32,000	Sample of 32,000	Sample of 32,000	Sample of 500
Consultations	Industry associations and regulators	Employers, industry associations, and regulators	Employers, industry associations, and regulators	Employers, industry associations, and regulators	Employers, industry associations, and regulators	Employers, industry associations, and regulators
Dovetailing	More top-down and bottom-up evidence were incorporated with each new MyCOL					
Validation	More stakeholders were engaged with each new MyCOL					

For the past few years of publication, the MyCOL has targeted significant policy areas. In essence, the MyCOL aims to mitigate the issues of skills gap that make it possible for an occupation to experience a shortage. At the education level, a shortage list such as the MyCOL can be highly useful in guiding appropriate resources to create policy interventions that will generate the missing skills. As a result, the CSC has – over the years – cooperated with many public and private universities in course review exercises that could match with the current needs of the labour market. Additionally, the MyCOL has been used to inform migration policy to attract high-skilled labour to immediately fill the gaps in the labour market without the time lag involved in developing and delivering training programmes.

As the MyCOL 2022/2023 focuses on three selected MyNSR pilot sectors: Aerospace, Construction, and Manufacturing (Food Processing), recommendations were made to address the employment challenges faced by the three sectors. Among the key recommendations include strengthening collaboration between the government, industry associations and employers, and education institutions, offering financial incentives to encourage wider technological adoption, provision of effective workforce development and training programmes, and more.

The Critical Occupations List (MyCOL) 2022/2023

MASCO 4D	Job Title
1121	Managing Directors And Chief Executives
1211	Finance Managers
1214	Business Services Managers
1216	Quality Managers
1321	Manufacturing Managers
1323	Construction Managers
1511	Information And Communications Technology Managers
2141	Industrial And Production Engineers
2142	Civil Engineers
2144	Mechanical Engineers
2146	Mining Engineers, Metallurgists And Related Professionals
2151	Electrical Engineers
2173	Aircraft Pilots And Related Professionals
2182	Manufacturing Professionals
2263	Environmental And Occupational Health And Hygiene Professionals
2426	Research And Development Professionals
2512	Software Developers
2522	Information Technology System Administrators
3112	Civil Engineering Technicians
3113	Electrical Engineering Technicians
3115	Mechanical Engineering Technicians
3119	Industrial And Production Technicians
3122	Manufacturing Supervisors
3123	Construction Supervisors
3151	Aircraft Technicians
3211	Medical Imaging And Therapeutic Equipment Technicians
7111	House Builders
7132	Spray Painters And Varnishers
7212	Welders And Flame Cutters
7411	Building And Related Electricians
7412	Electrical Mechanics And Fitters
7422	Information And Communications Technology Installers And Services
8161	Food And Related Products Machine Operators
8189	Stationary Plant And Machine Operators Not Elsewhere Classified
8332	Heavy Truck And Lorry Drivers
8342	Earth-Moving And Related Plant Operators
8343	Crane, Hoist And Related Plant Operators

Acknowledgement

The Critical Occupations List (MyCOL) benefited from fruitful discussions with and feedback from stakeholders, including but not limited to ministries, agencies, industry associations, regulators, and employers and is based on a methodology developed in partnership with the World Bank. The Critical Skills Monitoring Committee (CSC) would like to extend its sincere appreciation to these stakeholders for their support and collaboration.

Adeka Food (Asia) Sdn. Bhd.
Axtrium Sdn. Bhd.
Civil Aviation Authority of Malaysia (CAAM)
Construction Industry Development Board (CIDB)
Construction Research Institute of Malaysia (CREAM)
D'viation Group
Encorp Berhad
Galaxy Aerospace (M) Sdn. Bhd.
GE Aviation
Halal Development Corporation Berhad (HDC)
HICOM-Teck See Manufacturing Malaysia Sdn. Bhd.
IJM Construction Sdn. Bhd.
Institute of Labour Market Information and Analysis (ILMIA)
Mafipro Sdn. Bhd.
Malaysia Aerospace Industry Association (MAIA)
Malaysia Food Canners Association (MFCA)
MAMEE Double Decker (M) Sdn. Bhd.
Master Builders Association Malaysia (MBAM)
Ministry of Agriculture and Food Industries (MAFI)
Ministry of Human Resources (MOHR)
National Aerospace Industry Corporation Malaysia (NAICO Malaysia)
Rex Canning Co. Sdn. Bhd.
Rosfaniaga Services Sdn. Bhd.
Satujaya Sdn. Bhd.

Singularity Aerotech Asia Sdn. Bhd.
S P Setia Berhad
Spirit Aerosystems Malaysia Sdn. Bhd.
STRAND Aerospace Malaysia
Sunway Construction Group Bhd.
Talent Corporation Malaysia Berhad (TalentCorp)
Tastiway Sdn. Bhd.
The Federation of Malaysia Manufacturers (FMM)
UMW Holdings Berhad
WCT Holdings Berhad

Abbreviations

3D	Dirty, Dangerous, and Difficult
4D	Four-Digit
BIM	Building Information Modelling
CAAM	Civil Aviation Authority of Malaysia
CfE	Call for Evidence Survey
CIDB	Construction Industry Development Board
CREAM	Construction Research Institute of Malaysia
CSC	Critical Skills Monitoring Committee
DOSM	Department of Statistics Malaysia
DSD	Department of Skills Development
FMM	Federation of Malaysia Manufacturers
HDC	Halal Development Corporation Berhad
HRD Corp	Human Resource Development Corporation
IBS	Industrialised Building System
ILMIA	Institute of Labour Market Information and Analysis
JAKIM	Department of Islamic Development Malaysia
JMI	Job Market Insights
LFS	Labour Force Survey
MAFI	Ministry of Agriculture and Food Industries
MAIA	Malaysia Aerospace Industry Association
MASCO	Malaysian Standard Classification of Occupations
MBAM	Master Builders Association Malaysia
MFCA	Malaysia Food Canners Association
MOHR	Ministry of Human Resources
MRO	Maintenance, Repair and Overhaul
MSIC	Malaysia Standard Industrial Classification
MyCOL	The Malaysia Critical Occupations List
MyNSR	Malaysia National Skills Registry
MYSA	Malaysian Space Agency
NAICO	National Aerospace Industry Corporation Malaysia
RPEL	Recognition of Prior Experiential Learning
R&D	Research and Development
SWS	Salaries and Wages Survey
TAP	Talent Analytics Platform

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Introduction

The Critical Skills Monitoring Committee (CSC) was established as part of the Eleventh Malaysian Plan with the mandate to monitor skills imbalances in the Malaysian labour market. Jointly chaired by Talent Corporation Malaysia Berhad (TalentCorp) and the Institute of Labour Market Information and Analysis (ILMIA), the CSC has developed and published a Critical Occupations List (MyCOL) on an annual basis since 2015 to serve as a platform for the coordination of human capital development policies.

The Malaysia Critical Occupations List (MyCOL) comprises a list of occupations for which there is strong evidence that there are significant labour market shortages that may be alleviated through government action. Occupations on the MyCOL meet the criteria of being skilled, sought-after, and strategic. The MyCOL seeks to identify and draw stakeholder attention to this set of occupations that are critical to the continued growth and development of the Malaysian economy but that are currently difficult to fill.

The methodology of the MyCOL has been improved over time based on international best practices and experience in previous rounds of the MyCOL. As a tool for monitoring skills imbalances in occupations that are strategic to Malaysia's economic development, the MyCOL can guide decision-making and help policymakers prioritise investments in human capital. By incorporating rigorous evidence-based indicators and the views of stakeholders, the MyCOL has the credibility to inform decision-makers about where there are skills gaps that must be filled.

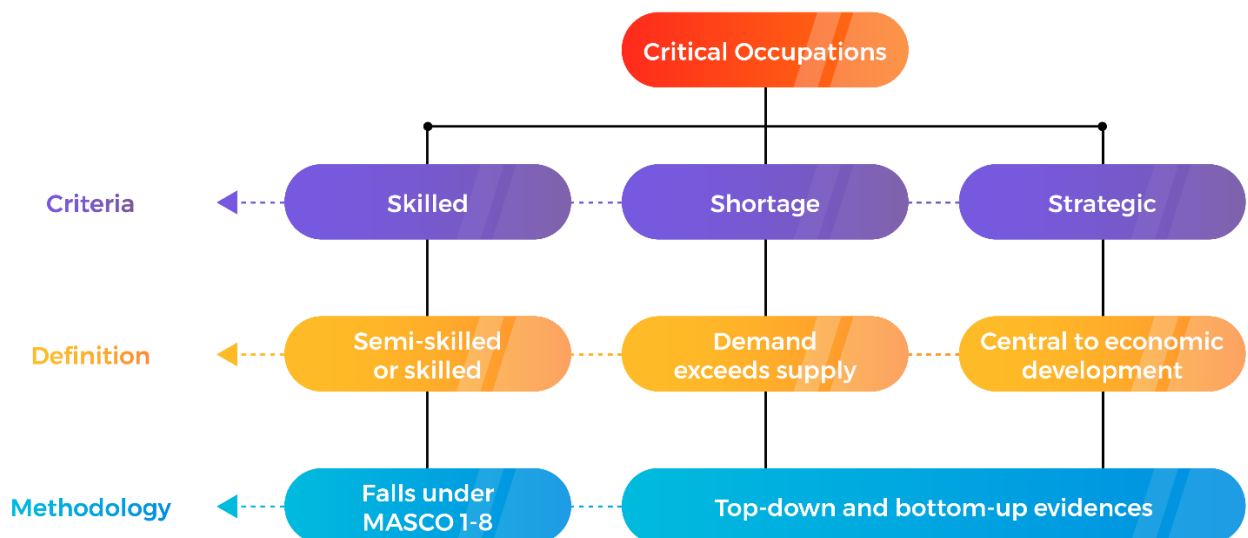
Under the Twelfth Malaysia Plan, the role of MyCOL is enhanced where a comprehensive and dynamic national skills framework, the Malaysia National Skills Registry (MyNSR), will be developed and act as a reference for occupation with skills standards to assist in policy coordination and enhance human capital planning by the government, agencies, businesses, and the general public. As the 7th edition of the study, the MyCOL 2022/2023 will supplement the development of MyNSR by focusing on three selected MyNSR pilot sectors: construction, manufacturing (food processing), and aerospace.

Methodology for the MyCOL 2022/2023

What is a critical occupation?

An occupation is considered critical if they are skilled, sought-after, and strategic. The MyCOL aims to identify shortages in occupations that are associated with Malaysia's growing knowledge-based economy. To accomplish this, the MyCOL is focused on identifying occupations that are *skilled*. It also seeks to uncover mismatches between employers' demand for certain occupations and the supply of the skills associated with these occupations. It does this by identifying shortages in occupations that are *sought-after* by employers. Finally, the MyCOL is designed to be a tool to help policymakers make decisions. Therefore, an occupation is considered critical only if filling the occupational shortage aligns with Malaysia's *strategic* economic development objectives. The definition of critical occupations is illustrated in **Figure 1**.

Figure 1: Defining critical occupations



Is the occupation skilled?

Occupations are determined to be *skilled* based on the Malaysian Standard Classification of Occupations list. The MyCOL 2022/2023 uses the Malaysian Standard Classification of Occupations (MASCO) 2020 list to determine the skill level of occupations. This list is maintained and regularly updated by the Ministry of Human Resources (MOHR). Eight of the nine MASCO occupational major groups are semi-skilled or skilled. These are:

MASCO 1: Managers

MASCO 2: Professionals

MASCO 3: Technical and Associate Professionals

MASCO 4: Clerical Support Workers

MASCO 5: Service and Sales Workers

MASCO 6: Skilled Agricultural, Forestry, Livestock and Fisheries Workers

MASCO 7: Craft and Related Trades Workers

MASCO 8: Plant and Machine Operators and Assemblers

Elementary Occupations (MASCO 9) are classified as low- or unskilled due to its low education requirements. Unlike other occupational groups, which require secondary education or Malaysian Skill Certificate (SKM) levels 1-3, the Elementary Occupations group only requires primary education level. Therefore, these occupations do not qualify for inclusion in the MyCOL.

Is the occupation sought-after?

Sought-after occupations are identified using quantitative indicators of shortage and qualitative evidence from employers and other stakeholders. An occupation is considered sought-after if its demand exceeds the number of suitably qualified workers available for the role, even after efforts on the part of employers to satisfy their demand and for reasons not easily addressed through changes in employer hiring practices. The top-down approach defines specific indicators of occupations that are sought-after and sets thresholds based on national labour market statistics. The bottom-up approach uses nominations of hard-to-fill occupations in a Call for Evidence Survey (CfE) of employers as the most important indicator of occupations that are sought-after. To assess the validity and potential drivers of *sought-after* occupations, additional information is gathered through the CfE survey and consultation sessions. The additional information covers areas such as job and skill requirements, desired level of experience, minimum qualification required, reasons why occupations are hard-to-fill, strategies to overcome hiring difficulties, potential for automation, and more.

Is the occupation strategic?

Strategic means that an occupation is central to Malaysia's economic development objectives. A strategic occupation is one that is closely tied to the growth of Malaysia's economy and the development of its knowledge-based economy. The *strategic* criterion allows the Malaysian government to use MyCOL as a reference to set priorities and allocate resources for its development programs. This criterion is more flexible than the skilled and sought-after criteria and draws on evidence from both the top-down and bottom-up approaches. It is designed to ensure that the MyCOL meets the needs of policymakers and Malaysia as a whole. The *strategic* criterion is not intended to limit the number of skilled and sought-after occupations, it is rather aimed to ensure that the MyCOL is able to address emerging economic and social needs when the skilled and sought-after tests are passed.

Top-down methodology

Shortages in the labour market occur when there is an inadequate supply of competent workers willing to work under existing market conditions, particularly at prevailing wages (Shah and Burke 2005; Richardson 2007). Such shortages can be caused by factors including lags in the adjustment of wages, the adjustment of labour supply, and the lack of labour market information. Therefore, it is important to consider multiple factors, including employment, wages, working hours, and vacancies, when developing a suitable methodology to identify labour market shortages. The top-down approach accomplishes this by combining information from multiple data sources and using statistical analysis to provide objective, quantitative evidence of labour market shortage.

The top-down methodology looks at a range of data sources to define both quantity indicators (for example, employment levels and vacancies) and price indicators (for example, earnings and wage premiums); it uses indicator-specific thresholds to define when each indicator is likely to provide evidence of shortage; and employs a "traffic light" approach such that evidence of shortage in a certain percentage of indicators is used as the final gauge of shortage, rather than evidence of shortage in a single indicator. The initial step in the top-down approach involves identifying relevant data sources with shortage information. Next, several different indicators and their combinations are identified from these data sources and tested to determine a set of indicators for shortage. A final specification for the top-down methodology emerges from this process. Ipsos Strategy3 was engaged to assist the CSC in carrying out the top-down process.

Data sources

The MyCOL 2022/2023 has primarily utilised the following four data sources compiled from the Labour Market Information Data Warehouse and internal TalentCorp database:

- 1. Labour Force Survey (LFS).** MyCOL 2022/2023 utilises the Labour Force Survey (LFS) that is referred as a survey of the Malaysian workforce between 2015 to 2020. The LFS is conducted monthly at the household level and is representative of citizens and non-citizens at the national, state, and urban and rural levels. The LFS could be used to construct shortage indicators related to employment, working hours, and education level by occupation.
- 2. Salaries and Wages Survey (SWS).** The SWS is an annual survey on the earnings of employees at the household level and is representative of citizens and non-citizens at the national, state, and urban and rural levels from 2015 to 2020. The survey is restricted to only paid employees who have worked at least 6 hours a day or a minimum of 20 days a month. The SWS offers important data on shortage indicators related to salaries and wage premiums by occupation.
- 3. Online job posting data.** Online job posting data for the years 2020 and 2021 are gathered from the Job Market Insights (JMI) published by ILMIA. The available information from the data source includes job vacancies, education, skills and working experiences. This dataset could be used to construct shortage indicators related to job vacancies and changes in educational requirements.
- 4. Previous Critical Occupations List.** MyCOL 2022/2023 also considers the final MyCOLs developed in the previous 5 years. The trend of an occupation being included in the MyCOL over a period in recent years provides an indication of its criticality. This could be used to determine if a specific occupation is deemed critical due to single events or is consistently hard to fill. This could then facilitate the development of appropriate strategies to address the relevant hiring challenges.

The unit of analysis classified uses the 4-digit Malaysian Standard Classification of Occupations (MASCO), with MASCO 2020 being the latest version available. However, the occupational data from LFS and SWS data prior to the year 2020 were mapped to MASCO 2013, as the surveys were conducted before MASCO 2020 was made available. Therefore, the top-down analysis of the LFS and SWS data for the years prior to 2020 was conducted based on MASCO 2013 and later mapped to MASCO 2020 where applicable.

The top-down approach requires data to be available for the most recent year of the analysis (2020/2021), as well as previous years, to establish trends. The reference population for the top-down approach is all Malaysian and foreign individuals in the working-age population who are employed. The MyCOL 2022/2023 covers both skilled and semi-skilled occupations, including employees, employers, and self-employed individuals.

There is no set rule for the minimum number of observations that must be used for statistical analysis, but the academic literature typically uses between 20 and 50 observations, with 30 being the most frequent. According to Tanis and Hogg (2005), 30 is regarded as a boundary between small and large samples for the purpose of drawing distributions. As a result, 30 is used as the minimum number of observations per occupation when using the LFS and the SWS datasets. It is not necessary to set a minimum sample size for the online job posting data, which does not involve sampling.

Shortage indicators

This stage of the top-down approach seeks to define occupational shortage in detail by identifying potential shortage indicators. The MyCOL 2022/2023 had suggested 3 basic sets of indicators: earning-based, volume-based, and employment-based indicators to identify occupational shortages (**Table 1**). These are supplemented by the degree of persistence in the occupational shortages indicator, which refers to previous MyCOLs to determine if an occupation had been deemed critical in recent years.

Table 1: Set of shortage methodology indicators

No	Indicators set	Description
1.	Employment-based indicators	Rising employment in an occupation could indicate rising labour demand and an indication of shortage.
2.	Earning-based indicators	A rise in earning/income in an occupation relative to other occupations could be associated with an increase in demand for labour in an occupation and can be considered to provide an indication of shortage.
3.	Volume-based indicators	Increase in working hours, vacancies and a decrease in educational requirements could indicate rising demand and occupational shortage.

An initial list of indicators is compiled with economic rationale for why they are used as indicators of labour shortage. There are a total of 12 indicators constructed from the 4 data sources, as shown in **Table 2**.

Table 2: Initial indicators for the top-down methodology

Indicators set	Data source	Indicators	Calculating the indicators	Shortage rationale
Employment-based indicators	Labour force Survey (LFS)	1) 1-year employment growth	<ul style="list-style-type: none"> • Employment per occupation is given by the number of weighted observations per occupation. • Once the variable for employment per occupations is generated, the percentage change in employment is calculated with respect to 1 year (2019 and 2020) and 3 years (2017 and 2020). 	<ul style="list-style-type: none"> • An increase in number of employees in an occupation suggests that the demand for that occupation is rising.
		2) 3-year employment growth		
		3) 1-year working hours growth	<ul style="list-style-type: none"> • After generating the number of hours worked per week per individual, the median number of hours worked per week per occupation is generated. • The percentage change in median weekly hours worked per occupation is then calculated with respect to 1 year (2019 and 2020) and 3 years (2017 and 2020). 	<ul style="list-style-type: none"> • An increase in the median number of hours worked per week in an occupation could be linked to the use of the existing labour force for longer hours in order to fill a rise in demand for the labour force.
		4) 3-year working hours growth		
		5) 1-year education level decrease	<ul style="list-style-type: none"> • After generating the level of education per individual, the median level of education per occupation is generated. • The percentage change in median level of education per occupation is then calculated with respect to 1 year (2019 and 2020) and 3 years (2017 and 2020). 	<ul style="list-style-type: none"> • A decrease in the education level in an occupation could be linked to strategies that employers take in order to fill vacancies.
		6) 3-year education level decrease		

Indicators set	Data source	Indicators	Calculating the indicators	Shortage rationale
				<ul style="list-style-type: none"> In particular, an employer might accept workers with a lower level of education for a particular job if the vacancy has been very difficult to fill.
Earning-based indicators	Salaries and Wages Survey (SWS)	7) 1-year wage premium growth 8) 3-year wage premium growth	<ul style="list-style-type: none"> The premiums per occupation per year are calculated using an OLS regression where the dependent variable is the logarithm of the monthly wage per individual and the independent variables are dummies for each occupation controlling for gender, age, age squared, and the level of education (dummy variables for 7 education categories). The coefficient of the dummy variables for each occupation represents the wage premium, which is then used to generate the change with respect to 1 year (2019 and 2020) and 3 years (2017 and 2020). 	<ul style="list-style-type: none"> An increase in wage in an occupation could be associated with increase in demand for labour in an occupation.
Volume-based indicators	Online Job Posting Data (Job Market Insights)	9) Number of vacancies	<ul style="list-style-type: none"> This is the total number of vacancies posted per occupation per year. 	<ul style="list-style-type: none"> A large number of vacancies in an occupation are positively associated with rising labour demand.

Indicators set	Data source	Indicators	Calculating the indicators	Shortage rationale
		10) Vacancy rate (% of employment)	<ul style="list-style-type: none"> This indicator requires merging the vacancies dataset with the employment variable from the LFS by occupation. It is calculated as the number of vacancies as a percentage of total employment per occupation. 	<ul style="list-style-type: none"> The rationale is the same as the number of vacancies indicator, but this indicator controls for the level of employment in each occupation.
		11) 1-year education level decrease	<ul style="list-style-type: none"> This is the change in the median level of education required for an occupation. 	<ul style="list-style-type: none"> Similar rationale to LFS, education level decrease.
	Previous Critical Occupations List	12) Degree of persistence in occupational shortages	<ul style="list-style-type: none"> This is the number of times an occupation has been included in the past 5 editions of the MyCOL. 	<ul style="list-style-type: none"> Consistent inclusion in the MyCOL of recent years suggests that the occupation has been difficult to fill.

Threshold values

The threshold value of an indicator is the point at which the indicator suggests a shortage in an occupation when it is exceeded. Threshold values are set depending on the distribution of each indicator. The UK's Migration Advisory Committee uses two types of thresholds: the median of the indicator plus 50 per cent of the median value and the value of the 75th percentile of the distribution of the indicator's values (MAC 2008 and 2010). An application of the shortage list methodology in Mexico uses the value of the 85th percentile in an effort to offset any errors of inclusion (World Bank 2015).

Following similar approach as previous MyCOL editions, the MyCOL 2022/2023 considers two threshold scenarios as below:

1. A less restrictive scenario sets low threshold values for the shortage indicators, and thus includes a larger number of occupations that are considered to be in labour shortage for each indicator. The median plus 50 per cent (referred to as p50+50%) is the main threshold considered for this scenario.
2. A more restrictive scenario sets high threshold values for the shortage indicators, and thus includes a lower number of occupations that are considered to be in shortage for each indicator. The 75th percentile (referred to as p75) is the main threshold considered for this scenario.

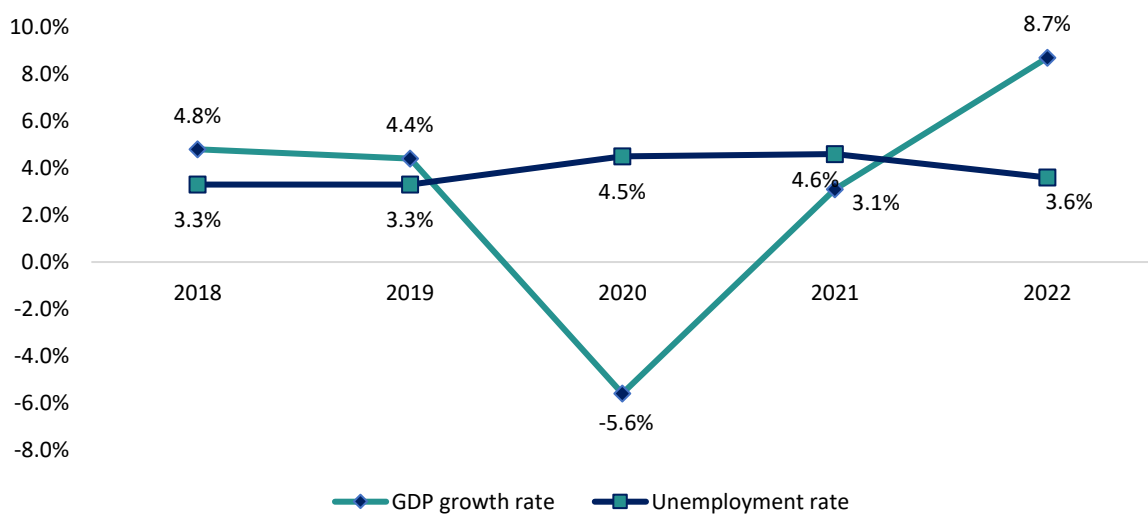
A benchmark period is used to set the threshold values for each shortage indicator. Because economic conditions affect the value of different indicators of shortage, a benchmark period is used to obtain the threshold values of shortage indicators to which the current period of study can be compared. The benchmark period is a period during which economic growth and employment are strong. This minimises errors of inclusion and has three additional benefits (MAC 2010). First, indicators change along with the economy. That is, when economic growth is weak, fewer occupations are found to be in shortage. Second, indicators change along with skill shortages rather than other types of shortages that are more stable over time. Third, thresholds do not have to be reconsidered for each period for which the MyCOL is undertaken. That is, the appropriateness of using the p50+50% or p75 threshold need only be evaluated for the benchmark period.

A benchmark period is utilised to establish the threshold values for each shortage indicator. This is because economic conditions can have a significant influence on the value of the different shortage indicators. The benchmark period is selected when economic growth and employment are robust to facilitate comparison to the current period being studied. This

reduces the risk of incorrect inclusion and has three additional benefits (MAC 2010). Firstly, indicators change as the economy evolves, meaning that fewer occupations are identified as being in shortage during periods of weak economic growth. Secondly, indicators reflect changes in skill shortages rather than other types of shortages that remain stable over time. Lastly, it eliminates the need to reconsider the threshold values for each period in assessment. This means that the appropriateness of using a p50+50% or p75 threshold need only be assessed for the benchmark period.

For the MyCOL 2022/2023, the gross domestic product (GDP) growth and unemployment rate of the three years up to 2020 were analysed to determine a suitable benchmark period. This is due to two reasons: the availability of LFS and SWS data up to the year 2020 only, and to ensure the benchmark period is not outdated nor affected by economic anomalies such as the impact caused by the COVID-19 pandemic. Based on the data shown in **Figure 2** below, 2018 was selected as the benchmark year for the MyCOL 2022/2023 as it exhibited the strongest GDP growth (4.8%) and lowest unemployment rate (3.3%) during the aforementioned period of assessment.

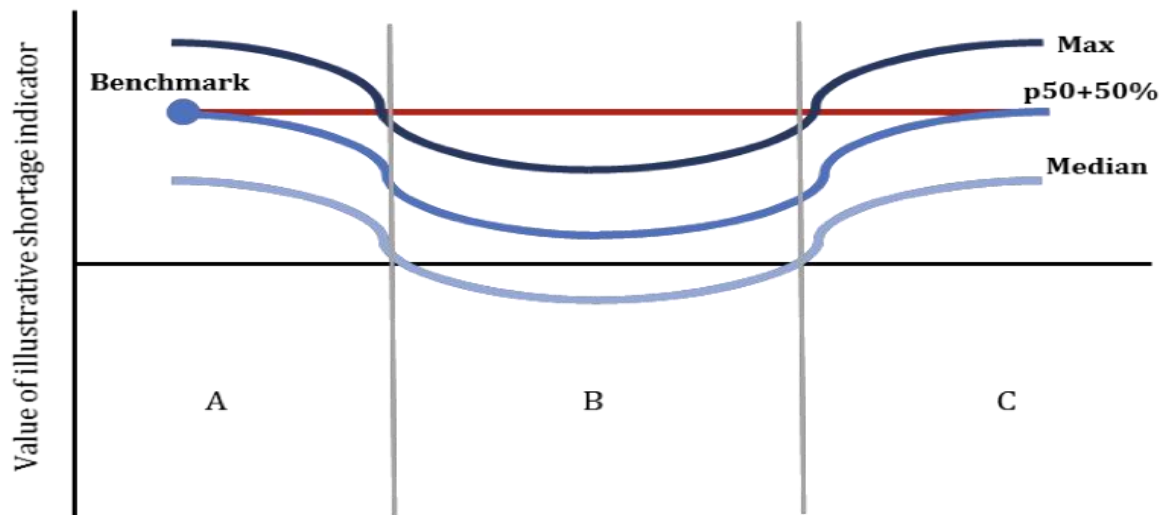
Figure 2: GDP (at constant price) and unemployment rate in Malaysia, 2018-2022



Source: Author's illustration based on data from the Department of Statistics Malaysia (DOSM)

Figure 3 provides an illustrative example of how the benchmark period and the threshold values interact. In Figure 3, the benchmark period is Period A, a period of high economic growth. The threshold value is set during this period at the blue dot using the p50+50% threshold. This sets the threshold value at its highest historical level. Period B, in contrast, is a period of lower economic growth. During this period, using the p50+50% threshold means that all values of the illustrative indicator are below the threshold set in the benchmark period (the red line) and thus, no occupations are considered to be in shortage for the illustrative indicator. Finally, there is a stronger growth returns in Period C. By the end of Period C occupations with values on the illustrative indicator that lie between p50+50% and the maximum value are considered to be in shortage.

Figure 3: Illustrative example of setting the benchmark period and threshold values



Source: Author's illustration, adapted from MAC (2010)

The MyCOL 2022/2023 generally uses the median plus fifty per cent rule (p50+50%) to address shortage as the less restrictive scenario. However, in cases where the data distribution indicates a median close to zero or the distribution is not approximately normal with p50+50% and found to be higher than top quartile p75, the MyCOL 2022/2023 adopts the top quartile as the less restrictive scenario. The less restrictive scenario sets a lower threshold value for the shortage indicators and enables greater room for inclusion in comparison to the more restrictive scenario with limited room for inclusion. Thus, the threshold values of each shortage indicator determine the number of occupations that may be in shortage.

Shortage occupations

The final step in the top-down approach is to combine the shortage indicators to create a list of occupations that are in shortage. This process requires designing a set of rules that could best reflect the shortage indicators. The MyCOL 2022/2023 adapted the same set of rules as previous MyCOLs, where a minimum of 4 indicators per occupation must be available for an occupation to be considered in shortage. In other words, any occupation with data available for fewer than 4 indicators will not be considered for further analysis. Potential lists of shortage occupations were created in a test series of different specifications of indicators. **Table 3** summarises the 12 indicators included at this stage of top-down process and their skills level accordingly.

Table 3: Indicators included in the final specification

Indicators set	Data source	Indicators	Skill level included
Employment-based indicators	Labour force Survey (LFS)	1) 1-year employment growth 2) 3-year employment growth	Skilled & semi-skilled
	Labour force Survey (LFS)	3) 1-year working hours growth 4) 3-year working hours growth	Skilled & semi-skilled
	Labour force Survey (LFS)	5) 1-year education level decrease 6) 3-year education level decrease	Skilled & semi-skilled
Earning-based indicators	Salaries and Wages Survey (SWS)	7) 1-year wage premium growth 8) 3-year wage premium growth	Skilled & semi-skilled
Volume-based indicators	Online Job Posting Data (JMI)	9) Number of vacancies (JMI)	Skilled & semi-skilled
	Online Job Posting Data (JMI)	10) Vacancy rate (% of employment)	Skilled & semi-skilled
	Online Job Posting Data (JMI)	11) 1-year education level decrease	Skilled & semi-skilled
	Previous Critical Occupation Lists	12) Degree of persistence in occupational shortages	Skilled & semi-skilled

Table 4 illustrates the different specification test using a less restrictive scenario. The baseline specification (Specification 1) acts as the main reference point for the comparison of other specifications of indicators. The indicators included in Specification 1 were 1 and 3-year employment growth, 1 and 3-year working hours growth, 1 and 3-year education level decrease, 1-year wage premium growth, number of vacancies, vacancy rate, and 1-year education level decrease (online). 6 alternative specifications were tested using robustness analysis by adding and excluding indicators in a similar combination to the MyCOL 2020/2021. Specifications 1 to 5 had applied a single threshold value for both skilled and semi-skilled occupations. However, disaggregated threshold values were applied respectively for skilled and semi-skilled occupation in Specification 6 due to differences in the labour market response to identical economic conditions.

Overall, the specification with the following characteristics are preferred over the other in a pairwise comparison: (1) larger list of occupational inclusion, (2) fewer list of dropped occupation (3) reflection of more indicators. The MyCOL 2022/2023 had chosen Specification 6 over Specification 2 as it fits the selection criteria. Specification 6 includes: 1 and 3-year employment growth, 1 and 3-year working hours growth, 1 and 3-year education level decrease, 1 and 3-year wage premium growth, number of vacancies, vacancy rate, 1-year education level decrease (online), and degree of persistence in occupational shortages, which treats skilled and semi-skilled occupations separately. It appears to be the most suitable combination of the top-down shortage list due to its inclusiveness of 12 indicators with a distinct threshold for skilled and semi-skilled occupations in the less restrictive scenario.

Table 4: Specification tested for top-down analysis

Indicators	Specification					
	1 ^a	2 ^a	3 ^a	4 ^a	5 ^a	6 ^b
1-year employment growth	x	x	x	x	x	x
3-year employment growth	x	x	x	x	x	x
1-year education level decrease (LFS)	x	x	x			x
3-year education level decrease (LFS)	x	x	x			x
1-year working hours growth	x	x		x		x
3-year working hours growth	x	x		x		x
1-year wage premium growth	x	x	x	x	x	x
3-year wage premium growth		x	x	x	x	x
Number of vacancies	x	x	x	x	x	x
Vacancy rate	x	x	x	x	x	x
1-year education level decrease (Online)	x	x	x	x	x	x
Degree of persistence in occupational shortages	x	x	x	x	x	x
Total indicators	11	12	10	10	8	12
Comparison		1 vs 2	3 vs 2	4 vs 2	5 vs 2	6 vs 2
Preferred specification	1	2	2	2	2	6

a Same threshold value for all occupations

b Separate threshold values for skilled and semi-skilled occupations

Note: The “x” indicates that the indicator is included in the specification. The grey shading indicates where the specification differs from the baseline specification

Shortage list

Table 5 summarises the number of occupations that are available for analysis and number of occupations exceeding the threshold for each indicator. The percentage of occupations exceeding the available threshold per occupation helps shortlist the occupations during the subsequent dovetailing exercise (this will be explained further in the later sections of this report).

Table 5: Descriptive statistics for each shortage indicator

Indicators	Threshold	Threshold value for skilled occupations	Threshold value for semi-skilled occupations	Number of occupations available	Number of occupations that exceed threshold	Percentage of occupations that exceed threshold per occupation available
1-year employment growth	p50+50%	0.05	0.07	432	127	29.40
3-year employment growth	p50+50%	0.17	0.17	432	169	39.12
1-year education level decrease	p50+50%	0	0	432	30	6.94
3-year education level decrease	p50+50%	0	0	432	24	5.56
1-year working hours growth	p50+50%	0	0	432	14	3.24
3-year working hours growth	p50+50%	0	0	432	251	58.10
1-year wage premium growth	p50+50%	0.08	0.08	440	3	0.68
3-year wage premium growth	p50+50%	0.22	0.25	440	1	0.23
Number of vacancies	p50+50%	33.00	4.50	423	292	69.03
Vacancy rate	p50+50%	1.01	0.05	433	168	38.80
1-year education level decrease (Online)	p50+50%	0	0	437	67	15.33

Note: The degree of persistence in occupational shortages indicator is not included in Table 5 as it does not involve statistical analysis

A comparison between the MyCOL 2020/2021 and MyCOL 2022/2023 on the inclusion of skilled and semi-skilled occupations by shortage indicators is highlighted in **Table 6** below. The MyCOL 2022/2023 introduced a new indicator: degree of persistence in occupational shortages to its top-down methodology. The results from the final specification of the MyCOL 2022/2023 indicated a total of 183 occupations to be in shortage across all 18 economic sectors based on the Malaysia Standard Industrial Classification (MSIC) 2008 (**Appendix 1**). The shortage list from top-down analysis saw a 273% increase in shortage occupations from 49 occupations in 2020/2021. The increase can be largely attributable to the impact of the COVID-19 pandemic on the Malaysian economy, which saw the unemployment rate increase to 4.5% in 2020 from 3.3% in 2019. 92 out of the 183 total occupations were skilled roles, while the remaining 91 were semi-skilled roles. This contrasts with the findings of the MyCOL 2020/2021, where most critical occupations identified were skilled (37 out of 42 total occupations). This suggests that there were significant layoffs at the semi-skilled occupation level as businesses reduced/closed operations to mitigate the adverse economic and financial impacts brought by the COVID-19 pandemic.

However, it is worth noting that the scope of the MyCOL 2022/2023 focuses on three selected MyNSR pilot sectors: construction, manufacturing (food processing), and aerospace, in contrast to recent editions of the MyCOLs, which covered all 18 MSIC economic sectors. Hence, the final MyCOL will only include occupations that are critical to the three sectors, and any comparison to previous MyCOLs may not be meaningful.

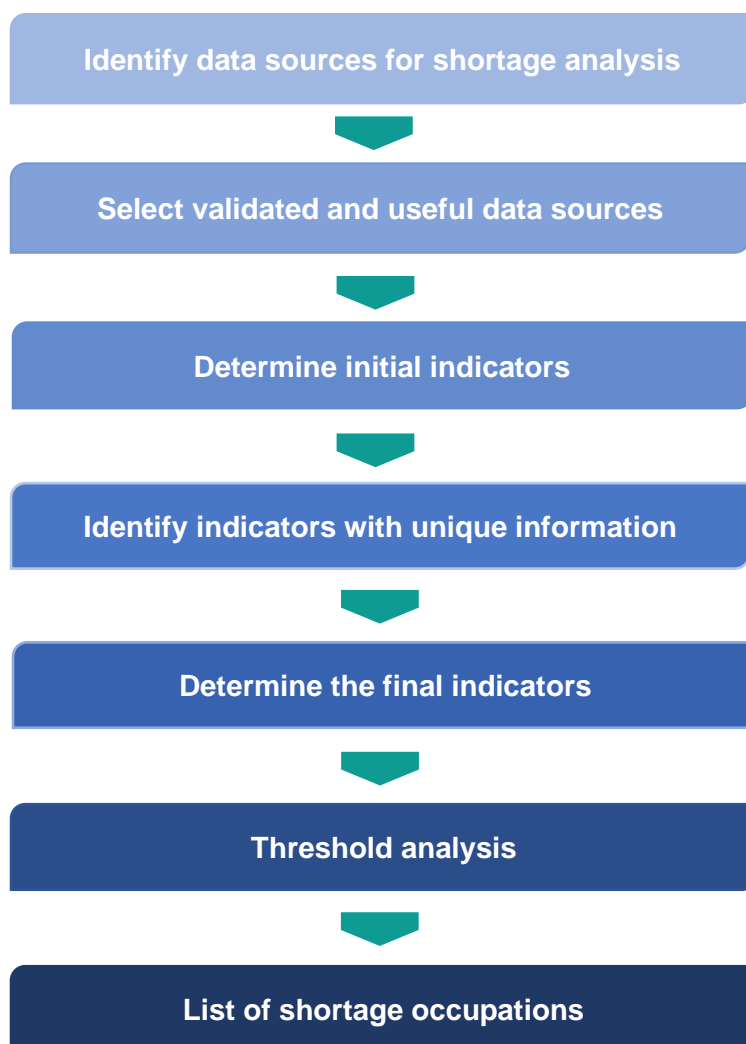
Table 6: Comparison with previous MyCOL

Indicators	MyCOL 2020/2021		MyCOL 2022/2023	
	Included	Occupation skills	Included	Occupation skills
1-year employment growth	Yes	Skilled & Semi-skilled	Yes	Skilled & Semi-skilled
3-year employment growth	Yes	Skilled & Semi-skilled	Yes	Skilled & Semi-skilled
1-year education level decrease	Yes	Skilled & Semi-skilled	Yes	Skilled & Semi-skilled
3-year education level decrease	Yes	Skilled & Semi-skilled	Yes	Skilled & Semi-skilled
1-year working hours growth	Yes	Skilled & Semi-skilled	Yes	Skilled & Semi-skilled
3-year working hours growth	Yes	Skilled & Semi-skilled	Yes	Skilled & Semi-skilled
1-year wage premium growth	Yes	Skilled & Semi-skilled	Yes	Skilled & Semi-skilled
3-year wage premium growth	Yes	Skilled & Semi-skilled	Yes	Skilled & Semi-skilled
Number of vacancies	Yes	Skilled & Semi-skilled	Yes	Skilled & Semi-skilled
Vacancy rate	Yes	Skilled & Semi-skilled	Yes	Skilled & Semi-skilled
1-year education level decrease (Online)	Yes	Skilled & Semi-skilled	Yes	Skilled & Semi-skilled
Degree of persistence in occupational shortages	No	N/A	Yes	Skilled & Semi-skilled

Summarising the top-down process

The top-down approach to creating a shortage list involves three main steps. The first step involves identifying relevant data sources on occupational shortages. The second step is selecting a shortage indicator and using threshold values to test various scenarios using a benchmark period, which results in a set of selected indicators. Finally, the selected indicators are combined to produce a final shortage list. **Figure 4** below illustrates the top-down methodology process.

Figure 4: Top-down methodology process



Source: Author's adaptation from previous MyCOL Report

Bottom-up methodology

The bottom-up approach includes a Call-for-Evidence (CfE) survey of employers and consultations with government agencies, industry associations, and employers from the construction, manufacturing (food processing), and aerospace sectors. The CfE survey is utilised to survey employers from the aforementioned sectors and gather information on which occupations they consider as critical. The definition of a critical occupation (skilled, sought-after, and strategic) is introduced to the employers at the beginning of the survey, and the employers can list down the occupations, job descriptions, and any relevant details of the occupations they deem critical. This CfE survey helps to generate a clearer picture of the labour market to further understand the issues on ground and the employment challenges that the employers face. In addition, the existing CfE survey questionnaire was also refined and enhanced to supplement the requirements of the MyNSR. New questions and sections were added to the questionnaire to gather crucial information for the development of the MyNSR, including the basic, specific, and future anticipated skills that are sought-after by industry employers, as well as future training and technology tool requirements.

Meanwhile, consultation sessions with key stakeholders of the three selected sectors serve to supplement the firm-level data canvassed from the online survey, which provides additional information that can aid in the interpretation of the CfE survey and top-down evidence. Ipsos Strategy3, a strategy consulting firm, was engaged to assist the CSC in carrying out the bottom-up process.

Call-for-Evidence (CfE) survey

The objective of the Call-for-Evidence (CfE) survey is to gather information on occupations that are considered critical by employers across three economic sectors in Malaysia: construction, manufacturing (food processing), and aerospace.

The sector coverage follows the Malaysia Standard Industrial Classification (MSIC) 2008 in classifying industries. **Appendix 2** details the classification of the three sectors within the scope of the 2022/2023 CfE survey.

Meanwhile, the classification of the occupations found in the CfE survey is based on the occupational description used in the Malaysian Classification of Occupations (MASCO) 2020.

The CfE survey was conducted using an online platform as the main data collection tool. The following tasks were executed:

- Web hosting the MyCOL survey on an online platform
- Emailing the survey link to companies from the three sectors across entire Malaysia to complete the survey
- Following up with the companies to ensure complete response
- Engaging employers during industry-related events
- Conducting survey with employers via telephone
- Engaging industry associations to distribute the survey link to their respective members
- Mapping the job title and key responsibility for each critical job position identified by the firm/company at the MASCO 6-digit level
- Data collection, compiling, and cleaning; quality assurance check and due diligence on cleaned data completed by Ipsos Strategy3
- Reviewing and verifying the job title classification by CSC. Cases of ambiguity or discrepancy are referred to MASCO team for further clarification.

Targeted companies for the survey were drawn from several government databases with company contact information that are publicly available or that were compiled by the CSC and Ipsos Strategy3. Ipsos Strategy3 has an internal database of 8,564 companies within the three sectors, in addition to industry contacts shared by the CSC and industry associations.

Survey questionnaire

There were four sections to the survey questionnaire:

- A. Section 1: Company Background
- B. Section 2: Critical Occupations - Employers identified occupations that were critical to the company, the key responsibilities of the occupations, reported on the employees in the positions, experience level needed, time taken to fill vacancies, reasons for defining its criticality, skills needed for the critical jobs reported, strategy used to tackle talent shortage etc.
- C. Section 3: Automation - Firms indicated or reported if there was a potential to automate critical jobs and provided suggestions related to solving skills shortages or deficits.
- D. Section 4: Future Anticipated Skills and Training Required for Upskilling - Employers nominated the future skills and training required by workers to meet changing demands in critical occupations brought upon by anticipated or future industry developments.

The CfE survey questionnaire was refined from the CfE 2020/2021 survey with Section 4: Future Anticipated Skills and Training Required for Upskilling added to cover the future or

anticipated skills and training requirements for the occupations nominated. In addition, a question was added on ‘top-3 technology tools required’ for the nominated occupations, while the response options for existing questions on ‘top-3 basic skills required’ and ‘top-3 specific skills required’ were refined based on the new MyNSR skills structure provided by TalentCorp to ensure that the answers received are reliable and consistent.

The 2022/2023 CfE survey questionnaire can be found in **Appendix 3**.

Survey findings

At the close of fieldwork on 30 November 2022, 500 firms (51 Aerospace firms, 228 Construction firms, and 221 Manufacturing (Food Processing firms)) responded to the CfE Survey and nominated a total of 713 critical occupations across the 3 sectors (98 critical occupations nominated for Aerospace, 315 critical occupations nominated for Construction, and 300 critical occupations nominated for Manufacturing (Food Processing)). These occupations that are nominated can be segregated into MASCO 4D and 6D unit groups across eight major occupational groups. **Figure 5** shows the results graphically.

Figure 5: Final survey status



Figure 6 and **Figure 7** illustrate the breakdown of the 500 firms that responded to the survey by state and sector respectively. A large percentage of survey respondents (43%) were from Selangor and W.P. Kuala Lumpur, highlighting the concentration of business activities for the three sectors in urban areas. Meanwhile, the breakdown of survey responses by sector is reflective of the relative size of the respective sectors (based on number of establishments) in Malaysia.

Figure 6: Breakdown of firms responded to the CfE survey, by State

N=500

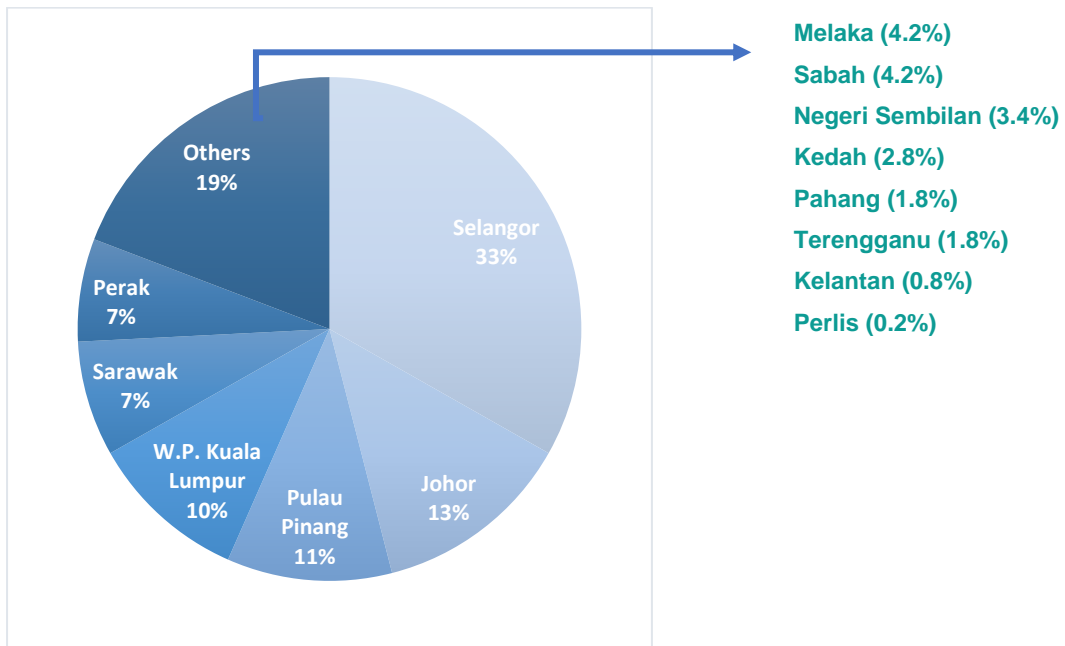


Figure 7: Breakdown of firms responded to the CfE survey, by Sector

N=500

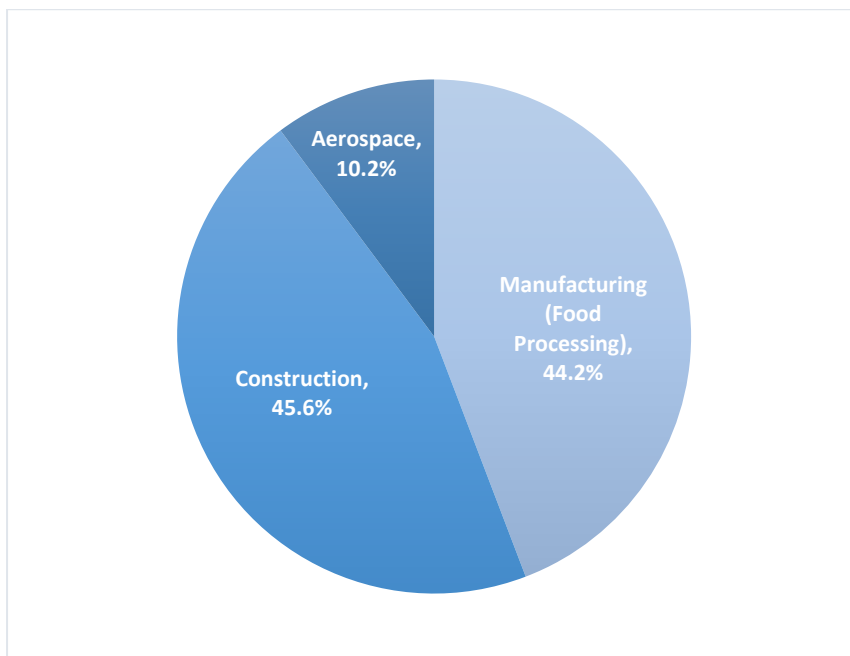
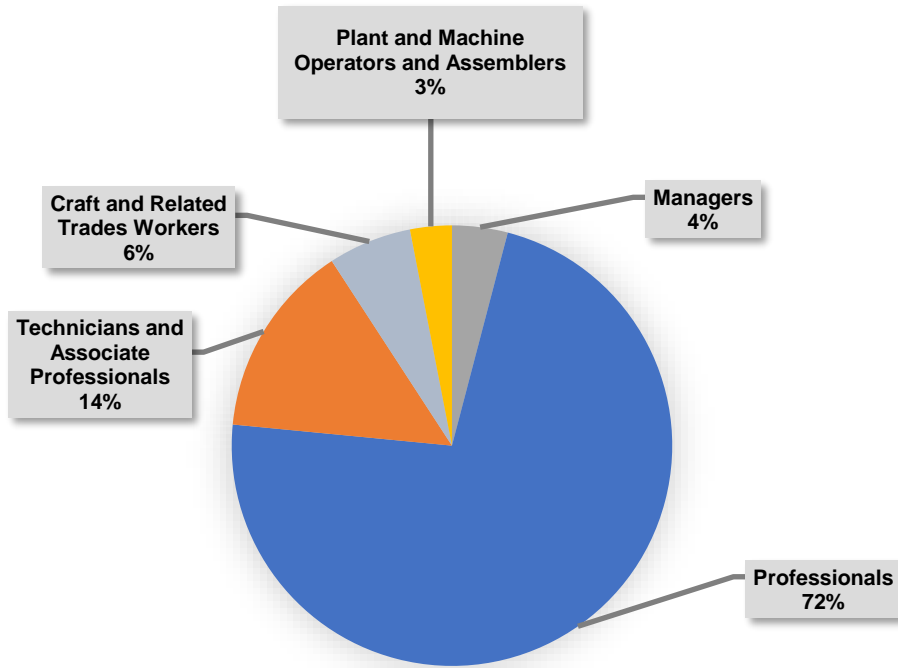


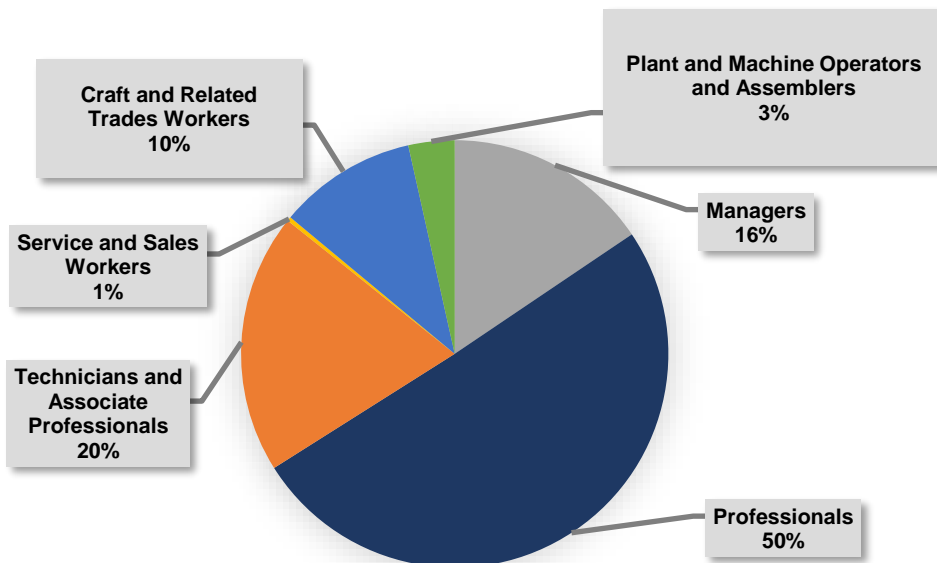
Figure 8 illustrates the results of the nominated jobs by occupational groups from the CfE survey for each sector.

Figure 8: nominated jobs by occupational groups from the CfE survey

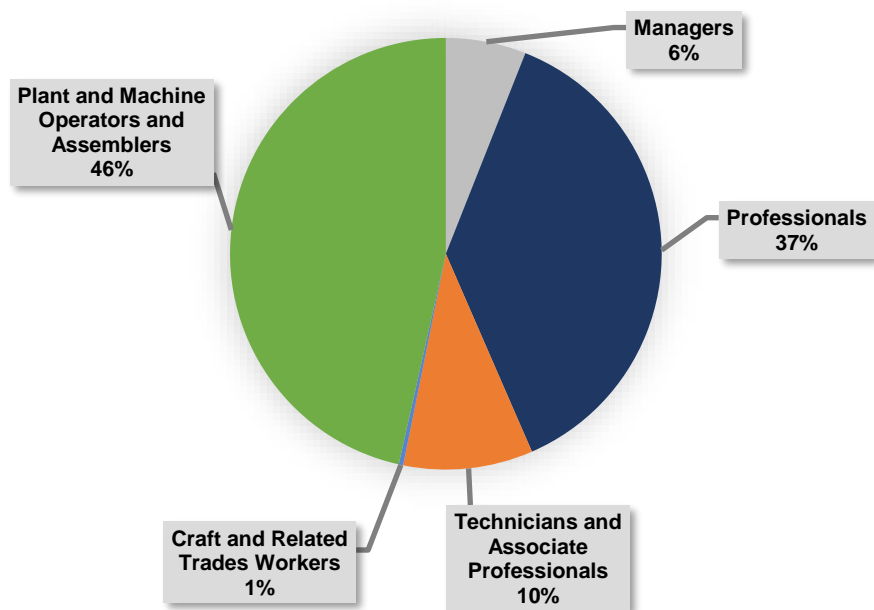
Aerospace



Construction



Manufacturing (Food Processing)



Based on the CfE survey results, the majority of occupational group (72%) nominated by employers from the aerospace sector were from the professional level. This was followed by technicians and associate professionals at 14%. This reflects the aerospace industry as a highly professional and specialised sector which requires highly skilled workers with strong technical expertise.

For the construction sector, half of the nominated occupations (50%) from the CfE survey were from the professional occupational group. This was followed by technician and associate professionals at 20% and craft and related trades workers at 10% which indicated a shortage of workers across varying skill levels.

The CfE survey responses from the food processing sector, on the other hand, suggested the greatest shortage among plant and machine operators and assemblers (46%). The occupational group with the next highest nominations was the professional (37%), followed by technicians and associate professionals (10%). The results are reflective of the nature of the industry, which is production-based whereby many vacancies for semi-skilled roles will need to be filled.

Consultation with Industry Stakeholders

Beyond the CfE survey, consultations with key government agencies, industry associations, and employers were also conducted as part of the bottom-up approach to gather their perspectives on various topics such as global trends, employment challenges, critical occupations, effects of automation, and anticipated future skills and training needs. A structured discussion guide was developed and used during these consultation sessions, ensuring that all relevant topics were covered, and the stakeholders were able to share valuable insights on these issues.

Prior to the consultation sessions, appointments were arranged with relevant stakeholders, and introductory materials were provided to explain the methodology behind the MyCOL and the objectives of the exercise.

Through the consultation sessions, the CSC and Ipsos Strategy3 team were able to gather in-depth information on the occupations nominated by stakeholders as potential inclusions in the MyCOL.

A consultation guide comprising of four (4) components was used:

- A. **Section 1: General Industry and Labour Market Trends** – impact of COVID-19 pandemic, industry performance, local and global emerging trends in the industry, key employment trends, employment challenges faced by the industry;
- B. **Section 2: Critical Occupations** – Stakeholders identified and nominated occupations and jobs that are critical in their industry, reasons that the nominated jobs are hard to fill, specific qualification/competencies/niche skills required, duration and venue to acquire such qualification or skills, level of experience that are most sought after, how the industry was impacted by the shortages, measures taken by the industry to reduce the shortages, and suggestions on what the government can do to assist;
- C. **Section 3: Automation and Technology Disruption** – understanding emerging technology trends in the industry, how automation or technology disruptions may reduce the number of workers or risk of occupations being automated, and the potential of future jobs or skills creation;
- D. **Section 4: Feedback on Previous MyCOL** – trace awareness and utilisation of MyCOL, and the industries' point of view on the previous MyCOL and suggestions for improvement.

The structured discussion guide used during the consultation sessions is included in **Appendix 4**.

Consultation Findings

For the MyCOL 2022/2023, the CSC and Ipsos Strategy3 team engaged and conducted 30 consultations with stakeholders from the three sectors:

- 1) 10 consultations with Aerospace stakeholders;
- 2) 10 consultations with Construction stakeholders; and
- 3) 10 consultations with Food Processing stakeholders.

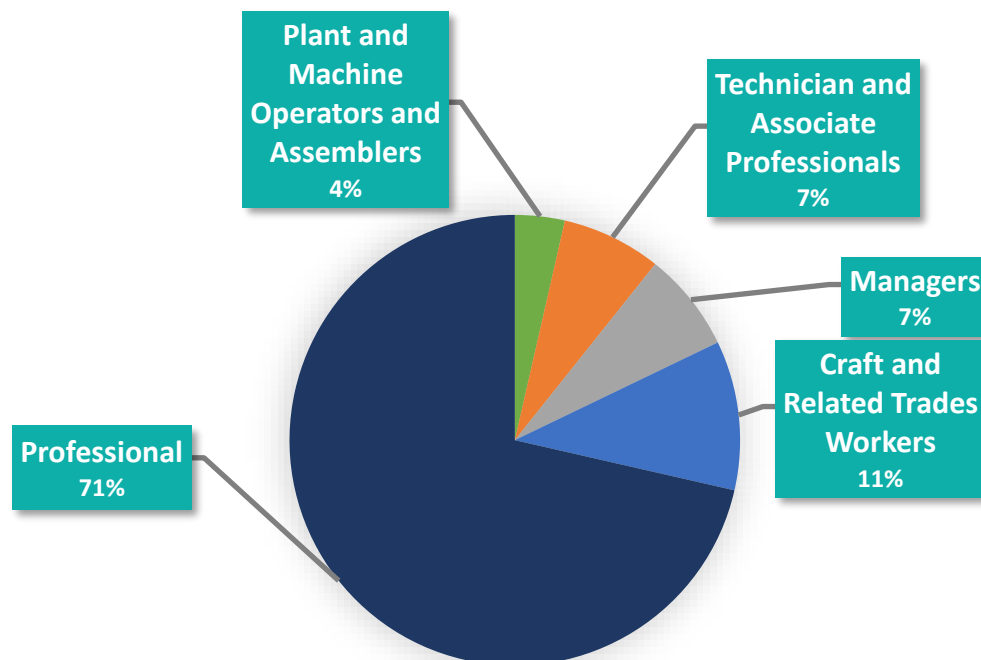
These consultations were held between May and October 2022. The list of stakeholders that took part in the consultation sessions is shown in **Appendix 5**. A total of 60 critical occupations were nominated for the MyCOL during these consultation sessions, with the breakdown by sector as follows:

- Aerospace: 28 occupations
- Construction: 19 occupations
- Manufacturing (Food Processing): 13 occupations

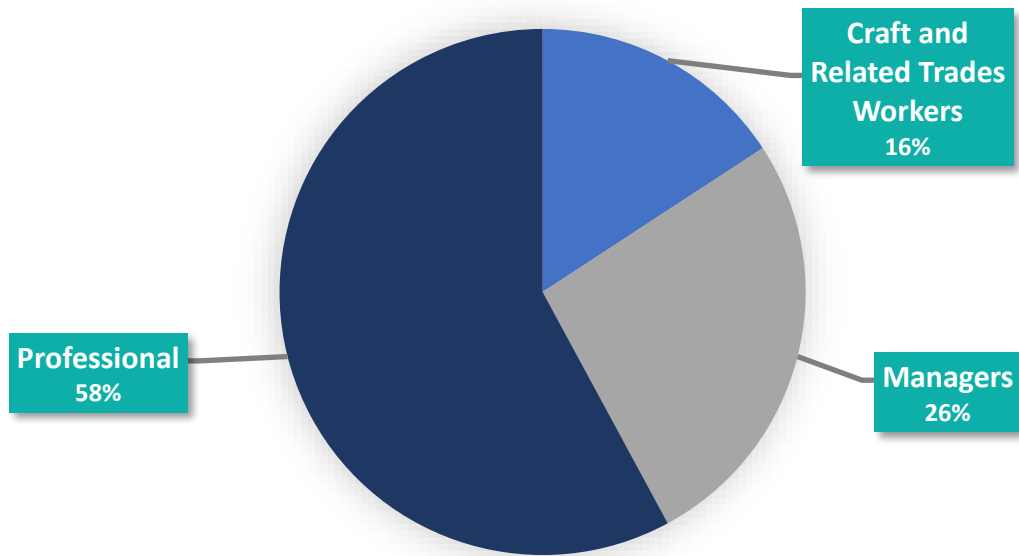
The results of the nominated jobs by occupational groups from the consultations for each sector are illustrated in **Figure 9**.

Figure 9: nominated jobs by occupational groups from the consultations

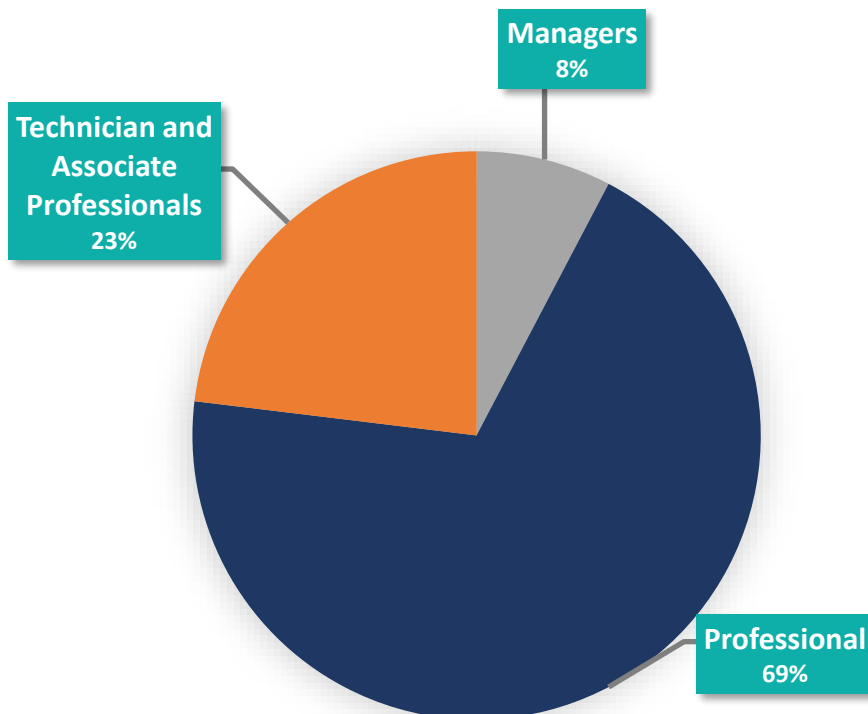
Aerospace



Construction



Manufacturing (Food Processing)



The key occupational group with most nominations from the consultation sessions for the aerospace industry were the professional group (71%), which is consistent with the findings from the CfE survey. Similarly, the construction industry also received highest nominations for the professional group (58%), which is again in line with the CfE survey results.

Lastly, nominations from the food processing industry were highest for the professional group (69%), followed by technician and associate professionals (23%). While this is largely agreeable to the CfE survey findings, the key difference noted was the lack of nominations for the plant & machine operators & assemblers. A possible explanation for this is a lack of understanding on the classification levels of MASCO occupations from the industry stakeholders that were consulted, as plant & machine operators & assemblers may be deemed to be low-skilled rather than semi-skilled from their perspectives.

There were no occupations nominated from clerical support workers (MASCO 4), services and sales workers (MASCO 5), and skilled agriculture, forestry, livestock and fishery workers (MASCO 6) occupational groups throughout the consultation session as these were not closely related to the sectors in focus for MyCOL 2022/2023.

Employment Challenges in the Malaysian Labour Market

Based on the feedback gathered from the consultations with government agencies, industry associations, and employers, the Malaysian labour market is facing a range of challenges that are affecting the country's ability to grow and capitalise on global trends such as the introduction of automation technologies. In particular, the COVID-19 pandemic and global economic downturn has had a profound impact on the local labour market, as employers are finding it increasingly difficult to hire suitable and competent personnel. The shared labour market and employment challenges faced by the Aerospace, Construction, and Food Processing sectors in Malaysia can be summarised as follows:

a) Skills Shortage and Mismatch

Feedback from the consultation stakeholders revealed growing concerns on the skills mismatch among the local workers. The skills and competencies of the workforce, in particular the fresh graduates do not meet the requirements of industry employers. This mismatch is evident in the three sectors within the scope of MyCOL 2022/2023: Aerospace, Construction, and Manufacturing (Food Processing). Due to its highly specialised nature, the Aerospace industry faces high competition for skilled and experienced workers from other countries in the region. Many employers within the local industry have seen their workers move abroad to countries such as Singapore, Indonesia, and the United Arab Emirates in seek of high remuneration and working conditions post-pandemic. On the other hand, traditional sectors such as Construction and Manufacturing (Food Processing) lack skilled professionals with expertise in areas such as machine learning, automation, and data analysis. This was cited among the key reasons for the slow technological adoption in both sectors. While existing workers struggle to keep up with the latest industry and technological advancements, new entrants often lack essential practical industrial experience, technical and soft skills required by the industry. A key reason for this is the lack of effective planning and collaboration among the government, learning institutions, and the industries to keep the education syllabus up-to-date and relevant to current and future industry demands. Learning institutions have fallen behind in adapting to rapid industry developments and technological advancements, resulting in a mismatch between the skills taught to graduates and the skills required in the job market. The industry stakeholders have expressed concerns that skills acquired by current graduates during their tertiary education may become outdated by the time they enter the workforce.

b) Underemployment

The Malaysian labour market has been suffering from underemployment for a long period of time. Many graduates are unable to secure suitable jobs based on their qualifications and skills, or jobs with remuneration that commensurate to their qualifications. A lack of effective planning and investments in education and skills-based training based on latest industry developments and trends have meant that many graduates often found the knowledge and skills they gained at universities and learning institutions redundant or irrelevant to the industry needs. For example, many workers in the local food processing industry who receive education and training in areas such as food science, HACCP, or GMP find it difficult to secure roles that are directly related to their qualifications due to the limited availability of higher-skilled occupations in the sector. As a result, these workers are forced to take up roles that do not make full use of their skills and education knowledge when they enter the workforce. This can have a detrimental effect on the motivation levels of the affected workers, which may impact the productivity and efficiency levels of the companies they work for, and ultimately the economic competitiveness of the country in the long run.

c) Difficulties in Talent Retention

Talent retention has become increasingly challenging for companies in Malaysia, including those within the Aerospace, Construction, and Manufacturing (Food Processing) industries. Widespread reduction in economic activities and job losses due to the COVID-19 pandemic has led to many workers seeking alternative employment opportunities such as providing ride-hailing and food delivery services in the gig economy. Feedback from the consultations revealed that many of these workers were reluctant to return to their previous jobs following the resumption of business activities, as they tend to enjoy higher earning potential and greater work flexibility working in the gig economy. In addition, many skilled and semi-skilled foreign workers previously working in Malaysia permanently returned to their respective countries during the COVID-19 pandemic, leading to a shortage of competent skilled and semi-skilled workers in the local labour market. The effect of this is especially evident in the aerospace sector where the demand for skilled technical roles such as aircraft technicians and aerospace engineers are high. The industry is experiencing a large backlog order of aircraft and components, as well as increased demand for MRO services after the lifting of air travel restrictions post-pandemic. However, the industry is struggling to cope with the demand given the shortage of workers. Technical roles in particular are not easily replaceable given the high level of technical expertise and industry experience required. At the same time, the trend of local workers moving abroad to seek for better employment opportunities has exacerbated following the COVID-19 pandemic, as neighbouring countries such as Singapore were able to offer higher wages and better career opportunities.

Other specific employment challenges faced by each individual sector include:

Aerospace

1) Low technical skill levels among fresh graduates

Feedback from the industry stakeholders have revealed technical skill levels among the current fresh graduates do not meet the standards required by the industry. Employers often found the need to provide fresh graduates intensive training for a period of 3-6 months before they can perform work that meets the industry's requirements. For smaller companies that could not afford to invest in such trainings, they struggle to meet customer demands and deadlines due to a lack of competent workers. This issue can be attributed to the outdated education syllabus at local universities and learning institutions, whereby the latest industry developments and requirements are not incorporated in the education courses. Further, employers also voiced concerns on the lack of practical element incorporated in the education syllabus, which limits the practical exposure of the students. As a result, graduates often find it difficult to keep up with the latest industry requirements when they enter the workforce.

2) Lack of relevant practical industry experience among new entrants

New entrants were often found to lack relevant practical industry experience when they enter the workforce. Feedback from employers suggested a lack of effective collaboration between universities/learning institutions and the industry on the design of internship/apprenticeship programmes, which has resulted in many of these programmes being ineffective. For instance, many local universities and learning institutions offer short internship programmes (3 months or lesser) as part of their courses. This was deemed insufficient by many employers, as a longer duration of time is needed for students to gain essential exposure and technical skills. From the employers' perspective, they do not see value in providing technical skills training opportunities to the students as they are unable to make significant contributions based on what they have learned due to the short internship duration.

Construction

1) Lack of interest in the sector among students/graduates

There is a general perception of the construction work nature and environment as 3D (dirty, dangerous, and difficult) among Malaysians, especially among the younger generation of students and graduates. This issue has been plaguing the Malaysian construction industry for years and has exacerbated in recent times with the emergence of new sectors and technological advancements. At school, students are not given sufficient exposure or groomed to pursue a career in the construction sector and are therefore not attracted to join the industry when they leave school. Further, industry stakeholders have also suggested work safety concerns and a lack of work-life balance as key reasons for the lack of interests among students and graduates, as the nature of the industry requires working at potentially dangerous construction sites and at irregular working hours.

2) Slow technological adoption

The construction industry in Malaysia is facing challenges in adopting new technologies due to a lack of financial incentives, expertise, and heavy investment and training costs. Many companies in the local industry, in particular the smaller contractors are reluctant to invest in new technologies and construction techniques such as BIM and IBS due to a lack of financial incentives, such as tax reliefs or subsidies, that would make the investments more attractive. In addition, there is a shortage of workers with the required expertise and knowledge to effectively implement and utilise these new technologies, which creates further barriers to adoption. Furthermore, the cost of training workers on the new technologies and construction techniques is high, making it difficult for companies to justify the investment. As a result, the construction industry in Malaysia has been slow to adopt new technologies, hindering its growth and competitiveness in the global market.

Manufacturing (Food Processing)

1) Shortage of skilled workers in specialised roles

The food processing industry requires a range of technical and specialised skills to produce safe and high-quality food products. Specialised skills and knowledge in food safety, quality control, production processes are essential in the industry. However, there is a shortage of skilled and experienced personnel in the local food processing industry, especially for specialised roles such as quality assurance/control managers and food technologists. This stems from a general lack of career growth opportunities within the industry, as professionals such as quality assurance/control managers are relied on for multiple roles within the production floor, rather than leveraged on for their expertise. At

the same time, there is also a lack of investments in new production techniques and technologies, thus inhibiting the growth of roles such as R&D professionals and the industry as a whole. These factors can cause demotivation and job dissatisfaction among employees, which leads to them switching industries or seeking better employment opportunities abroad.

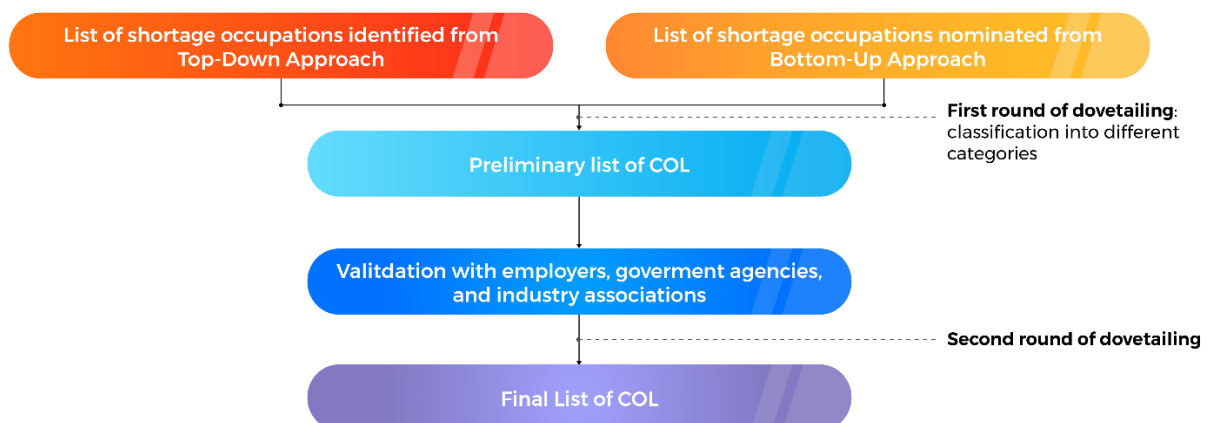
2) High turnover rate

According to the feedback gathered from the consultations, the local food processing industry experiences a high turnover rate, particularly among the semi-skilled roles such as food production workers and machine operators. These roles are typically repetitive and have limited growth opportunities. Further, low pay, long working hours, inflexible work arrangements, lack of job security, and poor working conditions also contribute to the high turnover rate in the industry. Therefore, there is a need for greater investments in training and technology to upskill the existing workforce and promote the growth and development of the industry.

Dovetailing and Validation

The dovetailing phase of the study involves a process of combining and consolidating evidence from the top-down and bottom-up approaches to determine whether an occupation merits inclusion in the final MyCOL. There are two rounds of dovetailing analysis and a validation exercise. The process is illustrated in **Figure 10** below. This process is to ensure all relevant data and information are being captured for the shortlisted occupations, and the coherence of top-down and bottom-up evidence as well as the plausibility of the case are being properly evaluated.

Figure 10: Process to develop the final Critical Occupations List



First round of dovetailing

In the first round of dovetailing, all occupations determined to be in shortage by the top-down analysis and all occupations for which a bottom-up nomination was made were reviewed for potential inclusion on the MyCOL. At this stage, occupations are classified into three categories for further examination:

Group 1: There is strong evidence for inclusion

Group 2: There is weak evidence for inclusion

Group 3: Evidence does not make a case for inclusion

For the MyCOL 2022/2023, occupations that received 20 or more nominations in the bottom-up process are considered to have strong evidence and are categorised into Group 1 (**Table 7**). Occupations that pass the top-down approach and that received at least 7 nominations in the bottom-up process are also considered to have strong evidence for inclusion and are categorised into Group 1. Occupations that pass the top-down approach but that received fewer than 7 nominations are categorised as having weak evidence for inclusion and are categorised into Group 2. The same is true for occupations that received between 3 and 19 nominations but did not pass the top-down approach or did not have sufficient data from the top-down approach. Occupations for which evidence does not make a case for inclusion that are categorised into Group 3 are those that do not pass the top-down approach or do not have enough data, and that received fewer than or equal to 4 nominations.

Table 7: Classifying occupations in the first round of dovetailing

Classification of Occupations		Top-down			
		Passed ¹	Do not pass (moderate) ²	Do not pass (low) ²	Insufficient evidence ²
Bottom-up	High (≥ 20 nominations)	Green	Green	Green	Green
	Moderate (7-19 nominations)	Green	Yellow	Yellow	Yellow
	Low (3-6 nominations)	Yellow	Yellow	Yellow	Yellow
	Very low (1-2 nominations)	Yellow	Red	Red	Red
	Not nominated	Yellow	Red	Red	Red
Group 1: There is strong evidence for inclusion		Green			
Group 2: There is weak evidence for inclusion		Yellow			
Group 3: Evidence does not make case for inclusion		Red			

1: ≥ 50% of top-down indicators show evidence of shortage with a minimum of 4 available indicators.

2: < 50% of top-down indicators show evidence of shortage with a minimum of 4 available indicators.

3: The top-down approach has fewer than 4 indicators for the occupation.

Note: For occupations very close to the threshold between groups, some discretion is used in the classification, especially in the case of particularly strong bottom-up evidence.

The thresholds of 3, 7, and 19 nominations are set in reference to the total number of respondents and the distribution of the frequency of nominations. Occupations that were nominated 2 times or lower were nominated by less than 0.5 per cent of total respondents. Occupations receiving 3 or more nominations are in the top 40 per cent of occupations by number of nominations. Occupations receiving 7 or more nominations are in the top 25 per cent of occupations by number of nominations. Occupations receiving 20 or more nominations are in the top 15 per cent of occupations by number of nominations.

The first round of dovetailing results in a preliminary MyCOL. Occupations in Group 1 are generally included in the preliminary MyCOL, based on the strong evidence from both the top-down and bottom-up approaches. Occupations in Group 3 are generally not included in the preliminary MyCOL, again after a discussion of the merits on their inclusion. More time is spent evaluating the evidence for occupations in Group 2 where the evidence for inclusion in the preliminary MyCOL is weak. This is to identify marginal cases for further evidence gathering during the validation stage, and for further evaluation during the second dovetailing stage. The decision on each occupation’s inclusion in the preliminary MyCOL is conducted through a rigorous deliberation that captures both the top-down and bottom-up evidence, as well as the team’s rationale for recommending its inclusion or exclusion. The outcome of the deliberation

process also captures questions that need to be addressed during validation before a decision on the occupation is considered final.

A total of 144 four-digit MASCO occupations were reviewed during the first round of dovetailing for the MyCOL 2022/2023. This represents 32 per cent of all non-military 4-digit MASCO occupations. The remaining 310 occupations that were not nominated in the bottom-up approach and did not pass the top-down approach were not reviewed. As shown in Table 8, the first round of dovetailing exercise resulted in 14 (3%) out of the total 454 occupations being classified as having strong evidence for inclusion (Group 1). 100 (22%) occupations were classified as having weak evidence for inclusion (Group 2), and 340 (75%) occupations were classified as not meriting inclusion.

Table 8: Classifying occupations in the first round of the MyCOL 2022/2023 dovetailing

Classification of Occupations		Top-down				Total
		Passed ¹	Do not pass (moderate) ²	Do not pass (low) ²	Insufficient evidence ²	
Bottom-up	High (≥ 20 nominations)	5 (1%)	5 (1%)	0 (0%)	1 (0%)	11 (2%)
	Moderate (7-19 nominations)	3 (1%)	4 (1%)	0 (0%)	1 (0%)	8 (2%)
	Low (3-6 nominations)	5 (1%)	7 (2%)	0 (0%)	1 (0%)	13 (3%)
	Very low (1-2 nominations)	12 (3%)	12 (3%)	12 (3%)	6 (1%)	42 (9%)
	Not nominated	70 (15%)	114 (25%)	13 (3%)	183 (40%)	380 (84%)
	Total	95 (21%)	142 (31%)	25 (6%)	192 (42%)	454 (100%)

Group 1: There is strong evidence for inclusion	14 (3%)
Group 2: There is weak evidence for inclusion	100 (22%)
Group 3: Evidence does not make case for inclusion	340 (75%)

Note: Percentages are calculated out of 454 skilled and semi-skilled occupations.

Upon the completion of the first round of dovetailing, a total of 14 occupations displayed strong evidence for inclusion in the MyCOL, while 100 occupations displayed weak evidence for inclusion and would require further validation by the industry.

Validation

A validation process was undertaken after the first round of dovetailing to further analyse the critical occupations identified, with greater emphasis placed on the 100 occupations which displayed weak evidence for inclusion in the MyCOL. These 100 occupations were further analysed and segregated based on their respective sectors, leaving a total of 40 occupations across the three sectors to be further validated by the industry.

A validation workshop was conducted virtually with participants from the private and public sectors. These included key government agencies, industry associations, and employers from the three sectors in scope. Feedback from the participants on whether the occupations are considered critical in their view were gathered through a voting exercise. Subsequently, a discussion on the reasons for validating/rejecting the occupations as a critical occupation was carried out.

Finally, desk research was also conducted to identify relevant industry reports that can support the inclusion or exclusion of those occupations in the final MyCOL.

Second round of dovetailing

A second round of dovetailing is conducted for those occupations for which additional information is received during the validation process. The process is similar to the first round of dovetailing, but considers the information gathered in the validation process. At this stage, if evidence remains inconclusive, the occupation is excluded from the MyCOL on the grounds that a robust case for inclusion did not emerge despite extensive data collection.

The strategic importance of occupations that meet the skilled and sought-after criteria for inclusion in the MyCOL is assessed during the second round of dovetailing. The strategic importance of an occupation is assessed based on a variety of factors including which industries are calling for certain occupations, the degree to which employers are actively seeking to fill shortages, and the potential impact of shortages on the health of businesses and industries. Other factors considered when assessing the strategic importance of skilled and sought-after occupations are:

- 1. Diversity of jobs in each 4-digit MASCO occupation.** Only some job titles (six-digit MASCO job titles) are included in the final MyCOL in cases in which nominations are concentrated on particular job titles and there is evidence that the skill content of the nominated jobs differs from others in the 4-digit MASCO occupation.

2. Importance to the development of the sectors. Occupations that are deemed critical by employers in contributing to the growth and development of the Aerospace, Construction, and Manufacturing (Food Processing) sectors in Malaysia.

3. Automatability of occupations. Occupations that are deemed more susceptible to automation based on automation-related questions in the CfE survey may be deemed less strategic to fill through the MyCOL. This is because these occupations are likely to be automated in the near future, and policy efforts to fill shortages may not be necessary. The reverse is true for occupations that are less likely to be automatable: these may be strategic to include in the MyCOL.

Following the review of the validation and second dovetailing results, a total of four occupations were excluded from the final MyCOL despite being nominated by industry stakeholders during the validation process due to insufficient/inconclusive evidence gathered from the top-down and bottom-up approaches. These occupations were:

MASCO 4D	Job Title
2113	Chemists
6122	Poultry Producers
7127	Air Conditioning And Refrigeration Mechanics
7233	Agricultural And Industrial Machinery Mechanics And Repairers

The final MyCOL was determined through the outcome of the second dovetailing stage. This stage marked the conclusion of the process of identifying critical occupations. The second dovetailing stage resulted in another 23 occupations being added to the final MyCOL 2022/2023, giving a total of 37 critical occupations at the four-digit MASCO level. The final MyCOL 2022/2023 is tabulated in the next section of this report.

The Critical Occupations List (MyCOL) 2022/2023

The MyCOL 2022/2023 consists of 37 critical occupations at the MASCO 4-digit level (**Table 9**). This is lower than the 42 occupations listed in the MyCOL 2020/2021, which is not unusual as the scope of the 2022/2023 is focused on three sectors: Aerospace, Construction, and Manufacturing (Food Processing). These three sectors are facing challenges in hiring and retaining talents post-COVID-19 pandemic.

The MyCOL 2022/2023 saw a total of 9 critical occupations included in the MyCOL for the first time (as shown in **Table 10**), while a total of 8 critical occupations in the 2022/2023 MyCOL have appeared in every edition of MyCOL since its inception. **Table 11** shows the list of occupations that have appeared in every edition of MyCOL since its inception.

Table 9: 2022/2023 Final Critical Occupations List

MASCO 4D	Job Title
1121	Managing Directors And Chief Executives
1211	Finance Managers
1214	Business Services Managers
1216	Quality Managers
1321	Manufacturing Managers
1323	Construction Managers
1511	Information And Communications Technology Managers
2141	Industrial And Production Engineers
2142	Civil Engineers
2144	Mechanical Engineers
2146	Mining Engineers, Metallurgists And Related Professionals
2151	Electrical Engineers
2173	Aircraft Pilots And Related Professionals
2182	Manufacturing Professionals
2263	Environmental And Occupational Health And Hygiene Professionals
2426	Research And Development Professionals
2512	Software Developers
2522	Information Technology System Administrators
3112	Civil Engineering Technicians
3113	Electrical Engineering Technicians
3115	Mechanical Engineering Technicians
3119	Industrial And Production Technicians
3122	Manufacturing Supervisors
3123	Construction Supervisors
3151	Aircraft Technicians
3211	Medical Imaging And Therapeutic Equipment Technicians
7111	House Builders
7132	Spray Painters And Varnishers
7212	Welders And Flame Cutters
7411	Building And Related Electricians
7412	Electrical Mechanics And Fitters
7422	Information And Communications Technology Installers And Services
8161	Food And Related Products Machine Operators
8189	Stationary Plant And Machine Operators Not Elsewhere Classified
8332	Heavy Truck And Lorry Drivers
8342	Earth-Moving And Related Plant Operators
8343	Crane, Hoist And Related Plant Operators

Table 10: Occupations that are new in the MyCOL

MASCO 4D	Job Title
1216	Quality Managers
3211	Medical Imaging And Therapeutic Equipment Technicians
7111	House Builders
7132	Spray Painters And Varnishers
7411	Building And Related Electricians
7422	Information And Communications Technology Installers And Services
8161	Food And Related Products Machine Operators
8342	Earth-Moving And Related Plant Operators
8343	Crane, Hoist And Related Plant Operators

Table 11: Occupations that have appeared in every MyCOL

MASCO 4D	Job Title
1211	Finance Managers
1214	Business Services Managers
2141	Industrial And Production Engineers
2144	Mechanical Engineers
2182	Manufacturing Professionals
2512	Software Developers
2522	Information Technology System Administrators
3115	Mechanical Engineering Technicians

Dovetailing Reports of Occupations on the Critical Occupations List (MyCOL) 2022/2023

The MyCOL 2022/2023 consists of 37 critical occupations at the MASCO 4-digit level. Out of the 37 occupations, 4 occupations were nominated by two or more sectors, giving a total of 41 critical occupations across the three sectors.

AEROSPACE

Occupation: Mining Engineers, Metallurgists and Related Professionals							
MASCO 2020(4-Digit Code): 2146							
MASCO 2020(6-Digit Code): 2146-39							
Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):				NDT Engineer (Non-destructive Testing)			
This occupation appears on MyCOL:							
2018	Yes	2019	Yes	2020/2021	No	2022	Yes
Source of evidence:							
Top-down indicators		Passed 4 out of 8 indicators					
Bottom-up CfE survey		8 nominations					
Consultation		4 nominations					
Talent/Skills studies		<ul style="list-style-type: none"> NAS410 certification 					
Top-down Data:							
Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)		
N/A	Yes	N/A	No	N/A	No		
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage		
N/A	No	Yes	Yes	No	Yes		

Occupation Overview:

<p>Top Reasons of Hard-to-Fill:</p> <ol style="list-style-type: none"> 1. Too few applicants or no applicant at all 2. Applicants lack the required technical skills. Please specify the technical skills: NDT analysis and NAS410 3. Applicants' expected compensation is beyond the market rate 	<p>Top Strategies to Meet Shortages:</p> <ol style="list-style-type: none"> 1. Raising wages 2. Hiring less well qualified applicants 3. Expanding international recruitment efforts
<p>Minimum Level of Qualification:</p> <ol style="list-style-type: none"> 1. Bachelor's Degree / Graduate Diploma / Graduate Certificate 2. Advanced Diploma / SKM Level 5 	<p>Top Field of Study:</p> <ol style="list-style-type: none"> 1. Engineering, Manufacturing, and Construction - Mechanics and metal work 2. Engineering, Manufacturing, and Construction - Electronics and automation 3. Engineering, Manufacturing, and Construction - Electricity and energy
<p>Top Basic Skills:</p> <ol style="list-style-type: none"> 1. Problem-solving 2. Numeracy 3. Learning 	<p>Top Specific Skills:</p> <ol style="list-style-type: none"> 1. Analyse data to inform operational decisions or activities 2. Conduct quantitative failure analyses of operational data 3. Inspect aircraft or aircraft components
<p>Top Technology Tools:</p> <ol style="list-style-type: none"> 1. Quantitative schedule and risk analysis software 2. Regulatory compliance software 3. Business intelligence and data analysis software 	<p>Top Future Anticipated Skills:</p> <ol style="list-style-type: none"> 1. Data Analytics System Design 2. Internet of Things Management 3. Computer-aided Manufacturing
<p>Top Trainings Needed:</p> <ol style="list-style-type: none"> 1. Training on Technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI) 	

Bottom-up Evidence:

These occupations are included in the MyCOL and were nominated to reflect the need for NDT engineer (Non-destructive Testing).

- i. These job titles were nominated approximately 8 times through the CfE survey and 4 times during interviews with industry stakeholders.
- ii. The companies have reported that the vacancies within the occupation group are for fresh graduates (0-2 years) and mid-level personnel with at least 5 years of experience. The key recruitment challenges cited by employers include a lack of applicants, a lack of technical skills such as NDT analysis and NAS410, and applicants' compensation expectations that are higher than the market rate. To overcome these challenges, employers are considering raising wages, hiring less qualified applicants, and increasing international recruitment efforts.
- iii. Employers expressed that they require a bachelor's degree/graduate diploma/graduate certificate as the minimum level of qualification for NDT engineers. For entry-level roles, a minimum of an advanced Diploma/SKM Level 5 with good interpersonal skills would suffice.

Preference is given to employees with backgrounds in engineering, manufacturing, and construction, specifically in mechanics and metal work, electronics and automation, and electricity and energy. A few survey and interview participants from the sector emphasised the importance of NAS410 certifications in employees.

- iv. Collective inputs from the CfE survey respondents revealed problem solving, numeracy, and learning as the top 3 basic skills. As for the top 3 specific skills, participants nominated analysing data to inform operational decisions or activities, conducting quantitative failure analyses of operational data, and inspecting aircraft or aircraft components. The top 3 technology tools nominated were quantitative schedule and risk analysis software, regulatory compliance software, and business intelligence and data analysis software.
- v. Additionally, the survey indicated that in the next 1-2 years, the top three anticipated skills for this job family are data Analytics System Design, Internet of Things Management, and computer-aided manufacturing. For continuous upskilling and training, the top nominated option was training on technology such as AI, Connected Hardhats, Smart infrastructure, VR, AR, and AI.
- vi. Further investigation revealed that there are gaps in the current talent pool and market demand that need to be addressed to facilitate digital adoption in the industry. Some of the gaps identified by industry stakeholders include a lack of relevant digital skills among employees and an education system and syllabus that is not up-to-date with industry requirements and developments. The lack of digital adoption was further supported through interviews, as most companies are unlikely to automate in the future, despite the fact that this occupation has the potential to automate 25% to 50% of their current tasks.

Occupation: Electrical Engineers

MASCO 2020(4-Digit Code): 2151

MASCO 2020(6-Digit Code): 2151-02

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Electrical Engineer

This occupation appears on MyCOL:

2018	Yes	2019	Yes	2020/2021	No	2022	Yes
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Source of evidence:

Top-down indicators	Passed 5 out of 12 indicators
Bottom-up CfE survey	4 nominations
Consultation	0 nomination
Talent/Skills studies	-

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	No	Yes	No	No
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	Yes	No	Yes

Occupation Overview:

Top Reasons of Hard-to-Fill:

1. Too few applicants or no applicant at all
2. Applicants' expected compensation is beyond the market rate
3. Applicants lack the required credentials or certification/ qualification

Top Strategies to Meet Shortages:

1. Raising wages
2. Hiring less well qualified applicants
3. Increasing employees' training

Minimum Level of Qualification:

1. Bachelor's Degree/ Graduate Diploma/ Graduate Certificate

Top Field of Study:

1. Engineering, Manufacturing, and Construction – Electronics and automation
2. Engineering, Manufacturing, and Construction – Electricity and energy

Top Basic Skills:

1. Problem solving
2. Learning
3. Numeracy

Top Specific Skills:

1. Analyse data to assess operational or project effectiveness
2. Analyse data to inform operational decisions or activities
3. Analyse data to identify or resolve operational problems

Top Technology Tools:

1. Quantitative schedule and risk analysis software
2. Analytical and scientific software
3. Electrical and electronic systems measurement instruments

Top Future Anticipated Skills:

1. Embedded System Integration
2. Internet of Things Management

Top Trainings Needed:

1. Training on Technology

Bottom-up Evidence:

These occupations are included in the MyCOL and were nominated to reflect the need for electrical engineer.

- i. These job titles were nominated approximately 4 times through the CfE survey.
- ii. The companies have reported that vacancies within the occupation group are for fresh graduates with 0 to 2 years of experience and mid-level personnel with at least 2 to 5 years of experience. The main recruitment challenges cited by employers are a shortage of applicants, compensation expectations higher than the market rate, and a lack of required certifications. To address these challenges, employers are looking to increase wages, hire less qualified applicants, and provide more employee training.
- iii. Employers are seeking a minimum of a bachelor's degree for entry and mid-level engineering positions. Priority is given to employees with an engineering background, particularly in electronics and automation, and electricity and energy. Some of the key industry skills sought by employers include the ability to maintain electrical equipment and systems.
- iv. Results from the CfE survey showed that the top three basic skills needed are problem-solving, learning, and numeracy. The top three specific skills are analysing data to assess operational or project effectiveness, inform operational decisions, and identify and resolve operational problems. The most important technology tools identified were quantitative schedule and risk analysis software, analytical and scientific software, and electrical and electronic systems measurement instruments.

- v. The survey also indicates that the top skills anticipated for this job family over the next 1 to 2 years are embedded system integration and Internet of Things management. The preferred type of training for continuous reskilling is technology training.
- vi. Further investigation also revealed the need for certain gaps between the current talent pool and market demand to be bridged to facilitate digital adoption within the industry. These gaps include a shortage of relevant digital skills among employees and an outdated education system and curriculum. To reduce these gaps, there needs to be closer collaboration between the government, industry players, and education institutions.

Occupation: Aircraft Pilots and Related Professionals

MASCO 2020(4-Digit Code): 2173

MASCO 2020(6-Digit Code): 2173-09; 2173-10

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Aircraft Engineer; Aircraft Design Engineer

This occupation appears on MyCOL:

2018	Yes	2019	No	2020/2021	No	2022	Yes
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Source of evidence:

Top-down indicators	Passed 2 out of 3 indicators
Bottom-up CfE survey	23 nominations
Consultation	5 nominations
Talent/Skills studies	<ul style="list-style-type: none"> NAS410 BCAR

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
N/A	N/A	N/A	N/A	N/A	N/A
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
N/A	N/A	Yes	N/A	No	Yes

Occupation Overview:

<p>Top Reasons of Hard-to-Fill:</p> <ol style="list-style-type: none"> 1. Too few applicants or no applicant at all 2. Applicants lack relevant job experience 3. Applicants lack the required credentials or certification/ qualification 	<p>Top Strategies to Meet Shortages:</p> <ol style="list-style-type: none"> 1. Increasing employees' training 2. Raising wages 3. Hiring less well qualified applicants
<p>Minimum Level of Qualification:</p> <ol style="list-style-type: none"> 1. Bachelor's Degree/ Graduate Diploma/ Graduate Certificate 	<p>Top Field of Study:</p> <ol style="list-style-type: none"> 1. Engineering, Manufacturing, and Construction - Electronics and automation 2. Engineering, Manufacturing, and Construction - Mechanics and metal work 3. Arts and Humanities - Design
<p>Top Basic Skills:</p> <ol style="list-style-type: none"> 1. Problem solving 2. Numeracy 3. Digital engagement 	<p>Top Specific Skills:</p> <ol style="list-style-type: none"> 1. Develop operating strategies, plans or procedures 2. Develop detailed project plans 3. Select production equipment according to product specifications
<p>Top Technology Tools:</p> <ol style="list-style-type: none"> 1. Computer aided design CAD software 2. Computer system software 3. Air, space, or watercraft guidance systems 	<p>Top Future Anticipated Skills:</p> <ol style="list-style-type: none"> 1. Internet of Things Management 2. Computer-aided Manufacturing 3. Data Analytics System Design
<p>Top Trainings Needed:</p> <ol style="list-style-type: none"> 1. Training on Technology 2. Training on Computer Aided Manufacturing (CAM) 3. Training on Occupational Safety and Health (OSH) 	

Bottom-up Evidence:

These occupations are included in the MyCOL and were nominated to reflect the need for aircraft engineers, and aircraft design engineer.

- i. These job titles were nominated approximately 23 times through the CfE survey and 5 times during interviews with industry stakeholders.
- ii. The companies reported that the vacancies within the occupation group are for fresh graduates (0–2 years) and mid-level personnel with at least 2 to 5 years of experience. The key recruitment challenges cited by employers were a shortage of applicants, a lack of experience, and a lack of the required credentials or certifications. To overcome these challenges, employers look to increase employee training, raise wages, and hire less-qualified applicants.
- iii. Employers also expressed a preference for bachelor's degrees as the minimum qualification for entry- and mid-level engineering roles. Priority is also given to employees with backgrounds in engineering, specifically electronics, automation, mechanical and metal work, and art design. A few survey and interview participants from the sector emphasised that some of the important industry skills they look for in employees include aircraft design and assembly and NAS410 and BCAR certifications.
- iv. Collective inputs from the CfE survey respondents revealed problem-solving, numeracy and digital engagement as the top 3 basic skills. As for the top 3 specific skills, participants nominated developing operating strategies, plans or procedures, developing detailed project

plans, and selecting production equipment according to product specifications. The top three technology tools nominated were computer-aided design (CAD) software, computer system software, and air, space, or watercraft guidance systems.

- v. Furthermore, the survey also shows that in the next 1 – 2 years, the top 3 anticipated skills for this job family are internet of things management, computer aided manufacturing, and data analytics system design. In terms of the types of trainings required for continuous up/reskilling, the top 3 nominated selections are training on technology, training on computer-aided manufacturing (CAM), and training on occupational safety and health (OSH).
- vi. Further investigation also suggests that certain gaps within the current talent pool and market demand needs to be bridged to facilitate digital adoption within the industry. Some of the gaps highlighted by the industry stakeholders were a lack of relevant digital skills among employees and that the education system and syllabus is not updated in line with industry requirements/developments..

Occupation: Manufacturing Professionals

MASCO 2020(4-Digit Code): 2182

MASCO 2020(6-Digit Code): 2182-02; 2182-04; 2182-18

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):	Quality Assurance Executive; Quality Control Executive; Supply Chain/ Procurement Specialist
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This occupation appears on MyCOL:

2018	Yes	2019	Yes	2020/2021	Yes	2022	Yes
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Source of evidence:

Top-down indicators	Passed 5 out of 12 indicators
Bottom-up CfE survey	5 nominations
Consultation	2 nominations
Talent/Skills studies	-

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	No	No	No	No
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	Yes	Yes	Yes	No	Yes

Occupation Overview:

Top Reasons of Hard-to-Fill:

1. Too few applicants or no applicant at all
2. Applicants lack relevant job experience
3. Applicants lack the required technical skills

Top Strategies to Meet Shortages:

1. Increasing employees' training
2. Raising wages
3. Hiring less well qualified applicants

Minimum Level of Qualification:

1. Bachelor's Degree/ Graduate Diploma/ Graduate Certificate
2. Advanced Diploma/ SKM Level 5

Top Field of Study:

1. General Programmes – Basic/broad, general programmes
2. Engineering, Manufacturing, and Construction – Mechanics and metal work
3. Engineering, Manufacturing, and Construction – Material engineering

Top Basic Skills:

1. Oral communication
2. Planning and organising
3. Problem solving

Top Specific Skills:

1. Test performance of aircraft equipment
2. Verify information or specifications
3. Monitor operational procedures in technical environments

Top Technology Tools:

1. Facilities management software
2. Aviation and marine communication systems
3. Air, space, or watercraft guidance systems

Top Future Anticipated Skills:

1. Internet of Things Management
2. Embedded System Design
3. Data Analytics System Design

Top Trainings Needed:

1. Training on Technology

Bottom-up Evidence:

These occupations are included in the MyCOL and were nominated to reflect the need for quality assurance executive, quality control executive, and supply chain/procurement specialist.

- i. These job titles were nominated approximately 5 times through the CfE survey and twice during interviews with industry stakeholders.
- ii. The companies reported that they are looking to fill vacancies within the occupation group with mid-level personnel who have 2 to 5 years of experience and senior-level personnel with at least 8 years of experience. The key recruitment challenges cited by employers included a shortage of applicants, lack of experience, and insufficient technical skills. To address these challenges, employers are increasing employee training, raising wages, and considering less well-qualified applicants.
- iii. Employers stated that a bachelor's degree is the minimum requirement for mid-level manufacturing professional roles. For entry-level roles, an advanced diploma or SKM Level 5 with good personal skills is sufficient. Preference is given to candidates with a background in basic or broad general programs and in engineering, specifically mechanics and metal work, and material engineering. Some survey and interview participants from the sector emphasised the importance of quality control and quality assurance skills in employees.
- iv. According to the survey results, oral communication, planning and organising, and problem-solving were the top three basic skills. The top three specific skills nominated by participants were testing aircraft equipment performance, verifying information or specifications, and monitoring operational procedures in technical environments. The top three technology tools mentioned were facilities management software, aviation and marine communication systems, and air, space, or watercraft guidance systems.

- v. Additionally, the survey found that internet of things management, embedded system design, and data analytics system design are the top three anticipated skills for this job family over the next 1 to 2 years. The most frequently nominated type of training for continuous upskilling was training on technology.
- vi. Further investigation suggests that there are gaps between the current talent pool and market demand that need to be bridged. These gaps include a lack of relevant experience and a lack of alignment between the education system and industry requirements/developments. Closer collaboration between the government, industry players, and educational institutions is needed to bridge these gaps.

Occupation: Software Developers

MASCO 2020(4-Digit Code): 2512

MASCO 2020(6-Digit Code): 2512-07; 2512-08

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Application Engineer (.Net); Software Engineer (.Net)

This occupation appears on MyCOL:

2018	Yes	2019	Yes	2020/2021	Yes	2022	Yes
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Source of evidence:

Top-down indicators	Passed 4 out of 12 indicators
Bottom-up CfE survey	4 nominations
Consultation	0 nomination
Talent/Skills studies	-

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	No	No	No	No
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	Yes	No	Yes

Occupation Overview:

Top Reasons of Hard-to-Fill:

1. Too few applicants or no applicant at all
2. Applicants lack relevant job experience
3. Applicants do not have required digital skills to address the needs post pandemic

Top Strategies to Meet Shortages:

1. Increasing employees' training
2. Raising wages
3. Establishing or expanding partnerships with education or training providers

Minimum Level of Qualification:

1. Bachelor's Degree / Graduate Diploma / Graduate Certificate

Top Field of Study:

1. Science, Mathematics, and Computing - Computer use
2. Engineering, Manufacturing, and Construction - Electronics and automation

Top Basic Skills:

1. Digital engagement
2. Problem solving
3. Planning and organising

Top Specific Skills:

1. Develop organisational policies or programs
2. Identify information technology project resource requirements
3. Troubleshoot issues with computer applications or systems

Top Technology Tools:

1. Software development and programming languages
2. Application server software
3. Data conversion software

Top Future Anticipated Skills:

1. Internet of Things Management

Top Trainings Needed:

1. Training on Technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI)
2. Training on cybersecurity

Bottom-up Evidence:

These occupations are included in the MyCOL and were nominated to reflect the need for application engineer (.Net) and software engineer (.Net).

- i. These job titles were nominated approximately 4 times through the CfE survey.
- ii. Companies have reported that vacancies within the occupation group are for fresh graduates with 0-2 years of experience and senior-level personnel with at least 6-10 years of experience. Key recruitment challenges cited by employers include a lack of applicants, a lack of relevant job experience, and a lack of required digital skills post-pandemic. To overcome these challenges, employers are increasing employee training, raising wages, and establishing or expanding partnerships with education or training providers.
- iii. Employers are looking for a bachelor's degree, graduate diploma, or graduate certificate as the minimum qualification for application engineers (.Net) and software engineers (.Net). For entry-level roles, an advanced diploma or SKM Level 3 with strong interpersonal skills is sufficient. Priority is given to employees with backgrounds in science, mathematics, and computing with a focus on computer use, and in engineering, manufacturing, and construction with a focus on electronics and automation. A few survey and interview participants from the sector emphasised the importance of design, implementation, and testing skills, and ensuring that quality specifications are met.

- iv. The CfE survey respondents collectively identified digital engagement, problem-solving, and planning and organising as the top three basic skills. The top three specific skills nominated were developing organisational policies or programs, identifying IT project resource requirements, and troubleshooting issues with computer applications or systems. The top three technology tools were software development and programming languages, application server software, and data conversion software.
- v. The survey also shows that the top anticipated skill for this job family over the next 1-2 years is internet of things management. The top three types of training required for continuous upskilling are in technology (AI, connected hardhats, smart infrastructure, VR, AR, AI), and cybersecurity.
- vi. Further investigation suggests that certain gaps in the current talent pool and market demand must be addressed to facilitate digital adoption within the industry. Some of the gaps highlighted by industry stakeholders include a lack of relevant digital skills among employees and an outdated education system and syllabus. To overcome these challenges, many companies in the interviews stated that they are likely to automate in the future, as this occupation can automate 25-50% of their current tasks.

Occupation: Aircraft Technicians

MASCO 2020(4-Digit Code): 3151

MASCO 2020(6-Digit Code): 3151-02; 3151-20

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Aircraft Technician; Workshop Planner, Aircraft

This occupation appears on MyCOL:

2018	No	2019	No	2020/2021	No	2022	Yes
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Source of evidence:

Top-down indicators	Passed 1 out of 3 indicators
Bottom-up CfE survey	12 nominations
Consultation	0 nomination
Talent/Skills studies	<ul style="list-style-type: none"> CAAM Part-66 Aircraft Maintenance License

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
N/A	N/A	N/A	N/A	No	N/A
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
N/A	N/A	Yes	N/A	N/A	No

Occupation Overview:

Top Reasons of Hard-to-Fill: <ol style="list-style-type: none"> 1. Too few applicants or no applicant at all 2. Applicants lack relevant job experience 3. Applicants' expected compensation is beyond the market rate 	Top Strategies to Meet Shortages: <ol style="list-style-type: none"> 1. Raising wages 2. Expanding local recruitment efforts 3. Increasing employees' training
Minimum Level of Qualification: <ol style="list-style-type: none"> 1. Advanced Diploma/ SKM Level 5 2. Bachelor's Degree / Graduate Diploma / Graduate Certificate 3. Diploma / SKM Level 4 	Top Field of Study: <ol style="list-style-type: none"> 1. Engineering, Manufacturing, and Construction - Electronics and automation 2. General Programmes - Basic/broad, general programmes 3. Engineering, Manufacturing, and Construction - Mechanics and metal work
Top Basic Skills: <ol style="list-style-type: none"> 1. Problem solving 2. Numeracy 3. Digital engagement 	Top Specific Skills: <ol style="list-style-type: none"> 1. Select production equipment according to product specifications 2. Perform manual service or maintenance tasks 3. Develop detailed project plans
Top Technology Tools: <ol style="list-style-type: none"> 1. Computer system software 2. Configuration management software 3. Computer aided design CAD software 	Top Future Anticipated Skills: <ol style="list-style-type: none"> 1. Internet of Things Management 2. Embedded System Integration 3. Computer-aided Manufacturing
Top Trainings Needed: <ol style="list-style-type: none"> 1. Training on Technology 2. Training on Occupational Safety and Health (OSH) 	

Bottom-up Evidence:

These occupations are included in the MyCOL and were nominated to reflect the need for aircraft technician, and workshop planner, aircraft.

- These job titles were nominated approximately 12 times through the CfE survey.
- The companies have also reported that vacancies within the occupation group are for fresh graduates (0-2 years) and mid-level personnel with at least 2 to 5 years of experience. The key recruitment challenges cited by employers were a lack of applicants, a lack of relevant job experience, and higher expected compensation rates than the market. To overcome these challenges, employers are looking to raise wages, expand local recruitment efforts, and increase employee training.
- Employers also expressed that they are looking for a bachelor's degree as the minimum level of qualification for mid-level aircraft technicians' roles. For entry-level positions, a minimum of an advanced diploma or SKM Level 4 with good interpersonal skills would be sufficient. Employees with backgrounds in engineering, specifically electronics, automation, mechanical and metal work, and basic general programs are given priority. A few survey and interview participants from the sector emphasised the importance of aircraft maintenance and repair skills with a CAAM Part-66 Aircraft Maintenance License.
- Collective inputs from the CfE survey respondents indicated that problem-solving, numeracy, and digital engagement are the top three basic skills. For the top three specific skills, participants nominated selecting production equipment according to product specifications, performing manual service or maintenance tasks, and developing detailed project plans. The top three

technology tools nominated were computer system software, configuration management software, and computer-aided design (CAD) software.

- v. The survey also shows that the top three anticipated skills for this job family over the next 1-2 years are internet of things management, embedded system integration, and computer-aided manufacturing. For continuous up/reskilling, the top three training needs identified were training in technology and occupational safety and health (OSH).
- vi. Further investigation also suggests that there are gaps in the current talent pool and market demand that need to be bridged to facilitate digital adoption within the industry. Some of the gaps highlighted by industry stakeholders were a lack of relevant digital skills among employees and an education system and syllabus that is not updated in line with industry requirements/developments.

Occupation: Spray Painters and Varnishers

MASCO 2020(4-Digit Code): 7132

MASCO 2020(6-Digit Code): 7132-01; 7132-02

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Spray-Painter; Spray-Painter, Metal

This occupation appears on MyCOL:

2018	No	2019	No	2020/2021	No	2022	Yes
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Source of evidence:

Top-down indicators	Passed 3 out of 9 indicators
Bottom-up CfE survey	3 nominations
Consultation	1 nomination
Talent/Skills studies	-

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	No	No	N/A	N/A
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	Yes	No	N/A

Occupation Overview:

Top Reasons of Hard-to-Fill: <ol style="list-style-type: none"> 1. Too few applicants or no applicant at all 2. Applicants lack relevant job experience 3. Applicants lack other required skills 	Top Strategies to Meet Shortages: <ol style="list-style-type: none"> 1. Raising wages 2. Increasing worker hours or overtime 3. Hiring less well qualified applicants
Minimum Level of Qualification: <ol style="list-style-type: none"> 1. SKM Level 3 2. SPM Level 	Top Field of Study: <ol style="list-style-type: none"> 1. Engineering, Manufacturing, and Construction - Mechanics and metal work 2. General Programmes – Basic/broad, general programmes
Top Basic Skills: <ol style="list-style-type: none"> 1. Oral communication 2. Learning 3. Initiative and innovation 	Top Specific Skills: <ol style="list-style-type: none"> 1. Confer with clients to determine needs 2. Mix ingredients to create specific finishes 3. Evaluate reports or designs to determine work needs
Top Technology Tools: <ol style="list-style-type: none"> 1. Messaging and communications software 2. Facilities management software 3. Computer based training software 	Top Future Anticipated Skills: <ol style="list-style-type: none"> 1. Computer-aided Manufacturing 2. Internet of Things Management
Top Trainings Needed: <ol style="list-style-type: none"> 1. Training on Computer Aided Manufacturing (CAM) 2. Training on Occupational Safety and Health (OSH) 	

Bottom-up Evidence:

These occupations are included in the MyCOL and were nominated to reflect the need for spray-painter, and spray-painter, metal.

- These job titles were nominated approximately 3 times through the CfE survey and once during interviews with industry stakeholders.
- The companies have also reported that the vacancies within the occupation group are for fresh graduates (0-2 years). The key recruitment challenges cited by employers were a shortage of applicants, a lack of experience, and a lack of other required skills. To overcome these challenges, employers are looking to raise wages, increase worker hours or overtime, and hire less well-qualified applicants.
- Employers also indicated that they require a minimum qualification of SKM level 3 or SPM level, with good personal skills, for entry-level spray painters and varnishers roles. Preference is given to employees with a background in engineering, specifically mechanical and metal work, and basic general programs. Some of the survey and interview participants from the sector emphasised that an important industry skill they look for in employees is an aircraft painting skillset.
- The collective inputs from the CfE survey respondents identified oral communication, learning, and initiative and innovation as the top three basic skills. As for the top three specific skills, participants nominated conferencing with clients to determine their needs, mixing ingredients to create specific finishes, and evaluating reports or designs to determine work requirements. The top three technology tools nominated were messaging and communication software, facilities management software, and computer-based training software.

- v. The survey also showed that in the next 1-2 years, the top anticipated skills for this job family are computer-aided manufacturing and internet of things management. As for the types of training required for continuous upskilling, the top selections were training on computer-aided manufacturing (CAM) and training on occupational safety and health (OSH).
- vi. Further investigation suggests that there are gaps in the current talent pool and market demand that need to be addressed to facilitate digital adoption within the industry. Some of the gaps highlighted by the industry stakeholders include a lack of relevant digital skills among employees and the fact that the education system and syllabus are not updated to align with industry requirements and developments.

Occupation: Mechanical Engineering Technicians

MASCO 2020(4-Digit Code): 3115

MASCO 2020(6-Digit Code): 3115-01

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Aerospace (Mechanical) Engineering Technician

This occupation appears on MyCOL:

2018	Yes	2019	Yes	2020/2021	Yes	2022	Yes
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Source of evidence:

Top-down indicators	Passed 6 out of 12 indicators
Bottom-up CfE survey	1 nomination
Consultation	0 nomination
Talent/Skills studies	-

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	Yes	Yes	No	No
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	Yes	No	Yes

Occupation Overview:**Top Reasons of Hard-to-Fill:**

1. Applicants lack relevant job experience
2. Applicants lack the required credentials or certification / qualification

Top Strategies to Meet Shortages:

1. Increasing employees' training
2. Increasing worker hours or overtime

Minimum Level of Qualification:

1. Diploma / SKM Level 4

Top Field of Study:

1. Engineering, Manufacturing, and Construction - Mechanics and metal work

Top Basic Skills:

1. Numeracy
2. Digital engagement
3. Problem solving

Top Specific Skills:

1. Maintain vehicles in good working condition
2. Test products for functionality or quality
3. Maintain records, documents or other files

Top Technology Tools:

1. Computer aided design CAD software
2. Computer system software
3. Facilities management software

Top Future Anticipated Skills:

1. Computer-aided Manufacturing

Top Trainings Needed:

1. Training on Computer Aided Manufacturing (CAM)

Bottom-up Evidence:

These occupations are included in the MyCOL and were nominated to reflect the need for aerospace (mechanical) engineering technician.

- i. This job title was nominated once through the CfE survey.
- ii. The respondent have reported that vacancies in the occupation group are for both fresh graduates (0-2 years) and mid-level personnel with at least 5 years of experience. The key recruitment challenges cited by employers include a lack of relevant job experience among applicants and a lack of required credentials or certifications/qualifications. To overcome these challenges, the respondent is increasing employees' training and working hours or overtime.
- iii. The respondent stated that they require a minimum of a diploma or SKM Level 4 for aerospace (mechanical) engineering technicians, and a minimum of an advanced diploma or SKM Level 3 with good personal skills for entry-level roles. Priority is given to employees with backgrounds in engineering, manufacturing, and construction, particularly in mechanics and metal work. Several survey and interview participants from the sector emphasised the importance of critical thinking skills in employees.
- iv. The CfE survey respondent identified numeracy, digital engagement, and problem solving as the top 3 basic skills, while the top 3 specific skills were maintaining vehicles in good working condition, testing products for functionality or quality, and maintaining records, documents, or other files. The top 3 technology tools were Computer Aided Design (CAD) software, computer system software, and facilities management software.
- v. The survey also indicates that the top anticipated skill for this job family in the next 1-2 years is computer-aided manufacturing, and the top 3 types of training required for continuous upskilling are training on Computer Aided Manufacturing (CAM).
- vi. Further investigation suggests that there are gaps in the current talent pool and market demand that need to be addressed to facilitate digital adoption in the industry. These gaps include a lack of relevant digital skills among employees and an outdated education system and syllabus that doesn't align with industry requirements and developments. Despite the occupation being

automatable for less than 25% of its current tasks, the respondent intends to introduce some degree of automation to the role.

Occupation: Mechanical Engineers

MASCO 2020(4-Digit Code): 2144

MASCO 2020(6-Digit Code): 2144-03; 2144-24; 2144-27; 2144-33; 2144-36; 2144-53; 2144-59

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Machinery and Tools Industrial Engineer; Welding Technologist; Mechanical Engineer, Aerospace; Aero-Material Component Engineer; Welding Engineer; CNC Programmer (Computer Numerical Control); Aerospace Engineer

This occupation appears on MyCOL:

2018	Yes	2019	Yes	2020/2021	Yes	2022	Yes
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Source of evidence:

Top-down indicators	Passed 6 out of 12 indicators
Bottom-up CfE survey	13 nominations
Consultation	1 nomination
Talent/Skills studies	<ul style="list-style-type: none"> NAS410 BACR

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	Yes	Yes	Yes	No
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	Yes	No	Yes

Occupation Overview:	
Top Reasons of Hard-to-Fill: <ol style="list-style-type: none"> 1. Applicants lack relevant job experience 2. Applicants lack the required credentials or certification / qualification 3. Too few applicants or no applicant at all 	Top Strategies to Meet Shortages: <ol style="list-style-type: none"> 1. Raising wages 2. Increasing employees' training 3. Hiring less well qualified applicants
Minimum Level of Qualification: <ol style="list-style-type: none"> 1. Bachelor's Degree / Graduate Diploma / Graduate Certificate 	Top Field of Study: <ol style="list-style-type: none"> 1. Engineering, Manufacturing, and Construction - Mechanics and metal work 2. Engineering, Manufacturing, and Construction - Electronics and automation 3. Engineering, Manufacturing, and Construction - Chemical and process
Top Basic Skills: <ol style="list-style-type: none"> 1. Numeracy 2. Problem solving 3. Learning 	Top Specific Skills: <ol style="list-style-type: none"> 1. Analyse data to identify or resolve operational problems 2. Analyse data to assess operational or project effectiveness 3. Direct operational or production activities
Top Technology Tools: <ol style="list-style-type: none"> 1. Computer aided design CAD software 2. Computer system software 3. Business intelligence and data analysis software 	Top Future Anticipated Skills: <ol style="list-style-type: none"> 1. Internet of Things Management 2. Computer-aided Manufacturing 3. Data Analytics System Design
Top Trainings Needed: <ol style="list-style-type: none"> 1. Training on Technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI) 2. Training on Computer Aided Manufacturing (CAM) 3. Training on Occupational Safety and Health (OSH) 	
Bottom-up Evidence:	
<p>These occupations are included in the MyCOL and were nominated to reflect the need for machinery and tools industrial engineer, welding technologist, and mechanical engineer, aerospace.</p> <ol style="list-style-type: none"> i. These job titles were nominated approximately 13 times through the CfE survey and once during interviews with industry stakeholders. ii. The companies have also reported that vacancies within the occupation group are for fresh graduates (0 – 2 years) and mid-level personnel with at least 5 years of experience. The key recruitment challenges cited by employers were applicants lack relevant job experience, applicants lack the required credentials or certification / qualification, and too few applicants or no applicant at all. As such employers look to overcome these challenges by raising wages, increasing employees' training, and hiring less well qualified applicants. iii. Employers also expressed that they are looking for bachelor's degree / Graduate Diploma / Graduate Certificate degree as a minimum level of qualification for these mechanical engineer roles. Priority is also given to employees with background in engineering and manufacturing with 	

the focus in mechanics and metal work, electronics and automation, and chemical and process. A handful of survey and interview participants from the sector emphasised that some of the important skills and certifications they look for in applicants include aircraft design and assembly and NAS410 and BACR certifications.

- iv. Collective inputs from the CfE survey respondents revealed numeracy, problem solving, and learning as the top 3 basic skills. As for the top 3 specific skills, participants have nominated analyse data to identify or resolve operational problems, analyse data to assess operational or project effectiveness, and direct operational or production activities. The top 3 technology tools nominated were Computer Aided Design (CAD) software, computer system software, and business intelligence and data analysis software.
- v. Furthermore, the survey also shows that in the next 1 – 2 years, the top 3 anticipated skills for this job family are Internet of Things Management, computer-aided manufacturing, and data analytics system design. In terms of the types of trainings required for continuous up/reskilling, the top 3 nominated selections are training on technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI), Computer Aided Manufacturing (CAM), and training on Occupational Safety and Health (OSH).
- vi. Further investigation also suggests that certain gaps within the current talent pool and market demand needs to be bridged to facilitate digital adoption within the industry. Some of the gaps highlighted by the industry stakeholders were a lack of relevant digital skills among employees and that the education system and syllabus is not updated in line with industry requirements/developments. The lack of digital adoption was further supported through the interviews as most companies are most likely not to automate in the future despite this occupation being able to automate 25%-50% of their current tasks.

CONSTRUCTION

Occupation: Business Services Managers							
MASCO 2020(4-Digit Code): 1214							
MASCO 2020(6-Digit Code): 1214-14							
Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):				Project Manager			
This occupation appears on MyCOL:							
2018	Yes	2019	Yes	2020/2021	Yes	2022	Yes
Source of evidence:							
Top-down indicators		Passed 4 out of 12 indicators					
Bottom-up CfE survey		18 nominations					
Consultation		4 nominations					
Talent/Skills studies		<ul style="list-style-type: none"> Civil Engineers, bachelor's in construction management Project Management Professional (PMP) certification 					
Top-down Data:							
Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)		
No	Yes	No	No	No	No		
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage		
No	No	Yes	Yes	No	Yes		

Occupation Overview:	
Top Reasons of Hard-to-Fill: <ol style="list-style-type: none"> 1. Applicants lack relevant job experience 2. Too few applicants or no applicant at all 3. Applicants' expected compensation is beyond the market rate 	Top Strategies to Meet Shortages: <ol style="list-style-type: none"> 1. Expanding local recruitment efforts 2. Raising wages 3. Convincing workers to delay retirement
Minimum Level of Qualification: <ol style="list-style-type: none"> 1. Bachelor's Degree / Graduate Diploma / Graduate Certificate 2. Diploma / SKM Level 4 	Top Field of Study: <ol style="list-style-type: none"> 1. Engineering, Manufacturing, and Construction - Civil engineering 2. Engineering, Manufacturing, and Construction - Building 3. General Programmes - Basic/broad, general programmes
Top Basic Skills: <ol style="list-style-type: none"> 1. Problem solving 2. Oral communication 3. Planning and organising 	Top Specific Skills: <ol style="list-style-type: none"> 1. Estimate construction project costs 2. Assign duties or work schedules to employees 3. Estimate time or monetary resources needed to complete projects
Top Technology Tools: <ol style="list-style-type: none"> 1. Cost modelling software 2. Project management software 3. Quantitative schedule and risk analysis software 	Top Future Anticipated Skills: <ol style="list-style-type: none"> 1. 4D Construction 2. Cloud data for projects 3. Design for Manufacturing and Assembly
Top Trainings Needed: <ol style="list-style-type: none"> 1. Training on Building Information Modelling (BIM) 2. Training in Technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI) 3. Training on Computer Aided Design (CAD) 	
Bottom-up Evidence:	
<p>These occupations are included in the MyCOL and were nominated to reflect the need for project manager.</p> <ol style="list-style-type: none"> i. These job titles were nominated approximately 18 times through the CfE survey and 4 times during interviews with industry stakeholders. ii. The companies have reported that vacancies within the occupation group are for both fresh graduates (0-2 years) and mid-level personnel with at least five years of experience. It was also reported that most stakeholders are looking for individuals with a minimum of 10-15 years of industry experience and who have completed at least three projects. The main recruitment challenges cited by employers are a lack of relevant job experience among applicants, too few applicants, and compensation expectations that are beyond the market rate. To overcome these challenges, employers plan to expand local recruitment efforts, raise wages, and encourage workers to delay retirement. iii. Employers also indicated that they require a bachelor's degree, graduate diploma, or graduate certificate as a minimum level of qualification for project manager roles. Preference is given to 	

individuals with a background in engineering, manufacturing, and construction, particularly in civil engineering and building. A few survey participants emphasised that they look for employees with qualifications in civil engineering and bachelor's degrees in construction management, as well as PMP certification.

- iv. The survey respondents identified problem-solving, oral communication, and planning and organising as the top three basic skills. The top three specific skills were estimating construction project costs, assigning duties or work schedules to employees, and estimating time and monetary resources needed to complete projects. The top three technology tools mentioned were cost modeling software, project management software, and quantitative schedule and risk analysis software.
- v. The survey also indicated that the top three anticipated skills for this job family over the next 1-2 years are 4D Construction, cloud data for projects, and design for manufacturing and assembly. For continuous upskilling and reskilling, the top three nominated training areas are Building Information Modeling (BIM), technology (AI, connected hardhats, smart infrastructure, VR, AR, AI), and Computer-Aided Design (CAD).
- vi. Further investigation revealed that there are gaps in the current talent pool and market demand that need to be addressed to facilitate digital adoption within the industry. The industry stakeholders identified a lack of relevant digital skills among employees and an education system that is not updated in line with industry requirements and developments. To address this, most companies mentioned through interviews that they plan to automate in the future, as automation can potentially handle 25-50% of their current tasks.

Occupation: Construction Managers

MASCO 2020(4-Digit Code): 1323

MASCO 2020(6-Digit Code): 1323-01; 1323-03; 1323-04; 1323-05; 1323-06; 1323-13; 1323-19

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Construction Manager; Construction Contract Manager; Construction Operation Manager; Construction Project Manager; Construction Site Manager; Construction Engineering Manager; Quantity Surveyor Manager

This occupation appears on MyCOL:

2018	Yes	2019	Yes	2020/2021	No	2022	Yes
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Source of evidence:

Top-down indicators	Passed 5 out of 12 indicators
Bottom-up CfE survey	26 nominations
Consultation	1 nomination
Talent/Skills studies	<ul style="list-style-type: none"> Trained in scaffolding, safety, and CPR Certified Construction Manager (CCM)

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	Yes	Yes	No	No
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	No	No	Yes

Occupation Overview:	
Top Reasons of Hard-to-Fill: <ol style="list-style-type: none"> 1. Applicants lack relevant job experience 2. Too few applicants or no applicant at all 3. Applicants lack the required credentials or certification / qualification 	Top Strategies to Meet Shortages: <ol style="list-style-type: none"> 1. Raising wages 2. Hiring less well qualified applicants 3. Increasing employees' training
Minimum Level of Qualification: <ol style="list-style-type: none"> 1. Bachelor's Degree / Graduate Diploma / Graduate Certificate 2. Diploma / SKM Level 4 	Top Field of Study: <ol style="list-style-type: none"> 1. Engineering, Manufacturing, and Construction - Civil engineering 2. Engineering, Manufacturing, and Construction – Building 3. Engineering, Manufacturing, and Construction - Mechanics and metal work
Top Basic Skills: <ol style="list-style-type: none"> 1. Problem solving 2. Planning and organising 3. Oral communication 	Top Specific Skills: <ol style="list-style-type: none"> 1. Coordinate construction or installation activities 2. Estimate construction project costs 3. Manage construction activities
Top Technology Tools: <ol style="list-style-type: none"> 1. Computer aided design CAD software 2. Quantitative schedule and risk analysis software 3. Project management software 	Top Future Anticipated Skills: <ol style="list-style-type: none"> 1. 4D Construction 2. Cloud data for projects 3. Smart Facilities Management
Top Trainings Needed: <ol style="list-style-type: none"> 1. Training on Building Information Modelling (BIM) 2. Training in Technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI) 3. Training on Industrialised building system (IBS) 	
Bottom-up Evidence:	
<p>These occupations are included in the MyCOL and were nominated to reflect the need for construction manager, construction contract manager, construction operation manager.</p> <ol style="list-style-type: none"> i. These job titles were nominated approximately 26 times through the CfE survey and once during interview with industry stakeholders. ii. The companies have reported that vacancies within the occupation group are available for both fresh graduates (0-2 years) and mid-level personnel with at least 2-5 years of experience. The main recruitment challenges cited by employers include a lack of relevant job experience among applicants, a shortage of applicants or a complete absence of applicants, and a lack of the required credentials or certifications/qualifications. To address these challenges, employers are considering increasing wages, hiring less-qualified applicants, and providing additional training to employees. iii. Employers have stated that they require a minimum qualification of Diploma/SKM Level 4 for managerial-level roles. Preference is given to candidates with backgrounds in engineering, manufacturing, and construction, specifically in the areas of civil engineering, building, and 	

mechanics and metal work. Some survey and interview participants from the sector have emphasised the importance of industry-specific skills, such as training in scaffolding, safety, and CPR, and the Certified Construction Manager (CCM) designation.

- iv. The results of the CfE survey indicate that problem solving, planning and organising, and oral communication are the top three basic skills sought by employers. For specific skills, survey participants nominated the ability to coordinate construction or installation activities, estimate construction project costs, and manage construction activities. The top three technology tools identified were Computer Aided Design (CAD) software, quantitative schedule and risk analysis software, and project management software.
- v. The survey also indicates that the top three skills anticipated to be in demand in the next 1-2 years are 4D Construction, cloud data for projects, and smart facilities management. For continuous upskilling and reskilling, the top three types of training selected by survey participants were Building Information Modelling (BIM), technology (including AI, connected hardhats, smart infrastructure, VR, AR, and AI), and Industrialised Building System (IBS).
- vi. vi. The results of the investigation suggest that there are gaps between the current talent pool and market demand that need to be addressed to facilitate digital adoption within the industry. Industry stakeholders have highlighted a lack of relevant digital skills among employees and an education system and syllabus that are not up-to-date with industry requirements and developments. Through the interviews, it was confirmed that most companies are unlikely to automate in the future, as this occupation can only automate 25% of their current tasks.

Occupation: Industrial and Production Engineers

MASCO 2020(4-Digit Code): 2141

MASCO 2020(6-Digit Code): 2141-04; 2141-67

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Production Engineer; Project Engineer

This occupation appears on MyCOL:

2018	Yes	2019	Yes	2020/2021	Yes	2022	Yes
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Source of evidence:

Top-down indicators	Passed 6 out of 12 indicators
Bottom-up CfE survey	11 nominations
Consultation	0 nominations
Talent/Skills studies	<ul style="list-style-type: none"> Project engineer must register with the Board of Engineers Malaysia (BEM)

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	Yes	Yes	No	No
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	Yes	No	Yes

Occupation Overview:	
Top Reasons of Hard-to-Fill: <ol style="list-style-type: none"> 1. Applicants lack relevant job experience 2. Too few applicants or no applicant at all 3. Applicants' expected compensation is beyond the market rate 	Top Strategies to Meet Shortages: <ol style="list-style-type: none"> 1. Raising wages 2. Increasing employees' training 3. Expanding local recruitment efforts (e.g. wider distribution of job openings...)
Minimum Level of Qualification: <ol style="list-style-type: none"> 1. Bachelor's Degree / Graduate Diploma / Graduate Certificate 	Top Field of Study: <ol style="list-style-type: none"> 1. Engineering, Manufacturing, and Construction – Building 2. Engineering, Manufacturing, and Construction - Civil engineering 3. Engineering, Manufacturing, and Construction - Material engineering
Top Basic Skills: <ol style="list-style-type: none"> 1. Problem solving 2. Planning and organising 3. Oral communication 	Top Specific Skills: <ol style="list-style-type: none"> 1. Prepare detailed work plans 2. Implement design or process improvements 3. Confer with other staff to resolve design or operational problems
Top Technology Tools: <ol style="list-style-type: none"> 1. Computer aided design CAD software 2. Project management software 3. Quantitative schedule and risk analysis software 	Top Future Anticipated Skills: <ol style="list-style-type: none"> 1. 4D Construction 2. Cloud data for projects
Top Trainings Needed: <ol style="list-style-type: none"> 1. Training on Building Information Modelling (BIM) 2. Training on Industrialised building system (IBS) 3. Training on Computer Aided Design (CAD) 	
Bottom-up Evidence:	
<p>These occupations are included in the MyCOL and were nominated to reflect the need for production engineer and project engineer.</p> <ol style="list-style-type: none"> i. These job titles were nominated approximately 11 times through the CfE survey. ii. The companies have reported that the vacancies in the occupation group are for fresh graduates with 0-2 years of experience and mid-level personnel with 2-5 years of experience. Employers cited the key recruitment challenges as a lack of relevant job experience among applicants, too few applicants, or no applicants at all, and expected compensation beyond the market rate. To overcome these challenges, employers plan to raise wages, increase employee training, and expand local recruitment efforts. iii. Employers require a minimum qualification of a bachelor's degree, graduate diploma, or graduate certificate for production engineers and project engineers. They give priority to candidates with backgrounds in engineering, manufacturing, and construction, specifically in building, civil engineering, and material engineering. Some of the important industry skills that 	

employers look for in employees include being registered with the Board of Engineers Malaysia (BEM).

- iv. The top three basic skills identified by the CfE survey respondents are problem-solving, planning, and organising, and oral communication. The top three specific skills are preparing detailed work plans, implementing design or process improvements, and conferring with other staff to resolve design or operational problems. The top three technology tools are computer-aided design (CAD) software, project management software, and quantitative schedule and risk analysis software.
- v. The survey shows that the top two anticipated skills for this job family in the next 1-2 years are 4D Construction and cloud data for projects. The top three training needs for continuous upskilling are Building Information Modelling (BIM), Industrialized Building System (IBS), and Computer Aided Design (CAD).
- vi. Further investigation suggests that there are gaps in the current talent pool and market demand that need to be addressed to facilitate digital adoption within the industry. The gaps highlighted by industry stakeholders include a lack of relevant digital skills among employees and an education system and syllabus that is not updated to meet industry requirements and developments. The lack of digital adoption was further supported by interviews, as most companies are unlikely to automate in the future and believe that the tasks of this occupation cannot be automated.

Occupation: Civil Engineers

MASCO 2020(4-Digit Code): 2142

MASCO 2020(6-Digit Code): 2142-04; 2142-07; 2142-08; 2142-10; 2142-16; 2142-34; 2142-40; 2142-45; 2142-48

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Engineer; Civil Engineer; Site Construction Engineer; Civil Engineer, Construction; Civil Engineer, Structural; Structural Engineer; Construction Engineer; Quantity Surveyor Grade J41; Quantity Surveyor

This occupation appears on MyCOL:

2018	Yes	2019	Yes	2020/2021	Yes	2022	Yes
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Source of evidence:

Top-down indicators	Passed 6 out of 12 indicators
Bottom-up CfE survey	93 nominations
Consultation	3 nominations
Talent/Skills studies	<ul style="list-style-type: none"> Graduate Engineer with the Board of Engineers Malaysia (BEM)

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	Yes	Yes	No	No
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	Yes	No	Yes

Occupation Overview:	
Top Reasons of Hard-to-Fill: <ol style="list-style-type: none"> 1. Applicants lack relevant job experience 2. Too few applicants or no applicant at all 3. Applicants lack the required credentials or certification / qualification 	Top Strategies to Meet Shortages: <ol style="list-style-type: none"> 1. Increasing employees' training 2. Expanding local recruitment efforts 3. Raising wages
Minimum Level of Qualification: <ol style="list-style-type: none"> 1. Bachelor's Degree / Graduate Diploma / Graduate Certificate 2. STPM Level / Matriculation / Foundation / Pre-University Program 3. Diploma / SKM Level 4 	Top Field of Study: <ol style="list-style-type: none"> 1. Engineering, Manufacturing, and Construction - Civil engineering 2. Engineering, Manufacturing, and Construction - Building 3. Engineering, Manufacturing, and Construction - Mechanics and metal work
Top Basic Skills: <ol style="list-style-type: none"> 1. Numeracy 2. Problem solving 3. Planning and organising 	Top Specific Skills: <ol style="list-style-type: none"> 1. Estimate construction project costs 2. Communicate with management or other staff to resolve problems 3. Determine design criteria or specifications
Top Technology Tools: <ol style="list-style-type: none"> 1. Computer aided design CAD software 2. Project management software 3. Computer system software 	Top Future Anticipated Skills: <ol style="list-style-type: none"> 1. 4D Construction 2. Cloud data for projects 3. Computational Design
Top Trainings Needed: <ol style="list-style-type: none"> 1. Training on Building Information Modelling (BIM) 2. Training in Technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI) 3. Training on Computer Aided Design (CAD) 	
Bottom-up Evidence:	
<p>These occupations are included in the MyCOL and were nominated to reflect the need for site construction engineer, quantity surveyor, and civil engineer.</p> <ol style="list-style-type: none"> i. These job titles were nominated approximately 93 times through the CfE survey and 3 times during interviews with industry stakeholders. ii. The companies reported that vacancies within the occupation group are for fresh graduates with 0-2 years of experience and mid-level personnel with at least 5 years of experience. The key recruitment challenges cited by employers were a lack of relevant job experience among applicants, too few applicants, or no applicants at all, and applicants' expected compensation being beyond the market rate. To overcome these challenges, employers are increasing employee training, expanding local recruitment efforts, and raising wages. iii. Employers expressed a preference for employees with a bachelor's degree as a minimum level of qualification for civil engineering roles. For entry-level positions, a minimum of pre-university education or a diploma/SKM Level 4 with good personal skills is sufficient. Priority is also given to employees with backgrounds in engineering and construction, particularly in civil engineering, building, and mechanics and metal work. A few survey and interview participants from the sector emphasised the importance of industry certifications, such as being a graduate engineer registered with the Board of Engineers Malaysia (BEM). iv. According to the survey results, the top 3 basic skills identified by respondents were numeracy, problem solving, and planning and organising. The top 3 specific skills were estimating 	

construction project costs, communicating with management or other staff to resolve problems, and determining design criteria or specifications. The top 3 technology tools were Computer Aided Design (CAD) software, project management software, and computer system software.

- v. The survey also shows that in the next 1-2 years, the top 3 anticipated skills for this job family are 4D Construction, cloud data for projects, and computational design. The top 3 types of training nominated for continuous up/reskilling are training on Building Information Modelling (BIM), technology (including AI, connected hardhats, smart infrastructure, VR, AR, AI), and Computer Aided Design (CAD).
- vi. Further investigation reveals that there are gaps in the current talent pool and market demand that need to be addressed to facilitate digital adoption in the industry. Industry stakeholders highlighted a lack of relevant digital skills among employees and an outdated education system and syllabus that does not align with industry requirements and developments. Interviews with companies support the lack of digital adoption, as most companies are unlikely to automate in the future, even though this occupation could automate up to 25% of their current tasks.

Occupation: Mechanical Engineers**MASCO 2020(4-Digit Code):** 2144**MASCO 2020(6-Digit Code):** 2144-02; 2144-40

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Mechanical Engineer; Operation Engineer

This occupation appears on MyCOL:

2018	Yes	2019	Yes	2020/2021	Yes	2022	Yes
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Source of evidence:

Top-down indicators	Passed 6 out of 12 indicators
Bottom-up CfE survey	13 nominations
Consultation	0 nomination
Talent/Skills studies	<ul style="list-style-type: none"> Register as a Graduate Engineer with the Board of Engineers Malaysia (BEM)

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	Yes	Yes	No	No
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	Yes	No	Yes

Occupation Overview:	
Top Reasons of Hard-to-Fill: 1. Applicants lack relevant job experience 2. Too few applicants or no applicant at all	Top Strategies to Meet Shortages: 1. Increasing employees' training 2. Expanding local recruitment efforts (e.g. wider distribution of job openings...) 3. Establishing or expanding partnerships with education or training providers...
Minimum Level of Qualification: 1. Bachelor's Degree / Graduate Diploma / Graduate Certificate 2. STPM Level / Matriculation / Foundation / Pre-University Program	Top Field of Study: 1. Engineering, Manufacturing, and Construction - Mechanics and metal work 2. Engineering, Manufacturing, and Construction – Building
Top Basic Skills: 1. Problem solving 2. Numeracy 3. Initiative and innovation	Top Specific Skills: 1. Analyse test or performance data to assess equipment operation 2. Estimate cost or material requirements 3. Write reports or evaluations
Top Technology Tools: 1. Computer aided design CAD software 2. Industrial control and automation software 3. Electrical and electronic systems measurement instruments	Top Future Anticipated Skills: 1. Computational Design 2. Cloud data for projects 3. Design for Manufacturing and Assembly
Top Trainings Needed: 1. Training on Computer Aided Design (CAD) 2. Training on occupational safety and health (OSH) 3. Training in Technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI)	
Bottom-up Evidence:	
<p>These occupations are included in the MyCOL and were nominated to reflect the need for Mechanical Engineer and Operation Engineer.</p> <ol style="list-style-type: none"> i. These job titles were nominated approximately 13 times through the CfE survey. ii. The companies have also reported that vacancies within the occupation group are for fresh graduates (0 – 2 years) and mid-level personnel with at least 5 years of experience. Key recruitment challenges cited by employers were a lack of relevant job experience among applicants, too few or no applicants at all. As such employers look to overcome these challenges by increasing employees' training, expanding local recruitment efforts, and establishing or expanding partnerships with education or training providers. iii. Employers also expressed that they are looking for bachelor's Degree / Graduate Diploma / Graduate Certificate as a minimum level of qualification for Mechanical and Operation Engineer. As for entry roles, a minimum of STPM Level / Matriculation / Foundation / Pre-University Program with good personal skills would be sufficient. Priority is also given to employees with background in engineering, manufacturing, and construction with the focus in mechanics and metal work and building. A handful of survey and interview participants from the sector 	

emphasised that they prefer candidates that are registered as a graduate engineer with the Board of Engineers Malaysia (BEM).

- iv. Collective inputs from the CfE survey respondents revealed problem solving, numeracy, and initiative and innovation as the top 3 basic skills. As for the top 3 specific skills, participants have nominated analyse test or performance data to assess equipment operation, estimate cost or material requirements, and write reports or evaluations. The top 3 technology tools nominated were Computer Aided Design (CAD) software, industrial control and automation software, and electrical and electronic systems measurement instruments.
- v. Furthermore, the survey also showed that in the next 1 – 2 years, the top 3 anticipated skills for this job family are computational design, cloud data for projects, and design for Manufacturing and Assembly. In terms of the types of trainings required for continuous up/reskilling, the top 3 nominated selections are training on Computer Aided Design (CAD), occupational safety and health (OSH), and technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI).
- vi. Further investigation also suggested that certain gaps within the current talent pool and market demand needs to be bridged to facilitate digital adoption within the industry. Some of the gaps highlighted by the industry stakeholders were a lack of relevant digital skills among employees and that the education system and syllabus is not updated in line with industry requirements/developments. Lastly, most companies from the survey and interviews indicated that they were not likely automate job functions in the near future, with only 25% of the current job functions being automatable.

Occupation: Construction Supervisors

MASCO 2020(4-Digit Code): 3123

MASCO 2020(6-Digit Code): 3123-01; 3123-02; 3123-04; 3123-06

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Operation Supervisor; Project Supervisor; Site Supervisor; Site Safety Supervisor

This occupation appears on MyCOL:

2018	No	2019	Yes	2020/2021	Yes	2022	Yes
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Source of evidence:

Top-down indicators	Passed 5 out of 10 indicators
Bottom-up CfE survey	45 nominations
Consultation	0 nominations
Talent/Skills studies	<ul style="list-style-type: none"> • Certified Construction Site Supervisor (CSS) • Construction Skills Competency Certificate (CSCC)

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	No	Yes	N/A	N/A
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	Yes	No	Yes

Occupation Overview:

Top Reasons of Hard-to-Fill:

1. Applicants lack relevant job experience
2. Too few applicants or no applicant at all
3. Applicants lack the required credentials or certification/ qualification

Top Strategies to Meet Shortages:

1. Raising wages
2. Expanding local recruitment efforts
3. Increasing employees' training

Minimum Level of Qualification:

1. Diploma/ SKM Level 4
2. Bachelor's Degree/ Graduate Diploma/ Graduate Certificate
3. STPM Level/ Matriculation/ Foundation/ Pre-University Program

Top Field of Study:

1. Engineering, Manufacturing, and Construction – Civil engineering
2. Engineering, Manufacturing, and Construction – Building
3. Engineering, Manufacturing, and Construction – Electricity and energy

Top Basic Skills:

1. Oral communication
2. Problem solving
3. Planning and organising

Top Specific Skills:

1. Direct construction or mining staff
2. Monitor work areas or procedures to ensure compliance with safety procedures
3. Investigate system, equipment or product failures

Top Technology Tools:

1. Facilities management software
2. Regulatory compliance software
3. Computer system software

Top Future Anticipated Skills:

1. Smart Facilities Management
2. 4D Construction
3. Integrated Digital Delivery Application

Top Trainings Needed:

1. Training on occupational safety and health (OSH)
2. Training on Building Information Modelling (BIM)
3. Training on Industrialised building system (IBS)

Bottom-up Evidence:

These occupations are included in the MyCOL and were nominated to reflect the need for operation supervisor, project supervisor and site supervisor.

- i. These job titles were nominated approximately 45 time through the CfE survey.
- ii. The companies have reported that the vacancies in the occupation group are for fresh graduates (0-2 years) and mid-level personnel with 2 to 5 years of experience. The key recruitment challenges cited by employers include a lack of relevant job experience among applicants, a shortage of applicants, and a lack of required credentials or qualifications. Employers are trying to overcome these challenges by raising wages, expanding local recruitment efforts, and increasing employee training.
- iii. iEmployers have expressed that they require a bachelor's degree as the minimum level of qualification for mid-level construction supervisor roles. For entry-level roles, a minimum of a diploma or STPM level with good personal skills would be sufficient. Preference is given to employees with a background in construction, particularly in civil engineering, building, and electricity and energy. Some of the survey and interview participants from the sector have emphasised the importance of certifications such as Construction Site Supervisor (CSS) and Skills Competency Certificate (CSCC).
- iv. According to the CfE survey respondents, the top 3 basic skills are oral communication, problem-solving, and planning and organising. The top 3 specific skills are directing construction staff,

monitoring work areas or procedures to ensure compliance with safety procedures, and investigating system, equipment, or product failures. The top 3 technology tools nominated were facilities management software, regulatory compliance software, and computer system software.

- v. The survey also indicates that the top 3 anticipated skills for this job family in the next 1-2 years are smart facilities management, 4D construction, and integrated digital delivery applications. The top 3 types of training required for continuous up/reskilling are training on occupational safety and health (OSH), Building Information Modelling (BIM), and Industrialized Building System (IBS).
- vi. Another challenge highlighted by industry stakeholders is the negative perception towards the construction industry, which leads to a lack of talent joining the industry. This challenge can be addressed by the government, certification bodies, and industry players by raising awareness among the targeted talent pool.

Occupation: Environmental and Occupational Health and Hygiene Professionals

MASCO 2020(4-Digit Code): 2263

MASCO 2020(6-Digit Code): 2263-11

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Safety and Health Officer

This occupation appears on MyCOL:

2018	Yes	2019	Yes	2020/2021	Yes	2022	Yes
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Source of evidence:

Top-down indicators	Passed 5 out of 12 indicators
Bottom-up CfE survey	5 nominations
Consultation	1 nomination
Talent/Skills studies	<ul style="list-style-type: none"> Certification Construction Safety and Health Officer (CSHO)

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	No	Yes	No	No
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	Yes	No	Yes

Occupation Overview:

Top Reasons of Hard-to-Fill:

1. Applicants lack relevant job experience
2. Applicants lack other required skills

Top Strategies to Meet Shortages:

1. Expanding local recruitment efforts
2. Hiring less well qualified applicants
3. Establishing or expanding partnerships with education or training providers

Minimum Level of Qualification:

1. Bachelor's Degree/ Graduate Diploma/ Graduate Certificate
2. Advanced Diploma/ SKM Level 5
3. STPM Level/ Matriculation/ Foundation/ Pre-University Program

Top Field of Study:

1. General Programmes – Personal skills
2. Engineering, Manufacturing, and Construction – Civil engineering
3. Engineering, Manufacturing, and Construction – Building

Top Basic Skills:

1. Problem solving
2. Oral communication
3. Teamwork

Top Specific Skills:

1. Manage construction activities
2. Develop safety standards, policies or procedures
3. Inspect work sites to identify potential environmental or safety hazards

Top Technology Tools:

1. Computer system software
2. Document management software
3. Regulatory compliance software

Top Future Anticipated Skills:

1. Smart Facilities Management
2. Cloud data for projects

Top Trainings Needed:

1. Training on Occupational Safety and Health (OSH)

Bottom-up Evidence:

These occupations are included in the MyCOL and were nominated to reflect the need for safety and health officer.

- i. These job titles were nominated approximately 5 times through the CfE survey and once during interviews with industry stakeholders.
- ii. The companies have reported that there are vacancies within the occupation group for mid-level personnel with a minimum of 2 to 5 years of experience. The main recruitment challenges mentioned by employers were the lack of relevant job experience and problem-solving skills among applicants. To overcome these challenges, employers are looking to increase their local recruitment efforts, hire less qualified applicants, and form partnerships with educational institutions or training providers.
- iii. Employers also indicated that they require mid-level environmental and occupational health and hygiene professionals to have a bachelor's degree, while entry-level roles require an advanced diploma or STPM and good personal skills. Preference is given to employees with backgrounds in general personal skills and construction, specifically civil engineering and building. Some survey and interview participants from the sector emphasised the importance of Construction Safety and Health Officer (CSHO) certification as a key industry skill.
- iv. The survey results showed that problem-solving, oral communication, and teamwork were the top 3 basic skills required. The top 3 specific skills mentioned were managing construction activities, developing safety standards and procedures, and inspecting work sites to identify potential environmental or safety hazards. The top 3 technology tools cited were computer system software, document management software, and regulatory compliance software.

- v. The survey also found that in the next 1-2 years, the top anticipated skills for this job family are smart facilities management and cloud data for projects. The top training areas for continuous upskilling are occupational safety and health (OSH).
- vi. Further analysis suggests that there are gaps in experience, education systems, and syllabus that need to be addressed in order to align with industry requirements and developments. Bridging these gaps requires closer collaboration between the government, industry players, and educational institutions.

Occupation: Electrical Engineers

MASCO 2020(4-Digit Code): 2151

MASCO 2020(6-Digit Code): 2151-02

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Electrical Engineer

This occupation appears on MyCOL:

2018	Yes	2019	Yes	2020/2021	No	2022	Yes
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Source of evidence:

Top-down indicators	Passed 5 out of 12 indicators
Bottom-up CfE survey	24 nominations
Consultation	0 nomination
Talent/Skills studies	-

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	No	Yes	No	No
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	Yes	No	Yes

Occupation Overview:	
Top Reasons of Hard-to-Fill: <ol style="list-style-type: none"> 1. Applicants lack relevant job experience 2. Too few applicants or no applicant at all 3. Applicants lack the required credentials or certification/ qualification 	Top Strategies to Meet Shortages: <ol style="list-style-type: none"> 1. Increasing employees' training 2. Raising wages 3. Expanding local recruitment efforts
Minimum Level of Qualification: <ol style="list-style-type: none"> 1. Bachelor's Degree/ Graduate Diploma/ Graduate Certificate 2. STPM Level / Matriculation / Foundation / Pre-University Program 	Top Field of Study: <ol style="list-style-type: none"> 1. Engineering, Manufacturing, and Construction – Electricity and energy 2. Engineering, Manufacturing, and Construction – Electronics and automation
Top Basic Skills: <ol style="list-style-type: none"> 1. Numeracy 2. Problem solving 3. Oral communication 	Top Specific Skills: <ol style="list-style-type: none"> 1. Test performance of electrical, electronic, mechanical, or integrated systems or equipment 2. Test electrical circuits or components for proper functioning 3. Test electrical equipment or systems to ensure proper functioning
Top Technology Tools: <ol style="list-style-type: none"> 1. Electrical and electronic systems measurement instruments 2. Computer aided design CAD software 3. Industrial control and automation software 	Top Future Anticipated Skills: <ol style="list-style-type: none"> 1. Computational Design 2. Design for Manufacturing and Assembly 3. Smart Facilities Management
Top Trainings Needed: <ol style="list-style-type: none"> 1. Training on occupational safety and health (OSH) 2. Training in Technology 3. Training on Building Information Modelling (BIM) 	
Bottom-up Evidence:	
<p>These occupations are included in the MyCOL and were nominated to reflect the need for electrical engineer.</p> <ol style="list-style-type: none"> i. These job titles were nominated approximately 24 times through the CfE survey. ii. The companies have also reported that vacancies within the occupation group are for fresh graduates (0-2 years) and mid-level personnel with at least 5 years of experience. Employers cited the lack of relevant job experience and a shortage of applicants with required credentials or qualifications as the key recruitment challenges. To overcome these challenges, employers are increasing employee training, raising wages, and expanding local recruitment efforts. iii. Employers stated that a bachelor's degree is the minimum level of qualification required for mid-level engineering roles. For entry-level roles, having a pre-university program or STPM level with good interpersonal skills is sufficient. Priority is given to candidates with a background in engineering and construction, specifically electricity and energy, and electronics and automation. A few survey and interview participants from the sector emphasised the importance of an employee's ability to maintain the performance of electrical components, equipment, and systems. iv. The top three basic skills according to the CfE survey respondents were numeracy, problem-solving, and oral communication. The top three specific skills identified were testing the performance of electrical, electronic, mechanical, or integrated systems or equipment, testing 	

electrical circuits or components for proper functioning, and testing electrical equipment or systems to ensure proper functioning. The top three technology tools were electrical and electronic systems measurement instruments, computer-aided design (CAD) software, and industrial control and automation software.

- v. The survey also revealed that the top three anticipated skills for this job family in the next 1-2 years are computational design, design for manufacturing and assembly, and Smart Facilities Management. The top three types of training required for continuous upskilling were technology training, occupational safety and health (OSH) training, and Building Information Modeling (BIM) training.
- vi. Further investigation suggests that there are gaps in the current talent pool and market demand that need to be bridged to facilitate digital adoption within the industry. Some of the gaps identified by industry stakeholders include a lack of relevant digital skills among employees and an outdated education system and syllabus. To reduce these gaps, closer collaboration between the government, industry players, and education institutions is necessary.

Occupation: Information Technology System Administrators

MASCO 2020(4-Digit Code): 2522

MASCO 2020(6-Digit Code): 2522-37

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

BIM Coordinator (Building Information Modeling)

This occupation appears on MyCOL:

2018	Yes	2019	Yes	2020/2021	Yes	2022	Yes
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Source of evidence:

Top-down indicators	Passed 6 out of 12 indicators
Bottom-up CfE survey	3 nominations
Consultation	0 nomination
Talent/Skills studies	<ul style="list-style-type: none"> Building Information Modeling (BIM) Certification

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	Yes	Yes	No	No
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	Yes	No	Yes

Occupation Overview:

Top Reasons of Hard-to-Fill:

1. Applicants lack the required technical skills. Please specify the technical skills: BIM knowledge
2. Too few applicants or no applicant at all
3. Have less exposure on 3D Printing and Data analytics

Top Strategies to Meet Shortages:

1. Establishing or expanding partnerships with education or training providers...
2. Increasing employees' training
3. Raising wages

Minimum Level of Qualification:

1. Bachelor's Degree / Graduate Diploma / Graduate Certificate
2. Advanced Diploma / SKM Level 5

Top Field of Study:

1. Engineering, Manufacturing, and Construction - Civil engineering

Top Basic Skills:

1. Problem solving
2. Oral communication
3. Initiative and innovation

Top Specific Skills:

1. Confer with co-workers to resolve equipment problems
2. Manage information technology projects or system activities
3. Liaise between departments or other groups to improve function or communication

Top Technology Tools:

1. Computer aided design CAD software
2. Computer system software
3. Application server software

Top Future Anticipated Skills:

1. Computational Design
2. 4D Construction

Top Trainings Needed:

1. Training on Computer Aided Design (CAD)
2. Training in Technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI)

Bottom-up Evidence:

These occupations are included in the MyCOL and were nominated to reflect the need for BIM coordinator (Building Information Modeling).

- i. These job titles were nominated approximately 3 times through the CfE survey.
- ii. The companies reported that vacancies within the occupation group are for fresh graduates (0 – 1 years), mid-level personnel with at least 2-5 years of experience and high-level personnel with at least 6-10 years. The key recruitment challenges cited by employers were applicants lack the required technical skills such as BIM knowledge, too few applicants or no applicant at all, and have less exposure on 3D Printing and Data analytics. As such employers look to overcome these challenges by establishing or expanding partnerships with education or training providers, increasing employees' training, and raising wages.
- iii. Employers also expressed that they are looking for bachelor's degree / Graduate Diploma / Graduate Certificate as a minimum level of qualification for BIM coordinator (Building Information Modeling). As for entry roles, a minimum of Advanced Diploma / SKM Level 5 with good personal skills would be sufficient. Priority is also given to employees with background in engineering, manufacturing, and construction with the focus in civil engineering. A handful of survey and

interview participants from the sector emphasised that they prefer candidates with Building Information Modeling (BIM) Certification.

- iv. Collective inputs from the CfE survey respondents revealed problem solving, oral communication, and initiative and innovation as the top 3 basic skills. As for the top 3 specific skills, participants have nominated confer with co-workers to resolve equipment problems, manage information technology projects or system activities, and liaise between departments or other groups to improve function or communication. The top 3 technology tools nominated were Computer Aided Design CAD software, computer system software, application server software.
- v. Furthermore, the survey also shows that in the next 1 – 2 years, the top 2 anticipated skills for this job family are computational design and 4D Construction. In terms of the types of trainings required for continuous up/reskilling, the top 2 nominated selections are training on Computer Aided Design (CAD) and on technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI).
- vi. Further investigation also suggests that certain gaps within the current talent pool and market demand needs to be bridged to facilitate digital adoption within the industry. Some of the gaps highlighted by the industry stakeholders were a lack of relevant digital skills among employees and that the education system and syllabus is not updated in line with industry requirements/developments. To overcome the lack of digital adoption, many companies in the interviews have mentioned that they are likely to automate in the future as this occupation is able to automate less than 25% of their current tasks.

Occupation: Civil Engineering Technicians

MASCO 2020(4-Digit Code): 3112

MASCO 2020(6-Digit Code): 3112-02; 3112-08; 3112-09; 3112-15; 3112-16; 3112-31

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Civil Engineering Technician; Engineering Designer; Civil Engineering Supervisor; Construction Technician; Building Contractor; Quantity Surveying Technician

This occupation appears on MyCOL:

2018	Yes	2019	Yes	2020/2021	No	2022	Yes
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Source of evidence:

Top-down indicators	Passed 4 out of 11 indicators
Bottom-up CfE survey	10 nominations
Consultation	0 nomination
Talent/Skills studies	<ul style="list-style-type: none"> Construction Industry Development Board (CIDB) certification

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	Yes	Yes	No	N/A
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	No	No	No

Occupation Overview:	
Top Reasons of Hard-to-Fill: <ol style="list-style-type: none"> 1. Too few applicants or no applicant at all 2. Applicants lack relevant job experience 3. We cannot afford to pay the market rate for the applicants due to poor business/sales 	Top Strategies to Meet Shortages: <ol style="list-style-type: none"> 1. Increasing employees' training 2. Hiring less well qualified applicants
Minimum Level of Qualification: <ol style="list-style-type: none"> 1. Bachelor's Degree / Graduate Diploma / Graduate Certificate 2. Diploma / SKM Level 4 	Top Field of Study: <ol style="list-style-type: none"> 1. Engineering, Manufacturing, and Construction – Building 2. Engineering, Manufacturing, and Construction - Civil engineering 3. Engineering, Manufacturing, and Construction - Mechanics and metal work
Top Basic Skills: <ol style="list-style-type: none"> 1. Teamwork 2. Oral communication 3. Problem solving 	Top Specific Skills: <ol style="list-style-type: none"> 1. Install plumbing or piping 2. Install heating, ventilation, or air conditioning (HVAC) equipment 3. Run wiring to connect equipment
Top Technology Tools: <ol style="list-style-type: none"> 1. Computer system software 2. Computer aided design CAD software 3. Facilities management software 	Top Future Anticipated Skills: <ol style="list-style-type: none"> 1. 4D Construction 2. Smart Facilities Management 3. Computational Design
Top Trainings Needed: <ol style="list-style-type: none"> 1. Training on Building Information Modelling (BIM) 2. Training on Computer Aided Design (CAD) 3. Training in Technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI) 	
Bottom-up Evidence:	
<p>These occupations are included in the MyCOL and were nominated to reflect the need for civil engineering technician, engineering designer, and civil engineering supervisor.</p> <ol style="list-style-type: none"> i. These job titles were nominated approximately 10 times through the CfE survey. ii. The companies reported that vacancies within the occupation group are for fresh graduates (0 – 2 years) and mid-level personnel with at least 5 years of experience. The key recruitment challenges cited by employers were that there are too few applicants or no applicant at all, applicants lack relevant job experience, and unable to afford to pay the market rate for the applicants due to poor business/sales. As such employers look to overcome these challenges by increasing employees' training and hiring less well qualified applicants. iii. Employers also expressed that they are looking for bachelor's degree / graduate diploma / graduate certificate as a minimum level of qualification for civil engineering technician, engineering designer, and civil engineering supervisor. As for entry roles, a minimum of diploma / SKM Level 4 with good personal skills would be sufficient. Priority is also given to employees with background in engineering, manufacturing, and construction with the focus in building, civil engineering, and mechanics and metal work. A handful of survey and interview participants from 	

the sector emphasised that they prefer applicants with Construction Industry Development Board (CIDB) certification.

- iv. Collective inputs from the CfE survey respondents revealed teamwork, oral communication, and problem solving as the top 3 basic skills. As for the top 3 specific skills, participants have nominated install plumbing or piping, install heating, ventilation, or air conditioning (HVAC) equipment, and run wiring to connect equipment. The top 3 technology tools nominated were computer system software, Computer Aided Design CAD software, and facilities management software.
- v. Furthermore, the survey also shows that in the next 1 – 2 years, the top 3 anticipated skills for this job family are 4D construction, smart facilities management, and computational design. In terms of the types of trainings required for continuous up/reskilling, the top 3 nominated selections are training on Building Information Modeling (BIM), Computer Aided Design (CAD), and technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI).
- vi. Further investigation also suggests that certain gaps within the current talent pool and market demand needs to be bridged to facilitate digital adoption within the industry. Some of the gaps highlighted by the industry stakeholders were a lack of relevant digital skills among employees and that the education system and syllabus is not updated in line with industry requirements/developments. The lack of digital adoption was further supported through the interviews as most companies are not likely to automate in the future as this occupation is able to automate less than 25% of their current tasks.

Occupation: Electrical Engineering Technicians

MASCO 2020(4-Digit Code): 3113

MASCO 2020(6-Digit Code): 3113-01; 3113-13

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Electrical Engineering Technician; Electrical Technician

This occupation appears on MyCOL:

2018	Yes	2019	Yes	2020/2021	No	2022	Yes
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Source of evidence:

Top-down indicators	Passed 6 out of 12 indicators
Bottom-up CfE survey	4 nominations
Consultation	0 nomination
Talent/Skills studies	<ul style="list-style-type: none"> CIDB Skills Competency Certificate

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	Yes	Yes	No	No
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	Yes	No	Yes

Occupation Overview:**Top Reasons of Hard-to-Fill:**

1. Applicants lack the required technical skills: troubleshooting
2. Too few applicants or no applicant at all
3. Applicants lack relevant job experience

Top Strategies to Meet Shortages:

1. Increasing employees' training
2. Expanding local recruitment efforts
3. Increasing worker hours or overtime

Minimum Level of Qualification:

1. Advanced Diploma / SKM Level 5
2. Bachelor's Degree / Graduate Diploma / Graduate Certificate
3. SKM Level 3

Top Field of Study:

1. Engineering, Manufacturing, and Construction - Electricity and energy

Top Basic Skills:

1. Problem solving
2. Learning
3. Initiative and innovation

Top Specific Skills:

1. Test electrical circuits or components for proper functioning
2. Repair electrical circuits or wiring
3. Review blueprints or specifications to determine work requirements

Top Technology Tools:

1. Computer system software
2. Electrical and electronic systems measurement instruments
3. Industrial control and automation software

Top Future Anticipated Skills:

1. Smart Facilities Management
2. Cloud data for projects

Top Trainings Needed:

1. Training on occupational safety and health (OSH)

Bottom-up Evidence:

These occupations are included in the MyCOL and were nominated to reflect the need for electrical engineering technician and electrical technician.

- i. These job titles were nominated approximately 4 times through the CfE survey.
- ii. The companies have also reported that vacancies within the occupation group are for fresh graduates (0 – 2 years) and mid-level personnel with at least 5 years of experience. The key recruitment challenges cited by employers were applicants lack the required technical skills such as troubleshooting, too few applicants or no applicant at all, and applicants lack relevant job experience. As such employers look to overcome these challenges by increasing employees' training, expanding local recruitment efforts, and increasing worker hours or overtime.
- iii. Employers also expressed that they are looking for advanced Diploma / SKM Level 5 as a minimum level of qualification for electrical engineering technician and electrical technician. As for entry roles, a minimum of SKM Level 3 with good personal skills would be sufficient. Priority is also given to employees with background in engineering, manufacturing, and construction with the focus in electricity and energy. A handful of survey and interview participants from the sector emphasised that they prefer applicants with CIDB Skills Competency Certificate.
- iv. Collective inputs from the CfE survey respondents revealed problem solving, learning, and initiative and innovation as the top 3 basic skills. As for the top 3 specific skills, participants have

nominated test electrical circuits or components for proper functioning, repair electrical circuits or wiring, and review blueprints or specifications to determine work requirements. The top 3 technology tools nominated were computer system software, electrical and electronic systems measurement instruments, and industrial control and automation software.

- v. Furthermore, the survey also shows that in the next 1 – 2 years, the top 2 anticipated skill for this job family are smart Facilities Management and cloud data for projects. In terms of the types of trainings required for continuous up/reskilling, the top nominated selection is training on Occupational Safety and Health (OSH).
- vi. Further investigation also suggests that certain gaps within the current talent pool and market demand needs to be bridged to facilitate digital adoption within the industry. Some of the gaps highlighted by the industry stakeholders were a lack of relevant digital skills among employees and that the education system and syllabus is not updated in line with industry requirements/developments. The lack of digital adoption was further supported through the interviews as most companies are likely not to automate in the future as this occupation is able to automate less than 25% of their current tasks.

Occupation: Building and Related Electricians

MASCO 2020(4-Digit Code): 7411

MASCO 2020(6-Digit Code): 7411-03

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):	Electrician
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This occupation appears on MyCOL:

2018	No	2019	No	2020/2021	No	2022	Yes
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Source of evidence:

Top-down indicators	Passed 5 out of 9 indicators
Bottom-up CfE survey	4 nominations
Consultation	0 nomination
Talent/Skills studies	<ul style="list-style-type: none"> • Certification in Air-Conditioning and Mechanical Ventilation • Certificate in Electrical Technology

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	Yes	Yes	N/A	N/A
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	No	Yes	N/A

Occupation Overview:	
Top Reasons of Hard-to-Fill: 1. Too few applicants or no applicant at all 2. Applicants lack the required technical skills	Top Strategies to Meet Shortages: 1. Increasing employees' training 2. Hiring temporary or contract workers 3. Increasing worker hours or overtime
Minimum Level of Qualification: 1. SKM Level 3	Top Field of Study: 1. Engineering, Manufacturing, and Construction - Electricity and energy
Top Basic Skills: 1. Problem solving 2. Oral communication 3. Initiative and innovation	Top Specific Skills: 1. Repair electrical circuits or wiring 2. Repair electrical components 3. Run wiring to connect equipment
Top Technology Tools: 1. Computer based training software 2. Electrical and electronic systems measurement instruments 3. Messaging and communications software	Top Future Anticipated Skills: 1. Smart Facilities Management
Top Trainings Needed: 1. Training on occupational safety and health (OSH)	
Bottom-up Evidence:	
<p>These occupations are included in the MyCOL and were nominated to reflect the need for electrician.</p> <ol style="list-style-type: none"> i. These job titles were nominated approximately 4 times through the CfE survey. ii. The companies reported that vacancies within the occupation group are for fresh graduates (0 – 2 years). The key recruitment challenges cited by employers were too little applicants and lack of required technical skills. As such employers look to overcome these challenges by increasing employees' training, hiring temporary or contract workers, and increase working hours or overtime. iii. Employers also expressed that they are looking for SKM Level 3 with good personal skills as a minimum level of qualification for entry level electrician roles. Priority is also given to employees with background in engineering and construction, specifically in electricity and energy. A handful of survey and interview participants from the sector emphasised that an important skill they look for in applicants is the ability to repair electrical component and equipment. iv. Collective inputs from the CfE survey respondents revealed problem-solving, oral communication, and initiative and innovation as the top 3 basic skills. As for the top 3 specific skills, participants have nominated repair electrical circuits or wiring, repair electrical components, and run wiring to connect equipment. The top 3 technology tools nominated were computer-based training software, electrical and electronic systems measurement instruments, and messaging and communications software. v. Furthermore, the survey also shows that in the next 1 – 2 years, the top anticipated skills for this job family is smart facilities management. In terms of the types of trainings required for continuous up/reskilling, the top nominated selections are training on occupational safety and health (OSH). vi. Further investigation also suggests that certain gaps within the current talent pool and market demand needs to be bridged to facilitate digital adoption within the industry. Some of the gaps 	

highlighted by the industry stakeholders were a lack of relevant digital skills among employees and that the education system and syllabus is not updated in line with industry requirements. This requires closer collaboration between government, industry player, and education institutions in order to reduce the gaps.

Occupation: Crane, Hoist and Related Plant Operators

MASCO 2020(4-Digit Code): 8343

MASCO 2020(6-Digit Code): 8343-01; 8343-07

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Operator, Crane; Operator, Mobile Crane

This occupation appears on MyCOL:

2018	No	2019	No	2020/2021	No	2022	Yes
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Source of evidence:

Top-down indicators	Passed 2 out of 8 indicators
Bottom-up CfE survey	3 nominations
Consultation	2 nominations
Talent/Skills studies	<ul style="list-style-type: none"> CIDB Skills Competency Certificate

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	No	No	N/A	N/A
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	No	N/A	N/A

Occupation Overview:

Top Reasons of Hard-to-Fill: 1. Applicants lack relevant job experience 2. Too few applicants or no applicant at all	Top Strategies to Meet Shortages: 1. Increasing employees' training 2. Increasing worker hours or overtime 3. Expanding local recruitment efforts
Minimum Level of Qualification: 1. Diploma / SKM Level 4 2. SKM Level 3 3. SPM Level	Top Field of Study: 1. Engineering, Manufacturing, and Construction - Building
Top Basic Skills: 1. Learning 2. Problem solving 3. Oral communication	Top Specific Skills: 1. Drive mobile plants on roads or work sites 2. Operate equipment or vehicles to clear construction sites or move materials 3. Report vehicle or equipment malfunctions
Top Technology Tools: 1. GPS receivers 2. Messaging and communications software 3. Computer based training software	Top Future Anticipated Skills: 1. 4D Construction 2. Integrated Digital Delivery Application
Top Trainings Needed: 1. Training on occupational safety and health (OSH)	

Bottom-up Evidence:

These occupations are included in the MyCOL and were nominated to reflect the need for operator, crane, and operator, mobile crane.

- i. These job titles were nominated approximately 3 times through the CfE survey and twice during interviews with industry stakeholders.
- ii. The companies reported that vacancies within the occupation group are for mid-level personnel with 2 to 5 years of experience. The key recruitment challenges cited by employers were lack of experience and too little applicants. As such employers look to overcome these challenges by increasing employees' training and overtime and expanding local recruitment efforts.
- iii. Employers also expressed that they are looking for diploma, SKM level 3 or SPM level as qualification for mid-level operators' roles. Priority is also given to employees with background in construction, specifically in building. A handful of survey and interview participants from the sector emphasised that prefer applicants with experience of operating crane machineries are certified with CIDB competency certification.
- iv. Collective inputs from the CfE survey respondents revealed learning, problem-solving, and oral communication as the top 3 basic skills. As for the top 3 specific skills, participants have nominated drive mobile plants on roads or work sites, operate equipment or vehicles to clear construction sites or move materials, and report vehicle or equipment malfunctions. The top 3 technology tools nominated were GPS receivers, messaging and communications software, and computer-based training software.
- v. Furthermore, the survey also shows that in the next 1 – 2 years, the top anticipated skills for this job family are 4D Construction and integrated digital delivery application. In terms of the types of trainings required for continuous up/reskilling, the top nominated selections are training on occupational safety and health (OSH).

- vi. Further challenges highlighted by industry stakeholders included a negative perception of the construction industry, leading talented individuals to choose other employment opportunities instead of working in this field. This challenge can be addressed by the government, certification bodies, and industry players working together to raise awareness and change the perceptions among potential talent.

Occupation: Earth-Moving and Related Plant Operators

MASCO 2020(4-Digit Code): 8342

MASCO 2020(6-Digit Code): 8342-06; 8342-12

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Operator, Road Making Machine; Operator, Drilling Plant

This occupation appears on MyCOL:

2018	No	2019	No	2020/2021	No	2022	Yes
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Source of evidence:

Top-down indicators	Passed 3 out of 9 indicators
Bottom-up CfE survey	6 nominations
Consultation	0 nomination
Talent/Skills studies	<ul style="list-style-type: none"> CIDB Skills Competency Certificate

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	No	No	N/A	N/A
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	No	Yes	N/A

Occupation Overview:	
Top Reasons of Hard-to-Fill: <ol style="list-style-type: none"> 1. Applicants lack relevant job experience 2. Applicants lack the required technical skills 3. Applicants lack other required skills 	Top Strategies to Meet Shortages: <ol style="list-style-type: none"> 1. Increasing employees' training 2. Increasing worker hours or overtime 3. Raising wages
Minimum Level of Qualification: <ol style="list-style-type: none"> 1. SPM Level 2. STPM Level / Matriculation / Foundation / Pre-University Program 3. SKM Level 3 	Top Field of Study: <ol style="list-style-type: none"> 1. Engineering, Manufacturing, and Construction - Building 2. Engineering, Manufacturing, and Construction - Mechanics and metal work 3. Engineering, Manufacturing, and Construction - Civil engineering
Top Basic Skills: <ol style="list-style-type: none"> 1. Learning 2. Problem solving 3. Reading 	Top Specific Skills: <ol style="list-style-type: none"> 1. Relay information between staff 2. Operate road-surfacing equipment 3. Move construction or mining materials
Top Technology Tools: <ol style="list-style-type: none"> 1. Computer system software 2. Computer based training software 3. GPS receivers 	Top Future Anticipated Skills: <ol style="list-style-type: none"> 1. 4D Construction 2. Smart Facilities Management 3. Design for Manufacturing and Assembly
Top Trainings Needed: <ol style="list-style-type: none"> 1. Training on Industrialised building system (IBS) 2. Training on occupational safety and health (OSH) 	
Bottom-up Evidence:	
<p>These occupations are included in the MyCOL and were nominated to reflect the need for operator, road making machine and operator, drilling plant.</p> <ol style="list-style-type: none"> i. These job titles were nominated approximately 6 times through the CfE survey. ii. The companies reported that vacancies within the occupation group are for fresh graduates (0 – 2 years) and mid-level personnel with 2 to 5 years of experience. The key recruitment challenges cited by employers were lack of experience, lack of technical skills and other required skills. As such employers look to overcome these challenges by increasing employees' training, worker hours or overtime, and raising wages. iii. Employers also expressed that they are looking for STPM level as a minimum level of qualification for mid-level engineering roles. As for entry roles, a minimum of SPM level or SKM Level 3 with good personal skills would be sufficient. Priority is also given to employees with background in construction, specifically building, mechanics and metal work, and civil engineering. A handful of survey and interview participants from the sector emphasised the need for CIDB-certified workers with abilities to operate machineries. iv. Collective inputs from the CfE survey respondents revealed learning, problem-solving, and reading as the top 3 basic skills. As for the top 3 specific skills, participants have nominated relay information between staff, operate road-surfacing equipment, and move construction or mining materials. The top 3 technology tools nominated were computer system software, computer-based training software, and GPS receivers. v. Furthermore, the survey also shows that in the next 1 – 2 years, the top 3 anticipated skills for this job family are 4D construction, smart facilities management, and design for manufacturing and assembly. In terms of the types of trainings required for continuous up/reskilling, the top 	

nominated selections are training on Industrialised building system (IBS) and training on occupational safety and health (OSH).

- vi. Further challenges highlighted by industry stakeholders included a negative perception of the construction industry, leading talented individuals to choose other employment opportunities instead of working in this field. This challenge can be addressed by the government, certification bodies, and industry players working together to raise awareness and change the perceptions among potential talent.

Occupation: Electrical Mechanics and Fitters

MASCO 2020(4-Digit Code): 7412

MASCO 2020(6-Digit Code): 7412-06; 7412-21

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Wireman; Chargeman

This occupation appears on MyCOL:

2018	Yes	2019	Yes	2020/2021	Yes	2022	Yes
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Source of evidence:

Top-down indicators	Passed 6 out of 10 indicators
Bottom-up CfE survey	3 nominations
Consultation	0 nomination
Talent/Skills studies	<ul style="list-style-type: none"> • Certification in Air-Conditioning and Mechanical Ventilation • Certificate in Electrical Technology

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	Yes	No	N/A	N/A
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	Yes	Yes	Yes

Occupation Overview:**Top Reasons of Hard-to-Fill:**

1. Too few applicants or no applicant at all
2. Applicants lack the required credentials or certification / qualification
3. Applicants' expected compensation is beyond the market rate

Top Strategies to Meet Shortages:

1. Increasing worker hours or overtime
2. Hiring less well qualified applicants
3. Increasing employees' training

Minimum Level of Qualification:

1. Diploma / SKM Level 4
2. STPM Level / Matriculation / Foundation / Pre-University Program
3. SKM Level 3

Top Field of Study:

1. Engineering, Manufacturing, and Construction - Electricity and energy

Top Basic Skills:

1. Problem solving
2. Writing
3. Oral communication

Top Specific Skills:

1. Repair electrical circuits or wiring
2. Test fire protection equipment and systems
3. Install electrical components, equipment or systems

Top Technology Tools:

1. Electrical and electronic systems measurement instruments
2. Computer system software
3. Regulatory compliance software

Top Future Anticipated Skills:

1. Smart Facilities Management
2. 4D Construction

Top Trainings Needed:

1. Training on occupational safety and health (OSH)

Bottom-up Evidence:

These occupations are included in the MyCOL and were nominated to reflect the need for wireman and charginman.

- i. These job titles were nominated approximately 3 times through the CfE survey.
- ii. The companies reported that vacancies within the occupation group are for fresh graduates (0 – 2 years) and mid-level personnel with 2 to 5 years of experience. The key recruitment challenges cited by employers were too little applicants, lack of required credentials or certification, and higher expected compensation rate than the market. As such employers look to overcome these challenges by increasing worker hours or overtime, hiring less well qualified applicants, and increase employees' training.
- iii. Employers also expressed that they are looking for diploma as a minimum level of qualification for mid-level electrical mechanics and fitters' roles. As for entry roles, a minimum of STPM level or SKM Level 3 with good personal skills would be sufficient. Priority is also given to employees with background in engineering and construction, specifically electricity and energy. A handful of survey and interview participants from the sector emphasised that an important skill they look for in applicants is the ability to repair electrical component and equipment.
- iv. Collective inputs from the CfE survey respondents revealed problem-solving, writing, and oral communication as the top 3 basic skills. As for the top 3 specific skills, participants have nominated repair electrical circuits or wiring, test fire protection equipment and systems, and install electrical components, equipment or systems. The top 3 technology tools nominated were electrical and electronic systems measurement instruments, computer system software and regulatory compliance software.

- v. Furthermore, the survey also shows that in the next 1 – 2 years, the top anticipated skills for this job family are smart facilities management and 4D construction. In terms of the types of trainings required for continuous up/reskilling, the top nominated selections are training on occupational safety and health (OSH).
- vi. Further investigation also suggests that certain gaps within the current talent pool and market demand needs to be bridged to facilitate digital adoption within the industry. Some of the gaps highlighted by the industry stakeholders were a lack of relevant digital skills among employees and that the education system and syllabus is not updated in line with industry requirements. This requires closer collaboration between government, industry player, and education institutions in order to reduce the gaps.

Occupation: Industrial and Production Technicians							
MASCO 2020(4-Digit Code): 3119							
MASCO 2020(6-Digit Code): 3119-03							
Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):				Maintenance Technician			
This occupation appears on MyCOL:							
2018	Yes	2019	Yes	2020/2021	Yes	2022	Yes
Source of evidence:							
Top-down indicators		Passed 5 out of 12 indicators					
Bottom-up CfE survey		1 nomination					
Consultation		0 nomination					
Talent/Skills studies		<ul style="list-style-type: none"> • Certification in Facility Management 					
Top-down Data:							
Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)		
No	Yes	No	No	No	No		
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage		
No	Yes	Yes	Yes	No	Yes		

Occupation Overview:	
Top Reasons of Hard-to-Fill: 1. Too few applicants or no applicant at all	Top Strategies to Meet Shortages: 1. Expanding local recruitment efforts 2. Increasing employees' training
Minimum Level of Qualification: 1. SPM Level	Top Field of Study: 1. Engineering, Manufacturing, and Construction - Electricity and energy
Top Basic Skills: 1. Problem solving 2. Oral communication 3. Planning and organising	Top Specific Skills: 1. Estimate maintenance service requirements or costs 2. Direct equipment maintenance or repair activities 3. Schedule equipment maintenance
Top Technology Tools: 1. Electrical and electronic systems measurement instruments 2. Facilities management software 3. Regulatory compliance software	Top Future Anticipated Skills: 1. Smart Facilities Management
Top Trainings Needed: 1. Training on occupational safety and health (OSH)	
Bottom-up Evidence:	
<p>These occupations are included in the MyCOL and were nominated to reflect the need for maintenance technician.</p> <ol style="list-style-type: none"> i. These job titles were nominated approximately 1 time through the CfE survey. ii. The companies have also reported that vacancies within the occupation group are for fresh graduates (0 – 2 years). The key recruitment challenges cited by employers were too little applicants. As such employers look to overcome these challenges by expanding local recruitment efforts and increase employees' training. iii. Employers also expressed that they are looking for SPM level with good personal skills as a minimum level of qualification for entry roles. Priority is also given to employees with background in construction, specifically electricity and energy. A handful of survey and interview participants from the sector emphasised that an important skill they look for in applicants is the ability to prevent and measure management for leaking and wall crack. iv. Collective inputs from the CfE survey respondents revealed problem solving, oral communication, planning and organising as the top 3 basic skills. As for the top 3 specific skills, participants have nominated estimate maintenance service requirements or costs, direct equipment maintenance or repair activities, and schedule equipment maintenance. The top 3 technology tools nominated were electrical and electronic systems measurement instruments, facilities management software, and regulatory compliance software. v. Furthermore, the survey also shows that in the next 1 – 2 years, the top anticipated skills for this job family are smart facilities management. In terms of the types of trainings required for continuous up/reskilling, the top nominated selection is training on occupational safety and health (OSH). vi. Further challenges highlighted by industry stakeholders included a negative perception of the construction industry, leading talented individuals to choose other employment opportunities 	

instead of working in this field. This challenge can be addressed by the government, certification bodies, and industry players working together to raise awareness and change the perceptions among potential talent.

Occupation: Welders and Flame Cutters

MASCO 2020(4-Digit Code): 7212

MASCO 2020(6-Digit Code): 7212-01

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Welder

This occupation appears on MyCOL:

2018	Yes	2019	No	2020/2021	Yes	2022	Yes
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Source of evidence:

Top-down indicators	Passed 4 out of 10 indicators
Bottom-up CfE survey	4 nominations
Consultation	1 nomination
Talent/Skills studies	<ul style="list-style-type: none"> CIDB Skills Competency Certificate

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	Yes	Yes	N/A	N/A
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	No	No	No

Occupation Overview:

Top Reasons of Hard-to-Fill:

1. Too few applicants or no applicant at all
2. Applicants lack the required credentials or certification / qualification
3. Applicants lack relevant job experience

Top Strategies to Meet Shortages:

1. Increasing employees' training
2. Increasing worker hours or overtime
3. Expanding local recruitment efforts

Minimum Level of Qualification:

1. SKM Level 3
2. Diploma/ SKM Level 4

Top Field of Study:

1. Engineering, Manufacturing, and Construction - Mechanics and metal work

Top Basic Skills:

1. Numeracy
2. Teamwork
3. Oral communication

Top Specific Skills:

1. Cut industrial materials in preparation for fabrication or processing
2. Review blueprints or specifications to determine work requirements
3. Heat material or work pieces to prepare for or complete production

Top Technology Tools:

1. Computer system software
2. Electrical and electronic systems measurement instruments
3. Computer based training software

Top Future Anticipated Skills:

1. Smart Facilities Management
2. 4D Construction

Top Trainings Needed:

1. Training on occupational safety and health (OSH)

Bottom-up Evidence:

These occupations are included in the MyCOL and were nominated to reflect the need for welder.

- i. These job titles were nominated approximately 4 times through the CfE survey and once during interview with industry stakeholders.
- ii. The companies have also reported that vacancies within the occupation group are for fresh graduates (0 – 2 years) and mid-level personnel with 2 to 5 years of experience. The key recruitment challenges cited by employers were too little applicants, lack of required credentials or certification, and lack of experience. As such employers look to overcome these challenges by increasing employees' training, increasing worker hours or overtime, and expanding local recruitment efforts.
- iii. Employers also expressed that they are looking for SKM level 4 as a minimum level of qualification for mid-level welder roles. As for entry roles, a minimum of SKM Level 3 with good personal skills would be sufficient. Priority is also given to employees with background in construction, specifically mechanics and metal work. A handful of survey and interview participants from the sector emphasised that they require workers with the ability to perform welding tasks such as shielded metal arc welding (SMAW), gas tungsten arc welding (GTAW).
- iv. Collective inputs from the CfE survey respondents revealed numeracy, teamwork, and oral communication as the top 3 basic skills. As for the top 3 specific skills, participants have nominated cut industrial materials in preparation for fabrication or processing, review blueprints or specifications to determine work requirements, and heat material or work pieces to prepare for or complete production. The top 3 technology tools nominated were computer system software, electrical and electronic systems measurement instruments, and computer-based training software

- v. Furthermore, the survey also shows that in the next 1 – 2 years, the top anticipated skills for this occupational group are smart facilities management, and 4D construction. In terms of the types of trainings required for continuous up/reskilling, the top nominated selections are training on occupational safety and health (OSH).
- vi. Further challenges highlighted by industry stakeholders included a negative perception of the construction industry, leading talented individuals to choose other employment opportunities instead of working in this field. This challenge can be addressed by the government, certification bodies, and industry players working together to raise awareness and change the perceptions among potential talent.

Occupation: House Builders

MASCO 2020(4-Digit Code): 7111

MASCO 2020(6-Digit Code): 7111-03; 7111-06; 7111-07

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Scaffolder; Barbender; Construction Worker

This occupation appears on MyCOL:

2018	No	2019	No	2020/2021	No	2022	Yes
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Source of evidence:

Top-down indicators	Passed 3 out of 8 indicators
Bottom-up CfE survey	10 nominations
Consultation	1 nomination
Talent/Skills studies	<ul style="list-style-type: none"> CIDB Skills Competency Certificate

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	No	Yes	N/A	N/A
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	No	N/A	N/A

Occupation Overview:

Top Reasons of Hard-to-Fill:

1. Too few applicants or no applicant at all
2. Applicants lack relevant job experience
3. Applicants lack the required credentials or certification/ qualification

Top Strategies to Meet Shortages:

1. Raising wages
2. Expanding international recruitment efforts
3. Increasing worker hours or overtime

Minimum Level of Qualification:

1. Diploma / SKM Level 4
2. SKM Level 3
3. SPM Level

Top Field of Study:

1. Engineering, Manufacturing, and Construction – Building
2. General Programmes - Basic/broad, general programmes
3. Engineering, Manufacturing, and Construction - Civil engineering

Top Basic Skills:

1. Teamwork
2. Oral communication
3. Reading

Top Specific Skills:

1. Estimate labour requirements
2. Coordinate construction or installation activities
3. Install doors or windows

Top Technology Tools:

1. Inventory management software
2. Graphics or photo imaging software
3. Computer system software

Top Future Anticipated Skills:

1. 4D Construction
2. Design for Manufacturing and Assembly
3. Smart Facilities Management

Top Trainings Needed:

1. Training on occupational safety and health (OSH)
2. Training in Technology
3. Training on Computer Aided Design (CAD)

Bottom-up Evidence:

These occupations are included in the MyCOL and were nominated to reflect the need for scaffolder, barbender, and construction worker.

- i. These job titles were nominated approximately 10 times through the CfE survey and once during interview with industry stakeholders.
- ii. The companies have also reported that vacancies within the occupation group are for fresh graduates (0 – 2 years) and mid-level personnel with 2 to 5 years of experience. The key recruitment challenges cited by employers were too little applicants, lack of experience, and lack the required credentials or certification. As such employers look to overcome these challenges by raising wages, expanding international recruitment efforts, and increase worker hours or overtime.
- iii. Employers also expressed that they are looking for diploma as a minimum level of qualification for mid-level house builders' roles. As for entry roles, a minimum of SKM Level 3 or SPM level with good personal skills would be sufficient. Priority is also given to employees with background in construction, specifically building and civil engineering, and basic general programmes. A handful of survey and interview participants from the sector emphasised that an example of an important skill they look for in applicants is competency in performing the activities with CIDB Skills Competency Certificate.
- iv. Collective inputs from the CfE survey respondents revealed teamwork, oral communication, and reading as the top 3 basic skills. As for the top 3 specific skills, participants have nominated estimate labour requirements, coordinate construction or installation activities and install doors

or windows. The top 3 technology tools nominated were inventory management software, graphics or photo imaging software and computer system software.

- v. Furthermore, the survey also shows that in the next 1 – 2 years, the top 3 anticipated skills for this job family are 4D construction, design for manufacturing and assembly, and smart facilities management. In terms of the types of trainings required for continuous up/reskilling, the top 3 nominated selections are training on occupational safety and health (OSH), training on technology, and training on Computer Aided Design (CAD).
- vi. Further challenges highlighted by industry stakeholders included a negative perception of the construction industry, leading talented individuals to choose other employment opportunities instead of working in this field. This challenge can be addressed by the government, certification bodies, and industry players working together to raise awareness and change the perceptions among potential talent.

Occupation: Information and Communications Technology Installers and Services

MASCO 2020(4-Digit Code): 7422

MASCO 2020(6-Digit Code): 7422-05

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Information Technology Support Worker

This occupation appears on MyCOL:

2018	No	2019	No	2020/2021	No	2022	Yes
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Source of evidence:

Top-down indicators	Passed 5 out of 10 indicators
Bottom-up CfE survey	1 nomination
Consultation	1 nomination
Talent/Skills studies	<ul style="list-style-type: none"> Construction Industry Development Board (CIDB) certification

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	Yes	Yes	No	No
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	Yes	N/A	N/A

Occupation Overview:**Top Reasons of Hard-to-Fill:****Top Strategies to Meet Shortages:**

1. Increasing worker hours or overtime

Minimum Level of Qualification:

1. Bachelor's Degree / Graduate Diploma / Graduate Certificate

Top Field of Study:

1. Engineering, Manufacturing, and Construction - Civil engineering

Top Basic Skills:

1. Digital engagement
2. Learning
3. Planning and organising

Top Specific Skills:

1. Develop models of information or communications systems
2. Develop information communication procedures
3. Develop guidelines for system implementation

Top Technology Tools:

1. Internet protocol software
2. Configuration management software
3. Database user interface and query software

Top Future Anticipated Skills:

1. Computational Design

Top Trainings Needed:

1. Training in Technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI)

Bottom-up Evidence:

These occupations are included in the MyCOL and were nominated to reflect the need for information technology support worker.

- i. These job titles were nominated approximately once through the CfE survey and once during interview with industry stakeholders.
- ii. The companies have also reported that vacancies within the occupation group are for mid-level personnel with at least 6 - 10 years of experience. It was stated that employers face recruitment challenges. As such employers look to overcome these challenges by increasing worker hours or overtime.
- iii. Employers also expressed that they are looking for bachelor's degree / graduate diploma / graduate certificate as a minimum level of qualification for information technology support worker. As for entry roles, a minimum of advanced diploma or SKM Level 3 with good personal skills would be sufficient. Priority is also given to employees with background in engineering, manufacturing, and construction with the focus in civil engineering. A handful of survey and interview participants from the sector emphasised that they prefer applicants with Construction Industry Development Board (CIBD) certification.
- iv. Collective inputs from the CfE survey respondents revealed digital engagement, learning, planning and organising as the top 3 basic skills. As for the top 3 specific skills, participants have nominated develop models of information or communications systems, develop information communication procedures, develop guidelines for system implementation. The top 3 technology tools nominated were internet protocol software, configuration management software, and database user interface and query software.
- v. Furthermore, the survey also shows that in the next 1 – 2 years, the top anticipated skill for this job family is computational Design. In terms of the types of trainings required for continuous up/reskilling, the top nominated selection is training in technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI).

vi. Further investigation also suggests that certain gaps within the current talent pool and market demand needs to be bridged to facilitate digital adoption within the industry. Some of the gaps highlighted by the industry stakeholders were a lack of relevant digital skills among employees and that the education system and syllabus is not updated in line with industry requirements/developments. To overcome the lack of digital adoption, most companies are automating in the future as this occupation can automate 25% - 50% of its current tasks.

Occupation: Stationary Plant and Machine Operators Not Elsewhere Classified

MASCO 2020(4-Digit Code): 8189

MASCO 2020(6-Digit Code): 8189-03

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Equipment & Machine Operator

This occupation appears on MyCOL:

2018	No	2019	No	2020/2021	No	2022	Yes
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Source of evidence:

Top-down indicators	Passed 5 out of 10 indicators
Bottom-up CfE survey	1 nomination
Consultation	0 nomination
Talent/Skills studies	<ul style="list-style-type: none"> Construction Industry Development Board (CIDB) certification

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	No	Yes	N/A	N/A
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	No	Yes	Yes

Occupation Overview:**Top Reasons of Hard-to-Fill:****Top Strategies to Meet Shortages:**

1. Raising wages
2. Outsourcing this job function
3. Hiring temporary or contract workers

Minimum Level of Qualification:

1. SPM Level

Top Field of Study:

1. Engineering, Manufacturing, and Construction - Building

Top Basic Skills:

1. Problem solving
2. Oral communication
3. Initiative and innovation

Top Specific Skills:

1. Operate excavation equipment
2. Notify others of emergencies, problems or hazards
3. Estimate materials requirements for projects

Top Technology Tools:

1. Quantitative schedule and risk analysis software
2. Air, space, or watercraft guidance systems
3. Graphics or photo imaging software

Top Future Anticipated Skills:

1. 4D Construction

Top Trainings Needed:

1. Training on occupational safety and health (OSH)

Bottom-up Evidence:

These occupations are included in the MyCOL and were nominated to reflect the need for equipment & machine operator.

- i. These job titles were nominated approximately once through the CfE survey.
- ii. The companies have also reported that vacancies within the occupation group are for fresh graduates with at least 0 -2 years of experience. It was stated that employers face recruitment challenges. As such employers look to overcome these challenges by raising wages, outsourcing this job function, and hiring temporary or contract workers.
- iii. Employers also expressed that they are looking for SPM Level as a minimum level of qualification for equipment & machine operator. Priority is also given to employees with background in engineering, manufacturing, and construction with the focus in building. A handful of survey and interview participants from the sector emphasised that they prefer Construction Industry Development Board (CIBD) certification.
- iv. Collective inputs from the CfE survey respondents revealed problem solving, oral communication, and initiative and innovation as the top 3 basic skills. As for the top 3 specific skills, participants have nominated operate excavation equipment, notify others of emergencies, problems or hazards, estimate materials requirements for projects. The top 3 technology tools nominated were quantitative schedule and risk analysis software, air, space, or watercraft guidance systems, and graphics or photo imaging software.
- v. Furthermore, the survey also shows that in the next 1 – 2 years, the top anticipated skill for this job family is 4D Construction. In terms of the types of trainings required for continuous up/reskilling, the top nominated selection is training on occupational safety and health (OSH).
- vi. Further investigation also suggests that certain gaps within the current talent pool and market demand needs to be bridged to facilitate digital adoption within the industry. Some of the gaps highlighted by the industry stakeholders were a lack of relevant digital skills among employees

and that the education system and syllabus are not updated in line with industry requirements/developments. The lack of digital adoption is further supported through the interviews as most companies are not automating in the future despite being able to automate less than 25% of this occupation's current tasks.

Occupation: Heavy Truck and Lorry Drivers

MASCO 2020(4-Digit Code): 8332

MASCO 2020(6-Digit Code): 8332-01

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Driver, Lorry

This occupation appears on MyCOL:

2018	No	2019	No	2020/2021	No	2022	Yes
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Source of evidence:

Top-down indicators	Passed 5 out of 10 indicators
Bottom-up CfE survey	1 nomination
Consultation	0 nomination
Talent/Skills studies	<ul style="list-style-type: none"> Vocational Driving License (VDL) or Commercial Driving License

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	No	Yes	N/A	N/A
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	No	Yes	Yes

Occupation Overview:	
Top Reasons of Hard-to-Fill:	Top Strategies to Meet Shortages: 1. Hiring less well qualified applicants
Minimum Level of Qualification: 1. No formal education required	Top Field of Study: 1. Engineering, Manufacturing, and Construction - Building
Top Basic Skills: 1. Teamwork 2. Learning 3. Oral communication	Top Specific Skills: 1. Drive trucks or truck-mounted equipment 2. Stock products or parts 3. Communicate with others to coordinate material handling or movement
Top Technology Tools: 1. GPS receivers 2. Inventory management software 3. Barcode reading technologies	Top Future Anticipated Skills: 1. Integrated Digital Delivery Application
Top Trainings Needed: 1. Training in Technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI)	
Bottom-up Evidence:	
<p>These occupations are included in the MyCOL and were nominated to reflect the need for driver, lorry.</p> <ol style="list-style-type: none"> i. These job titles were nominated approximately once through the CfE survey. ii. The companies have also reported that vacancies within the occupation group are for mid-level personnel with at least 5 years of experience. The key recruitment challenges cited by employers were too few applicants or no applicant at all and applicants' expected compensation is beyond the market rate. As such, employers look to overcome these challenges by expanding local recruitment efforts and increasing employees' training. iii. Employers also expressed that they are looking for bachelor's degree / Graduate Diploma / Graduate Certificate as a minimum level of qualification for operations manager and technical manager. As for entry roles, a minimum of advanced diploma or SKM Level 3 with good personal skills would be sufficient. Priority is also given to employees with background in general programmes such as basic/broad and engineering, manufacturing, and construction with the focus in civil engineering. A handful of survey and interview participants from the sector emphasised that they prefer Construction Industry Development Board (CIBD) certification. iv. Collective inputs from the CfE survey respondents revealed problem solving, oral communication, and planning and organising as the top 3 basic skills. As for the top 3 specific skills, participants have nominated inspect operational processes, communicate organisational policies and procedures, and develop operating strategies, plans or procedures. The top 3 technology tools nominated were project management software, content workflow software, and regulatory compliance software. v. Furthermore, the survey also shows that in the next 1 – 2 years, the top anticipated skill for this job family are cloud data for projects. In terms of the types of trainings required for continuous up/reskilling, the top 2 nominated selections are training in technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI) and training on Building Information Modelling (BIM). vi. Further investigation also suggests that certain gaps within the current talent pool and market demand needs to be bridged to facilitate digital adoption within the industry. Some of the gaps highlighted by the industry stakeholders were a lack of relevant digital skills among employees 	

and that the education system and syllabus is not updated in line with industry requirements/developments. The lack of digital adoption is further supported through the interviews as most companies are not automating in the future as they believe that this occupation cannot automate its current tasks.

Occupation: Managing Directors and Chief Executives

MASCO 2020(4-Digit Code): 1121

MASCO 2020(6-Digit Code): 1121-24; 1121-28

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Operations Manager; Technical Manager

This occupation appears on MyCOL:

2018	Yes	2019	Yes	2020/2021	Yes	2022	Yes
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Source of evidence:

Top-down indicators	Passed 7 out of 12 indicators
Bottom-up CfE survey	2 nominations
Consultation	1 nomination
Talent/Skills studies	<ul style="list-style-type: none"> Construction Industry Development Board (CIBD) certificate

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	Yes	Yes	No	No
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	Yes	Yes	Yes	No	Yes

Occupation Overview:	
Top Reasons of Hard-to-Fill: 1. Too few applicants or no applicant at all 2. Applicants' expected compensation is beyond the market rate	Top Strategies to Meet Shortages: 1. Expanding local recruitment efforts 2. Increasing employees' training
Minimum Level of Qualification: 1. Bachelor's Degree / Graduate Diploma / Graduate Certificate	Top Field of Study: 1. General Programmes - Basic/broad, general programmes 2. Engineering, Manufacturing, and Construction - Civil engineering
Top Basic Skills: 1. Problem solving 2. Oral communication 3. Planning and organising	Top Specific Skills: 1. Inspect operational processes 2. Communicate organisational policies and procedures 3. Develop operating strategies, plans or procedures
Top Technology Tools: 1. Project management software 2. Content workflow software 3. Regulatory compliance software	Top Future Anticipated Skills: 1. Cloud data for projects
Top Trainings Needed: 1. Training in Technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI) 2. Training on Building Information Modelling (BIM)	
Bottom-up Evidence:	
<p>These occupations are included in the MyCOL and were nominated to reflect the need for operations manager and technical manager.</p> <ol style="list-style-type: none"> i. These job titles were nominated approximately twice through the CfE survey. ii. The companies have reported that they have vacancies for mid-level personnel with at least 5 years of experience, and the key recruitment challenges they face are too few applicants or no applicants, and applicants' expected compensation being higher than the market rate. To overcome these challenges, employers plan to expand local recruitment efforts and increase employees' training. iii. Employers stated that they require a minimum of a bachelor's degree, Graduate Diploma, or Graduate Certificate for operations and technical managers, and a minimum of an advanced diploma or SKM Level 3 with good personal skills for entry-level positions. Priority is given to employees with a background in general programs such as basic/broad and engineering, manufacturing, and construction, specifically in civil engineering, and those with a Construction Industry Development Board (CIBD) certificate. iv. According to the CfE survey respondents, the top 3 basic skills are problem-solving, oral communication, and planning and organising. The top 3 specific skills are inspecting operational processes, communicating organisational policies and procedures, and developing operating strategies, plans or procedures. The top 3 technology tools are project management software, content workflow software, and regulatory compliance software. 	

- v. In the next 1-2 years, the top anticipated skill for this job family is cloud data for projects, and the top 2 types of training required for upskilling and reskilling are technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI) and Building Information Modelling (BIM) training.
- vi. Further investigation suggests that there are gaps in the current talent pool and market demand that need to be addressed to facilitate digital adoption within the industry. The industry stakeholders have identified a lack of relevant digital skills among employees and an outdated education system and syllabus not aligned with industry requirements and developments as some of the gaps. This lack of digital adoption is further supported by the interviews, as most companies do not plan to automate in the future, as they believe this occupation cannot automate its current tasks.

Occupation: Finance Managers

MASCO 2020(4-Digit Code): 1211

MASCO 2020(6-Digit Code): 1211-21

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Procurement Manager

This occupation appears on MyCOL:

2018	Yes	2019	Yes	2020/2021	Yes	2022	Yes
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Source of evidence:

Top-down indicators	Passed 6 out of 12 indicators
Bottom-up CfE survey	1 nomination
Consultation	0 nomination
Talent/Skills studies	<ul style="list-style-type: none"> Chartered Institute of Procurement & Supply (CIPS) certification.

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	Yes	Yes	No	No
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	Yes	No	Yes

Occupation Overview:	
Top Reasons of Hard-to-Fill: 1. Too few applicants or no applicant at all 2. Applicants lack the required credentials or certification / qualification	Top Strategies to Meet Shortages: 1. Raising wages 2. Hiring less well qualified applicants 3. Give bonuses
Minimum Level of Qualification: 1. Bachelor's Degree / Graduate Diploma / Graduate Certificate	Top Field of Study: 1. General Programmes - Basic/broad, general programmes
Top Basic Skills: 1. Problem solving 2. Planning and organising 3. Initiative and innovation	Top Specific Skills: 1. Determine construction project layouts 2. Develop procedures to evaluate organisational activities 3. Develop procedures for data management
Top Technology Tools: 1. Project management software 2. Enterprise system management software 3. Data conversion software	Top Future Anticipated Skills: 1. Design for Manufacturing and Assembly
Top Trainings Needed: 1. Training in Technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI)	
Bottom-up Evidence:	
<p>These occupations are included in the MyCOL and were nominated to reflect the need for procurement manager.</p> <ol style="list-style-type: none"> i. These job titles were nominated approximately once through the CfE survey. ii. The companies reported that vacancies within the occupation group are for high-level personnel with at least more than 10 years of experience. The key recruitment challenges cited by employers were too few applicants or no applicant at all and applicants lack the required credentials or certification / qualification. As such employers look to overcome these challenges by raising wages, hiring less well qualified applicants, and give bonuses. iii. Employers also expressed that they are looking for bachelor's degree / graduate diploma / graduate certificate as a minimum level of qualification for procurement manager. Priority is also given to employees with background in general programmes such as basic/broad. A handful of survey and interview participants from the sector emphasised that an important qualification they look for in applicants is the Chartered Institute of Procurement & Supply (CIPS) certification. iv. Collective inputs from the CfE survey respondents revealed problem solving, planning and organising, and initiative and innovation as the top 3 basic skills. As for the top 3 specific skills, participants have nominated determine construction project layouts, develop procedures to evaluate organisational activities, and develop procedures for data management. The top 3 technology tools nominated were project management software, enterprise system management software, and data conversion software. v. Furthermore, the survey also shows that in the next 1 – 2 years, the top anticipated skill for this job family is design for manufacturing and assembly. In terms of the types of trainings required for continuous up/reskilling, the top nominated selection is training in technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI). vi. Further investigation also suggests that certain gaps within the current talent pool and market demand needs to be bridged to facilitate digital adoption within the industry. Some of the gaps 	

highlighted by the industry stakeholders were a lack of relevant digital skills among employees and that the education system and syllabus is not updated in line with industry requirements/developments. The lack of digital adoption is supported through the interviews as most companies are not automating in the future despite being able to automate less than 25% of this occupation's current tasks.

Occupation: Information and Communications Technology Managers

MASCO 2020(4-Digit Code): 1511

MASCO 2020(6-Digit Code): 1511-38

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Building Information Modelling Manager (BIM)

This occupation appears on MyCOL:

2018	Yes	2019	Yes	2020/2021	Yes	2022	Yes
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Source of evidence:

Top-down indicators	Passed 6 out of 12 indicators
Bottom-up CfE survey	1 nomination
Consultation	1 nomination
Talent/Skills studies	<ul style="list-style-type: none"> Building Information Modelling (BIM) Certification

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	Yes	Yes	No	No
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	Yes	No	Yes

Occupation Overview:

Top Reasons of Hard-to-Fill:

1. Applicants lack the required credentials or certification / qualification
2. Applicants lack relevant job experience
3. Too few applicants or no applicant at all

Top Strategies to Meet Shortages:

1. Expanding international recruitment efforts

Minimum Level of Qualification:

1. Bachelor's Degree/ Graduate Diploma/ Graduate Certificate

Top Field of Study:

1. Engineering, Manufacturing, and Construction - Building

Top Basic Skills:

1. Digital engagement
2. Oral communication
3. Teamwork

Top Specific Skills:

1. Direct construction activities
2. Estimate materials requirements for projects
3. Recommend technical design or process changes to improve efficiency, quality or performance

Top Technology Tools:

1. Computer aided design CAD software
2. Application server software
3. Computer system software

Top Future Anticipated Skills:

1. Computational Design

Top Trainings Needed:

1. Training in Technology

Bottom-up Evidence:

These occupations are included in the MyCOL and were nominated to reflect the need for Building Information Modelling manager (BIM).

- i. These job titles were nominated approximately 1 time through the CfE survey and once during interviews with industry stakeholders.
- ii. The companies have also reported that vacancies within the occupation group are for fresh graduates (0 – 2 years) and mid-level personnel with 2 to 5 years of experience. The key recruitment challenges cited by employers were lack of required credentials or certification, lack of experience, and too little applicants. As such employers look to overcome these challenges by expanding international recruitment efforts.
- iii. Employers also expressed that they are looking for bachelor's degree with good personal skills as a minimum level of qualification for entry and mid-level information and communications technology managers roles. Priority is also given to employees with background in construction, specifically building. A handful of survey and interview participants from the sector emphasised that an important qualification they look for in applicants is Building Information Modelling (BIM) certification.
- iv. Collective inputs from the CfE survey respondents revealed digital engagement, oral communication, and teamwork as the top 3 basic skills. As for the top 3 specific skills, participants have nominated direct construction activities, estimate materials requirements for projects, and recommend technical design or process changes to improve efficiency, quality or performance. The top 3 technology tools nominated were computer aided design CAD software, application server software, and computer system software.
- v. Furthermore, the survey also shows that in the next 1 – 2 years, the top anticipated skills for this job family are computational design. In terms of the types of trainings required for continuous up/reskilling, the top nominated selections were related to training on technology.

vi. Further investigation also suggests that certain gaps within the current talent pool and market demand needs to be bridged to facilitate digital adoption within the industry. Some of the gaps highlighted by the industry stakeholders were a lack of relevant digital skills among employees and that the education system and syllabus is not updated in line with industry requirements. This requires closer collaboration between government, industry player, and education institutions in order to reduce the gaps.

MANUFACTURING (FOOD PROCESSING)

Occupation: Quality Managers

MASCO 2020(4-Digit Code): 1216

MASCO 2020(6-Digit Code): 1216-01; 1216-02

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Quality Control Manager, Quality Assurance Manager

This occupation appears on MyCOL:

2018	Yes	2019	Yes	2020/2021	Yes	2022	Yes
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Source of evidence:

Top-down indicators	Passed 1 out of 2 indicators
Bottom-up CfE survey	4 nominations
Consultation	6 nominations
Talent/Skills studies	<ul style="list-style-type: none"> • OSHA Safety Certificate • Degree holder for QAQC

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
N/A	N/A	N/A	N/A	N/A	N/A
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
N/A	N/A	Yes	N/A	No	N/A

Occupation Overview:	
Top Reasons of Hard-to-Fill: <ol style="list-style-type: none"> 1. Too few applicants or no applicant at all 2. Applicants lack the required technical skills: lack Quality control and assure 3. Applicants lack relevant job experience 	Top Strategies to Meet Shortages: <ol style="list-style-type: none"> 1. Expanding local recruitment efforts 2. Convincing workers to delay retirement 3. Raising wages
Minimum Level of Qualification: <ol style="list-style-type: none"> 1. Bachelor's Degree / Graduate Diploma / Graduate Certificate 	Top Field of Study: <ol style="list-style-type: none"> 1. Engineering, Manufacturing, and Construction - Food processing
Top Basic Skills: <ol style="list-style-type: none"> 1. Problem solving 2. Oral communication 3. Numeracy 	Top Specific Skills: <ol style="list-style-type: none"> 1. Check quality of foods or supplies 2. Inspect items for damage or defects 3. Evaluate quality of food, drinks, or ingredients
Top Technology Tools: <ol style="list-style-type: none"> 1. Analytical and scientific software 2. Database reporting software 3. Database management software 	Top Future Anticipated Skills: <ol style="list-style-type: none"> 1. Automated operation Monitoring 2. Good Manufacturing Practices Implementation
Top Trainings Needed: <ol style="list-style-type: none"> 1. Training on Food Safety 2. Training on Computer Aided Manufacturing (CAM) 	
Bottom-up Evidence:	
<p>These occupations are included in the MyCOL and were nominated to reflect the need for quality control manager and quality assurance manager.</p> <ol style="list-style-type: none"> i. These job titles were nominated approximately 4 times through the CfE survey and 6 times during interviews with industry stakeholders. ii. The companies have also reported that vacancies within the occupation group are for high-level personnel with at least 6-10 years of experience. The key recruitment challenges cited by employers were too few applicants or no applicant at all, applicants lack the required technical skills such as quality control and assure, and applicants lack relevant job experience. As such employers look to overcome these challenges by expanding local recruitment efforts, convincing workers to delay retirement, and raising wages. iii. Employers also expressed that they are looking for bachelor's degree / Graduate Diploma / Graduate Certificate as a minimum level of qualification for Quality Control Manager and Quality Assurance Manager. Priority is also given to employees with background in engineering, manufacturing, and construction with the focus in food processing. A handful of survey and interview participants from the sector emphasised that some of the important industry skills they look for in employees are degree holder for QAQC and OSHA Safety Certificate. iv. Collective inputs from the CfE survey respondents revealed problem solving, oral communication, and numeracy as the top 3 basic skills. As for the top 3 specific skills, participants have nominated check quality of foods or supplies, inspect items for damage or defects, and evaluate quality of food, drinks, or ingredients. The top 3 technology tools nominated were analytical and scientific software, database reporting software, and database management software. 	

- v. Furthermore, the survey also shows that in the next 1 – 2 years, the top 2 anticipated skills for this job family are automated operation monitoring and good manufacturing practices implementation. In terms of the types of trainings required for continuous up/reskilling, the top 3 nominated selections are training on food safety and Computer Aided Manufacturing (CAM).
- vi. Further investigation also suggests that certain gaps within the current talent pool and market demand needs to be bridged to facilitate digital adoption within the industry. Some of the gaps highlighted by the industry stakeholders were a lack of relevant digital skills among employees and that the education system and syllabus is not updated in line with industry requirements/developments. The lack of digital adoption was further supported through the interviews as most companies are not likely to automate in the future as the current tasks of this occupation is unable to automate.

Occupation: Manufacturing Managers

MASCO 2020(4-Digit Code): 1321

MASCO 2020(6-Digit Code): 1321-01; 1321-02; 1321-03; 1321-07

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Manufacturing Manager; Production and Operation Manager, Manufacturing; Factory manager; Production Manager, Food Processing

This occupation appears on MyCOL:

2018	Yes	2019	Yes	2020/2021	No	2022	Yes
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Source of evidence:

Top-down indicators	Passed 6 out of 12 indicators
Bottom-up CfE survey	7 nominations
Consultation	1 nomination
Talent/Skills studies	-

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	Yes	Yes	No	No
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	Yes	No	Yes

Occupation Overview:	
Top Reasons of Hard-to-Fill: <ol style="list-style-type: none"> 1. Applicants lack relevant job experience 2. Too few applicants or no applicant at all 3. Applicants lack the required credentials or certification/qualification 	Top Strategies to Meet Shortages: <ol style="list-style-type: none"> 1. Expanding local recruitment efforts (e.g. wider distribution of job openings...) 2. Convincing workers to delay retirement
Minimum Level of Qualification: <ol style="list-style-type: none"> 1. Bachelor's Degree / Graduate Diploma / Graduate Certificate 2. Advanced Diploma / SKM Level 5 3. Diploma / SKM Level 4 	Top Field of Study: <ol style="list-style-type: none"> 1. Engineering, Manufacturing, and Construction - Food processing 2. Engineering, Manufacturing, and Construction - Mechanics and metal work 3. General Programmes - Basic/broad, general programmes
Top Basic Skills: <ol style="list-style-type: none"> 1. Problem solving 2. Oral communication 3. Planning and organising 	Top Specific Skills: <ol style="list-style-type: none"> 1. Develop operating strategies, plans or procedures 2. Liaise between departments or other groups to improve function or communication 3. Analyse data to inform operational decisions or activities
Top Technology Tools: <ol style="list-style-type: none"> 1. Facilities management software 2. Project management software 3. Industrial control and automation software 	Top Future Anticipated Skills: <ol style="list-style-type: none"> 1. Internet of Things Management 2. Good Manufacturing Practices Implementation 3. Automated food manufacturing system maintenance
Top Trainings Needed: <ol style="list-style-type: none"> 1. Training on Technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI) 2. Training on Food Safety 3. Training on Occupational Safety and Health (OSH) 	
Bottom-up Evidence:	
<p>These occupations are included in the MyCOL and were nominated to reflect the need for manufacturing manager, production and operation manager - manufacturing, and factory manager.</p> <ol style="list-style-type: none"> i. These job titles were nominated approximately 7 times through the CfE survey and once during interviews with industry stakeholders. ii. The companies have also reported that vacancies within the occupation group are for fresh graduates (0 – 2 years) and mid-level personnel with at least 5 years of experience. The key recruitment challenges cited by employers were applicants lack relevant job experience, too few applicants or no applicant at all, and applicants lack the required credentials or certification / qualification. As such employers look to overcome these challenges by expanding local recruitment efforts and convincing workers to delay retirement. iii. Employers also expressed that they are looking for diploma / SKM Level 4 as a minimum level of qualification for these managerial roles. Priority is also given to employees with background in engineering, manufacturing, and construction with the focus in food processing and a background in mechanics and metal work and a background in general programmes that include basic/broad. A handful of survey and interview participants from the sector emphasised that 	

some of the important industry skills they look for in employees are those that are degree holder for QA/QC certifications.

- iv. Collective inputs from the CfE survey respondents revealed problem solving, oral communication, and planning and organising as the top 3 basic skills. As for the top 3 specific skills, participants have nominated develop operating strategies, plans or procedures, liaise between departments or other groups to improve function or communication, and analyse data to inform operational decisions or activities. The top 3 technology tools nominated were facilities management software, project management software, and industrial control and automation software.
- v. Furthermore, the survey also shows that in the next 1 – 2 years, the top 3 anticipated skills for this job family are internet of things management, good manufacturing practices implementation, and automated food manufacturing system maintenance. In terms of the types of trainings required for continuous up/reskilling, the top 3 nominated selections are training on technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI), food safety and Occupational Safety and Health (OSH).
- vi. Further investigation also suggests that certain gaps within the current talent pool and market demand needs to be bridged to facilitate digital adoption within the industry. Some of the gaps highlighted by the industry stakeholders were a lack of relevant digital skills among employees and that the education system and syllabus is not updated in line with industry requirements/developments. The lack of digital adoption was further supported through the interviews as most companies are most likely not to automate in the future despite this occupation being able to automate 25% of their current tasks.

Occupation: Manufacturing Professionals

MASCO 2020(4-Digit Code): 2182

MASCO 2020(6-Digit Code): 2182-02; 2182-04; 2182-05; 2182-06; 2182-08; 2182-12; 2182-13; 2182-18; 2182-22

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Quality Assurance Executive; Quality Control Executive; Production Executive; Warehouse Executive; Maintenance Executive; Product Quality Controller; Product Planner; Supply Chain/ Procurement Specialist; Production Specialist

This occupation appears on MyCOL:

2018	Yes	2019	Yes	2020/2021	Yes	2022	Yes
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Source of evidence:

Top-down indicators	Passed 5 out of 12 indicators
Bottom-up CfE survey	55 nominations
Consultation	5 nominations
Talent/Skills studies	<ul style="list-style-type: none"> Food and Beverages Environmental Scan

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	No	No	No	No
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	Yes	Yes	Yes	No	Yes

Occupation Overview:

Top Reasons of Hard-to-Fill:

1. Applicants lack relevant job experience
2. Too few applicants or no applicant at all
3. Applicants lack the required credentials or certification/ qualification

Top Strategies to Meet Shortages:

1. Increasing employees' training
2. Establishing or expanding partnerships with education or training providers
3. Expanding local recruitment efforts

Minimum Level of Qualification:

1. Bachelor's Degree/ Graduate Diploma/ Graduate Certificate
2. Advanced Diploma/ SKM Level 5
3. Diploma/ SKM Level 4

Top Field of Study:

1. Engineering, Manufacturing, and Construction – Food Processing
2. Engineering, Manufacturing, and Construction – Electronics and automation
3. General Programmes – Basic/broad, general programmes

Top Basic Skills:

1. Problem solving
2. Initiative and innovation
3. Oral communication

Top Specific Skills:

1. Monitor processes for compliance with standards
2. Discuss production content and progress with others
3. Research method to improve food products

Top Technology Tools:

1. Regulatory compliance software
2. Scientific laboratory analysers, sequencers, and measurement or manipulation instrumentation
3. Computer system software

Top Future Anticipated Skills:

1. Good Manufacturing Practices Implementation
2. Automation process control
3. Internet of Things Management

Top Trainings Needed:

1. Training on Computer Aided Manufacturing (CAM)
2. Training on Food Safety
3. Training on Technology

Bottom-up Evidence:

These occupations are included in the MyCOL and were nominated to reflect the need for quality assurance executive, quality control executive, and production executive.

- i. These job titles were nominated approximately 55 times through the CfE survey and 5 times during interviews with industry stakeholders.
- ii. The companies have also reported that vacancies within the occupation group are for fresh graduates (0 – 2 years) and mid-level personnel with 2 to 5 years of experience. The key recruitment challenges cited by employers were applicants lack experience, too little applicants, and lack the required credentials or certification. As such employers look to overcome these challenges by increasing employee's training, establishing or expanding partnerships with education or training providers, and expanding local recruitment efforts.
- iii. Employers also expressed that they are looking for bachelor's degree as a minimum level of qualification for mid-level manufacturing professionals' roles. As for entry roles, a minimum of advanced diploma or SKM Level 4 with good personal skills would be sufficient. Priority is also given to employees with background in manufacturing, specifically food processing, electronics and automation, general programmes in basic general programmes. A handful of survey and interview participants from the sector emphasised that some of the important industry skills they look for in employees is food and beverages environmental scan.

- iv. Collective inputs from the CfE survey respondents revealed problem-solving, initiative and innovation, and oral communication as the top 3 basic skills. As for the top 3 specific skills, participants have nominated monitor processes for compliance with standards, discuss production content and progress with others, and research method to improve food products. The top 3 technology tools nominated were regulatory compliance software, scientific laboratory analysers, sequencers, and measurement or manipulation instrumentation, and computer system software.
- v. Furthermore, the survey also shows that in the next 1 – 2 years, the top 3 anticipated skills for this job family are Good Manufacturing Practices implementation, automation process control, and Internet of Things management. In terms of the types of trainings required for continuous up/reskilling, the top 3 nominated selections are training on Computer Aided Manufacturing (CAM), food safety, and technology.
- vi. Further investigation also suggests that certain gaps within the current talent pool and market demand needs to be bridged to facilitate digital adoption within the industry. Some of the gaps highlighted by the industry stakeholders were a lack of relevant digital skills among employees and that the education system and syllabus is not updated in line with industry requirements. This requires closer collaboration between government, industry player, and education institutions in order to reduce the gaps.

Occupation: Environmental and Occupational Health and Hygiene Professionals

MASCO 2020(4-Digit Code): 2263

MASCO 2020(6-Digit Code): 2263-31; 2263-32; 2263-38

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Halal Executive; Halal Executive, Food Manufacturing; Food Technologist

This occupation appears on MyCOL:

2018	Yes	2019	Yes	2020/2021	Yes	2022	Yes
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Source of evidence:

Top-down indicators	Passed 5 out of 12 indicators
Bottom-up CfE survey	41 nominations
Consultation	5 nominations
Talent/Skills studies	<ul style="list-style-type: none"> Halal Executive Certification

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	No	Yes	No	No
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	Yes	No	Yes

Occupation Overview:	
Top Reasons of Hard-to-Fill: 1. Applicants lack the required credentials or certification / qualification 2. Too few applicants or no applicant at all 3. Applicants lack relevant job experience	Top Strategies to Meet Shortages: 1. Increasing employees' training 2. Expanding local recruitment efforts 3. Raising wages
Minimum Level of Qualification: 1. Bachelor's Degree/ Graduate Diploma/ Graduate Certificate 2. Diploma / SKM Level 4 3. Advanced Diploma/ SKM Level 5	Top Field of Study: 1. Engineering, Manufacturing, and Construction - Food processing 2. General Programmes - Basic/broad, general programmes 3. Arts and Humanities - Religion
Top Basic Skills: 1. Problem solving 2. Initiative and innovation 3. Writing	Top Specific Skills: 1. Complete documentation required by programs or regulations 2. Inspect facilities or equipment to ensure specifications are met 3. Interpret cultural or religious information
Top Technology Tools: 1. Regulatory compliance software 2. Database reporting software 3. Computer system software	Top Future Anticipated Skills: 1. Good Manufacturing Practices Implementation 2. Internet of Things Management 3. Automated food manufacturing system maintenance
Top Trainings Needed: 1. Training on Food Safety 2. Training on Computer Aided Manufacturing (CAM) 3. Training on Technology	
Bottom-up Evidence:	
<p>These occupations are included in the MyCOL and were nominated to reflect the need for halal executive, halal executive in food manufacturing, and food technologist.</p> <ol style="list-style-type: none"> i. These job titles were nominated approximately 41 times through the CfE survey and 5 times during interview with industry stakeholders. ii. The companies have reported that vacancies within the occupation group are for fresh graduates (0 – 2 years) and mid-level personnel with 2 to 5 years of experience. The key recruitment challenges cited by employers were applicants lack the required credentials or certification, too few applicants or no applicants at all, and applicants lack relevant job experience. As such employers look to overcome these challenges by increasing employees' training, expanding local recruitment efforts, and raising wages. iii. Employers also expressed that they are looking for bachelor's degree as a minimum level of qualification for mid-level environmental and occupational health and hygiene professionals' roles. As for entry roles, a minimum of advanced diploma or SKM Level 4 with good personal skills would be sufficient. Priority is also given to employees with background in manufacturing specifically in food processing, general programmes in basic/broad, general programmes, and arts and humanities in religion. A handful of survey and interview participants from the sector emphasised the industry skills they look for in employees is the halal executive certification. iv. Collective inputs from the CfE survey respondents revealed problem-solving, initiative and innovation, and writing as the top 3 basic skills. As for the top 3 specific skills, participants have 	

nominated complete documentation required by programs or regulations, inspect facilities or equipment to ensure specifications are met, and interpret cultural or religious information. The top 3 technology tools nominated were regulatory compliance software, database reporting software, and computer system software.

- v. Furthermore, the survey also shows that in the next 1 – 2 years, the top 3 anticipated skills for this job family are Good Manufacturing Practices Implementation, Internet of Things Management, automated food manufacturing system maintenance. In terms of the types of trainings required for continuous up/reskilling, the top 3 nominated selections are training on food safety, training on Computer Aided Manufacturing (CAM), and training on technology.
- vi. Further challenge that was highlighted by the industry stakeholders was the wrong perception towards the food processing industry, and thus talents will choose other jobs instead of joining the food processing industry. This challenge can be overcome when the government, certification bodies, and industry players are able to make changes by raising awareness of the targeted talent pool.

Occupation: Research and Development Professionals

MASCO 2020(4-Digit Code): 2426

MASCO 2020(6-Digit Code): 2426-09; 2426-12

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Research and Development Executive; Research and Development Executive, Halal Food Manufacturing

This occupation appears on MyCOL:

2018	No	2019	No	2020/2021	Yes	2022	Yes
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Source of evidence:

Top-down indicators	Passed 5 out of 12 indicators
Bottom-up CfE survey	8 nominations
Consultation	0 nomination
Talent/Skills studies	-

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	Yes	Yes	No	No
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	Yes	No	No

Occupation Overview:	
Top Reasons of Hard-to-Fill: <ol style="list-style-type: none"> 1. Applicants lack relevant job experience 2. Applicants lack the required credentials or certification / qualification 3. Applicants' expected compensation is beyond the market rate 	Top Strategies to Meet Shortages: <ol style="list-style-type: none"> 1. Increasing employees' training 2. Establishing or expanding partnerships with education or training providers 3. Expanding local recruitment efforts
Minimum Level of Qualification: <ol style="list-style-type: none"> 1. Bachelor's Degree / Graduate Diploma / Graduate Certificate 2. Advanced Diploma / SKM Level 5 	Top Field of Study: <ol style="list-style-type: none"> 1. General Programmes - Basic/broad, general programmes 2. Science, Mathematics, and Computing - Computer use 3. Science, Mathematics, and Computing – Chemistry
Top Basic Skills: <ol style="list-style-type: none"> 1. Problem solving 2. Initiative and innovation 3. Planning and organising 	Top Specific Skills: <ol style="list-style-type: none"> 1. Research methods to improve food products 2. Prepare scientific or technical reports or presentations 3. Teach life skills
Top Technology Tools: <ol style="list-style-type: none"> 1. Business intelligence and data analysis software 2. Database reporting software 3. Database management software 	Top Future Anticipated Skills: <ol style="list-style-type: none"> 1. Internet of Things Management 2. Automated operation Monitoring 3. Embedded System Integration
Top Trainings Needed: <ol style="list-style-type: none"> 1. Training on Technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI) 2. Training on Food Safety 	
Bottom-up Evidence:	
<p>These occupations are included in the MyCOL and were nominated to reflect the need for research and development executive and research and development executive, halal food manufacturing.</p> <ol style="list-style-type: none"> i. These job titles were nominated approximately 8 times through the CfE survey. ii. The companies reported that vacancies within the occupation group are for mid-level personnel with at least 2-5 years of experience and high-level personnel with at least 6-10 years of experience. The key recruitment challenges cited by employers were applicants lack relevant job experience, applicants lack the required credentials or certification / qualification, and applicants' expected compensation is beyond the market rate. As such employers look to overcome these challenges by increasing employees' training, establishing, or expanding partnerships with education or training providers, and expanding local recruitment efforts. iii. Employers also expressed that they are looking for bachelor's degree / graduate diploma / graduate certificate as a minimum level of qualification for research and development professionals. As for entry roles, a minimum of advanced diploma / SKM Level 5 with good personal skills would be sufficient. Priority is also given to employees with background in general programmes such as basic/broad and science, mathematics, and computing with the focus in 	

computer use and chemistry. A handful of survey and interview participants from the sector emphasised that some of the important industry skills they look for in employees is able to perform research and development on food such as create new products.

- iv. Collective inputs from the CfE survey respondents revealed problem solving, initiative and innovation, and planning and organising as the top 3 basic skills. As for the top 3 specific skills, participants have nominated research methods to improve food products, prepare scientific or technical reports or presentations, and teach life skills. The top 3 technology tools nominated were business intelligence and data analysis software, database reporting software, and database management software.
- v. Furthermore, the survey also shows that in the next 1 – 2 years, the top 3 anticipated skills for this job family are internet of things management, automated operation monitoring, and embedded system integration. In terms of the types of trainings required for continuous up/reskilling, the top 2 nominated selections are training on technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI) and training on food safety.
- vi. Further investigation also suggests that certain gaps within the current talent pool and market demand needs to be bridged to facilitate digital adoption within the industry. Some of the gaps highlighted by the industry stakeholders were a lack of relevant digital skills among employees and that the education system and syllabus is not updated in line with industry requirements/developments. The lack of digital adoption was further supported through the interviews as most companies are not likely to automate in the future as it is believed that this occupation cannot automate its current tasks.

Occupation: Manufacturing Supervisors

MASCO 2020(4-Digit Code): 3122

MASCO 2020(6-Digit Code): 3122-01; 3122-02; 3122-04; 3122-14; 3122-16; 3122-23; 3122-26; 3122-32

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Manufacturing Supervisor; Production Supervisor; Packaging Supervisor; Quality Control Inspector; Quality Controller; Supervisor; Maintenance Supervisor; Facilities Supervisor

This occupation appears on MyCOL:

2018	Yes	2019	Yes	2020/2021	Yes	2022	Yes
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Source of evidence:

Top-down indicators	Passed 5 out of 10 indicators
Bottom-up CfE survey	20 nominations
Consultation	0 nominations
Talent/Skills studies	<ul style="list-style-type: none"> Food and Beverages Environmental Scan

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	No	No	N/A	N/A
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	Yes	Yes	Yes

Occupation Overview:

Top Reasons of Hard-to-Fill:

1. Applicants lack the required credentials or certification/ qualification
2. Too few applicants or no applicant at all
3. Applicants lack relevant job experience

Top Strategies to Meet Shortages:

1. Increasing employees' training
2. Expanding local recruitment efforts
3. Convincing workers to delay retirement

Minimum Level of Qualification:

1. Diploma/ SKM Level 4
2. Advanced Diploma/ SKM Level 5
3. Bachelor's Degree/ Graduate Diploma/ Graduate Certificate

Top Field of Study

1. Engineering, Manufacturing, and Construction – Food Processing
2. General Programmes – Personal skills
3. General Programmes – Basic/broad, general programmes

Top Basic Skills:

1. Oral communication
2. Problem solving
3. Teamwork

Top Specific Skills:

1. Inspect products or operations to ensure that standards are met
2. Test quality of materials or finished products
3. Test products for functionality or quality

Top Technology Tools:

1. Regulatory compliance software
2. Analytical and scientific software
3. Computer system software

Top Future Anticipated Skills:

1. Good Manufacturing Practices Implementation
2. Automation process control
3. Automated food manufacturing system maintenance

Top Trainings Needed:

1. Training on Food Safety
2. Training on Technology
3. Training on Computer Aided Manufacturing (CAM)

Bottom-up Evidence:

These occupations are included in the MyCOL and were nominated to reflect the need for manufacturing supervisor, production supervisor, and quality controller.

- i. These job titles were nominated approximately 20 times through the CfE survey.
- ii. The companies have also reported that vacancies within the occupation group are for fresh graduates (0 – 2 years) and mid-level personnel with 2 to 5 years of experience. The key recruitment challenges cited by employers were applicants lack the required credentials or qualification, too little applicants, and applicants lack of relevant job experience. As such employers look to overcome these challenges by increasing employees' training, expanding local recruitment efforts, and convincing workers to delay retirement.
- iii. Employers also expressed that they are looking for bachelor's degree as a minimum level of qualification for mid-level supervisors' roles. As for entry roles, a minimum of advanced diploma or SKM Level 4 with good personal skills would be sufficient. Priority is also given to employees with background in manufacturing, specifically in food processing, and general programmes specifically in personal skills and basic general programmes. A handful of survey and interview participants from the sector emphasised that important industry skills they look for in employees are maintaining quality of production, and food and beverages environmental scan.
- iv. Collective inputs from the CfE survey respondents revealed oral communication, problem-solving, and teamwork as the top 3 basic skills. As for the top 3 specific skills, participants have nominated inspect products or operations to ensure that standards are met, test quality of materials or finished products, and test products for functionality or quality. The top 3 technology

tools nominated were regulatory compliance software, analytical and scientific software, and computer system software.

- v. Furthermore, the survey also shows that in the next 1 – 2 years, the top 3 anticipated skills for this job family are Good Manufacturing Practices implementation, automation process control, automated food manufacturing system maintenance. In terms of the types of trainings required for continuous up/reskilling, the top 3 nominated selections are training on food safety, technology, and computer-aided manufacturing (CAM).
- vi. Further investigation also suggests that certain gaps within the current talent pool and market demand needs to be bridged to facilitate digital adoption within the industry. Some of the gaps highlighted by the industry stakeholders were a lack of relevant digital skills among employees and that the education system and syllabus is not updated in line with industry requirements. This requires closer collaboration between government, industry player, and education institutions in order to reduce the gaps.

Occupation: Medical Imaging and Therapeutic Equipment Technicians

MASCO 2020(4-Digit Code): 3211

MASCO 2020(6-Digit Code): 3211-19

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Quality Assurance Supervisor, Halal Food Manufacturing

This occupation appears on MyCOL:

2018	No	2019	No	2020/2021	No	2022	Yes
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Source of evidence:

Top-down indicators	Passed 4 out of 7 indicators
Bottom-up CfE survey	2 nominations
Consultation	0 nomination
Talent/Skills studies	<ul style="list-style-type: none"> Quality Assurance and Quality Control (QAQC) certification

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
N/A	Yes	N/A	Yes	N/A	No
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
N/A	No	Yes	Yes	No	N/A

Occupation Overview:

Top Reasons of Hard-to-Fill: <ol style="list-style-type: none"> 1. Applicants lack the required credentials or certification / qualification 2. Applicants lack required skill of quality checking for niche products 	Top Strategies to Meet Shortages: <ol style="list-style-type: none"> 1. Increasing employees' training 2. Raising wages 3. Expanding local recruitment efforts (e.g. wider distribution of job openings...)
Minimum Level of Qualification: <ol style="list-style-type: none"> 1. Diploma / SKM Level 4 	Top Field of Study: <ol style="list-style-type: none"> 1. Engineering, Manufacturing, and Construction - Food processing
Top Basic Skills: <ol style="list-style-type: none"> 1. Digital engagement 2. Teamwork 3. Planning and organising 	Top Specific Skills: <ol style="list-style-type: none"> 1. Test products for functionality or quality 2. Inspect products or operations to ensure that standards are met 3. Verify information or specifications
Top Technology Tools: <ol style="list-style-type: none"> 1. Regulatory compliance software 2. Enterprise resource planning ERP software 3. Library management system 	Top Future Anticipated Skills: <ol style="list-style-type: none"> 1. Automated operation Monitoring
Top Trainings Needed: <ol style="list-style-type: none"> 1. Training on Food Safety 	

Bottom-up Evidence:

These occupations are included in the MyCOL and were nominated to reflect the need for quality assurance supervisor, halal food manufacturing.

- i. These job titles were nominated approximately twice through the CfE survey.
- ii. The companies have also reported that vacancies within the occupation group are for fresh graduates (0 – 2 years) and mid-level personnel with at least 5 years of experience. The key recruitment challenges cited by employers were applicants lack the required credentials or certification / qualification and applicants lack required skill of quality checking for niche products. As such employers look to overcome these challenges by increasing employees' training, raising wages, and expanding local recruitment efforts.
- iii. Employers also expressed that they are looking for Diploma / SKM Level 4 as a minimum level of qualification for quality assurance supervisor, halal food manufacturing. Priority is also given to employees with background in engineering, manufacturing, and construction with the focus in food processing. A handful of survey and interview participants from the sector emphasised that they look for Quality Assurance and Quality Control (QAQC) certification among the applicants.
- iv. Collective inputs from the CfE survey respondents revealed digital engagement, teamwork, and planning and organising as the top 3 basic skills. As for the top 3 specific skills, participants have nominated test products for functionality or quality, inspect products or operations to ensure that standards are met, verify information or specifications. The top 3 technology tools nominated were regulatory compliance software, enterprise resource planning ERP software, and library management system.
- v. Furthermore, the survey also shows that in the next 1 – 2 years, the top anticipated skill for this job family is automated operation Monitoring. In terms of the types of trainings required for continuous up/reskilling, the top nominated selection is training on food safety.
- vi. Further investigation also suggests that certain gaps within the current talent pool and market demand needs to be bridged to facilitate digital adoption within the industry. Some of the gaps

highlighted by the industry stakeholders were a lack of relevant digital skills among employees and that the education system and syllabus are not updated in line with industry requirements/developments. The lack of digital adoption is supported through the interviews as most companies are not automating in the future despite less than 25% of the current tasks for this occupation can be automated.

Occupation: Food and Related Products Machine Operators

MASCO 2020(4-Digit Code): 8161

MASCO 2020(6-Digit Code): 8161-01; 8161-03; 8161-05; 8161-07; 8161-09; 8161-11; 8161-13; 8161-22; 8161-26; 8161-36; 8161-38; 8161-44; 8161-46; 8161-50; 8161-55; 8161-58; 8161-79; 8161-85; 8161-87; 8161-91; 8161-94

Only the following job titles within this occupation are included in the Critical Occupations List (MyCOL):

Machine Operator, Meat Processing; Machine Operator, Food Processing; Machine Operator, Seafood Production; Machine Operator, Sausage Production; Machine Operator, Fish Canning; Machine Operator, Dairy Product Processing; Machine Operator, Milk Powder Production; Mixer, Spice; Miller, Palm Oil; Machine Operator, Noodle Production; Machine Operator, Pastry Production; Machine Operator, Nut Processing; Machine Operator, Vegetable Processing; Machine Operator, Sauce Production; Maker, Jem; Dehydrator, Foodstuffs; Machine Operator, Coffee-Bean Processing; Food Processing Operator; Machine Operator, Coconut Peeler; Food Production Operator; Food Processing Worker

This occupation appears on MyCOL:

2018	No	2019	No	2020/2021	No	2022	Yes
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Source of evidence:

Top-down indicators	Passed 5 out of 9 indicators
Bottom-up CfE survey	136 nominations
Consultation	2 nominations
Talent/Skills studies	-

Top-down Data:

Working hours growth (1 year)	Working hours growth (3 years)	Employment growth (1 year)	Employment growth (3 years)	Wage premium growth (1 year)	Wage premium growth (3 years)
No	Yes	Yes	Yes	N/A	N/A
Education level decrease (1 year)	Education level decrease (3 years)	Number of vacancies	Vacancy rate	Falling education requirements in job postings	Degree of persistence in occupational shortage
No	No	Yes	No	Yes	N/A

Occupation Overview:	
Top Reasons of Hard-to-Fill: <ol style="list-style-type: none"> 1. Too few applicants or no applicant at all 2. Applicants' expected compensation is beyond the market rate 3. Applicants lack the required credentials or certification/ qualification 	Top Strategies to Meet Shortages: <ol style="list-style-type: none"> 1. Increasing worker hours or overtime 2. Increasing employee's training 3. Raising wages
Minimum Level of Qualification: <ol style="list-style-type: none"> 1. SPM Level 2. SKM Level 3 3. Advanced Diploma/ SKM Level 5 	Top Field of Study: <ol style="list-style-type: none"> 1. Engineering, Manufacturing, and Construction – Food Processing 2. General Programmes – Literacy and numeracy 3. General Programmes – Basic/broad, general programmes
Top Basic Skills: <ol style="list-style-type: none"> 1. Initiative and innovation 2. Teamwork 3. Planning and organising 	Top Specific Skills: <ol style="list-style-type: none"> 1. Operate food processing equipment 2. Clean production equipment 3. Position raw materials on processing or production equipment
Top Technology Tools: <ol style="list-style-type: none"> 1. Computer-based training software 2. Computer system software 3. Messaging and communications software 	Top Future Anticipated Skills: <ol style="list-style-type: none"> 1. Good Manufacturing Practices Implementation 2. Automation operation monitoring 3. Automated food manufacturing system maintenance
Top Trainings Needed: <ol style="list-style-type: none"> 1. Training on Food Safety 2. Training on Technology 3. Training on Occupational Safety and Health (OSH) 	
Bottom-up Evidence:	
<p>These occupations are included in the MyCOL and were nominated to reflect the need for machine operators in food processing, food production operator, and food processing worker.</p> <ol style="list-style-type: none"> i. These job titles were nominated approximately 136 times through the CfE survey and twice during interview with industry stakeholders. ii. The companies have also reported that vacancies within the occupation group are for fresh graduates (0 – 2 years) and mid-level personnel with above 2 years of experience. The key recruitment challenges cited by employers were too little applicants, higher expected compensation rate than the market, and lack of required credentials or qualification. As such employers look to overcome these challenges by increasing worker hours or overtime, increasing employee's training, and raising wages. iii. Employers also expressed that they are looking for SKM Level 5 as a minimum level of qualification for mid-level machine operator roles. As for entry roles, a minimum of SPM level or SKM Level 3 with good personal skills would be sufficient. Priority is also given to employees with background in manufacturing for food processing, general programmes specifically in literacy and numeracy, and broad general programmes. A handful of survey and interview participants from the sector emphasised that an important skill they look for in applicants is the ability to operate machine in a safe and appropriate way. 	

- iv. Collective inputs from the CfE survey respondents revealed initiative and innovation, teamwork, and planning and organising as the top 3 basic skills. As for the top 3 specific skills, participants have nominated operate food processing equipment, clean production equipment, and position raw materials on processing or production equipment. The top 3 technology tools nominated were computer-based training software, computer system software, and messaging and communications software.
- v. Furthermore, the survey also shows that in the next 1 – 2 years, the top 3 anticipated skills for this job family are Good Manufacturing Practices implementation, automation operation monitoring, automated food manufacturing system maintenance. In terms of the types of trainings required for continuous up/reskilling, the top 3 nominated selections are training on food safety, technology, and occupational safety and health (OSH).
- vi. Further challenge that highlighted by the industry stakeholders were wrong perception towards food processing industry, and thus talents will choose other jobs instead of joining food processing industry. This challenge can be overcome when the government, certification bodies, and industry player able to make changes by raising awareness to the targeted talent pool.

Recommendations

There are two main parts to the recommendations section of this report. The first part explores potential ways to enhance the current methodology adopted in the MyCOL study to enhance the utility and effectiveness of MyCOL in meeting the current and future labour and skill requirements of the Aerospace, Construction, and Manufacturing (Food Processing) sectors in Malaysia. The second part provides insights, strategies, and evidence-based recommendations for addressing the labour market challenges faced by the three sectors.

Recommendations for future enhancement of the utility and methodology of MyCOL

1) Incorporate the public university and vocational college databases into the top-down analysis

The current top-down methodology considers a range of data sources to define both quantity indicators (employment levels and vacancies) and price indicators (earnings and wage premium) as detailed in the earlier part of this report. However, it could be useful to incorporate databases from education institutions including public universities and vocational colleges in the design of labour supply indicators in the top-down approach. This would strengthen the robustness of the data used in the top-down approach. Enrolment rates in education institutions can provide important information on the talent/labour supply for a particular sector. Further, the availability of supply-side data will facilitate the process of determining occupations in shortage by comparing this data to the demand for workers in the same field or occupation. To incorporate such data into the top-down methodology, the data from the education institutions would need to be mapped to the relevant occupations based on MASCO 2020.

2) Enhance visibility and understanding of the data processing and analysis process through TalentCorp's internal Talent Analytics Platform (TAP)

Having launched a pilot test of its newly developed TAP during the process of conducting the MyCOL 2022/2023, TalentCorp could organise a download session at the start of the study to provide its external partners/consultants an overview of the system's functionalities and reporting format, which would streamline and shorten the learning process. TalentCorp could also consider granting its external partners/consultants greater visibility of the data processing and analysis process through TAP to allow early detection of any potential discrepancies in the top-down and dovetailing results. Overall, well-planned usage of the TAP could introduce greater efficiencies in the overall project execution and help avoid potential delays to the project timeline.

3) Improve the CfE survey response rate

The initial response rate of the 2022/2023 CfE survey was low. To improve the response rate, Ipsos Strategy3 and TalentCorp carried out various actions to engage with the targeted respondents as well as widen the survey distribution. This includes engaging with different industry associations to distribute the survey link to their members, engaging with industry employers via external events, and conducting the CfE survey via telephone. Further survey distribution channels could be considered for future MyCOL studies to ensure sufficient responses are gathered from employers in a timely manner. Examples of other distribution methods for the CfE survey utilising different social media platforms such as Facebook, LinkedIn, and Twitter to promote the survey and reach a wider audience of companies, and partnering with relevant industrial event and conference organisers to distribute the survey to the attendees.

4) Integrate MyCOL and MyNSR in a single online platform

Given that a key objective of the MyCOL 2022/2023 is to supplement the development of the MyNSR, more information on MyCOL including its purpose and role in the development of the MyNSR should be made available on the MyNSR website when it is launched. This will help increase public awareness of MyCOL and enhance its overall utility by different stakeholders. At the same time, integrating MyCOL and MyNSR in a single user-friendly and interactive online platform to showcase information on job vacancies and skills/qualification requirements at a national level could also widen the current applications of MyCOL. For example, together with MyNSR, the MyCOL could be used by job seekers to find suitable job opportunities that match their skills and qualifications and are also in demand.

Strategic recommendations for addressing the labour market challenges facing the Aerospace, Construction, and Manufacturing (Food Processing) sectors

Aerospace

1) Strengthen strategic collaboration between the Government, industry associations, employers, and education institutions

Strengthening strategic collaboration between government, employers, industry associations, and education institutions is crucial in updating education syllabus and providing effective practical industry work experience to students. Close collaboration between all parties can ensure that the education and training systems stay current with the latest industry developments and trends such as the usage of 3D printing and advanced materials in aerospace manufacturing, artificial intelligence, and machine learning technologies. The government can provide financial and policy support to ensure that education and training programs are up to date and relevant to the needs of the aerospace industry. Employers and industry associations can provide insight into the skills that are in demand in the labour market and help to design training programs that meet those needs. Education institutions can utilise this information to revise their curriculum and design effective industrial training programmes that incorporate elements of real-world application for their students. The highly successful German dual education system, which combines on-the-job training with classroom instruction, can be a reference point for best practices in order to provide employers with a steady supply of well-trained and highly skilled workers. Overall, closer collaborations between all parties will help to bridge the gap between education and employment, ensuring that students are well-prepared and are able to meet industry demands when they enter the workforce after graduation.

2) Establish partnerships/collaborations with regional/international aerospace organisations to create sustained human capital growth and development

The Malaysian aerospace industry could leverage on its expertise and position as a hub for aerospace manufacturing and MRO services in the Southeast Asia region to address its issues of skills shortage and mismatch through the establishment of partnerships with other regional countries such as Singapore and Indonesia. Such partnerships could be led by industry associations such as MAIA, to bring benefits such as joint training programmes and research and development opportunities to the local aerospace sector. This would allow the countries to share expertise as well as reduce training and R&D costs. More importantly, this can provide the local workforce with upskilling opportunities and exposure to the latest technologies, which would benefit the growth and development of the Malaysian aerospace industry in the long run. At the same time, work placement or exchange programmes could also be established

through the regional partnerships to provide workers the chance to work abroad and gain exposure to different working practices and technologies. This can help the workers gain new perspectives and ideas, and allow them to implement the industry's best practices upon their return. Ultimately, the potential benefits of an effective regional partnership can help increase the global competitiveness of the aerospace industry in Malaysia and attract greater investments and growth to the sector.

3) Recognition of prior experiential learning

As a highly specialised industry with the need for specific qualifications to carry out specific work on various fleets of aircraft, the industry could benefit from recognising the skills and experiences of its workers, in particular aircraft technicians through the recognition of prior experiential learning (RPEL) programme offered by HRD Corp. RPEL is a scheme under the Twelfth Malaysia Plan which aims to recognise the abilities of Malaysian workers with qualifications below diploma or equivalent in specific skills based on the standards established by the Department of Skills Development (DSD) or related certifications, with the goal of promoting their professional development. This initiative could be promoted among industry employers to encourage them to certify their workers, which would address the needs of the industry as well as offer greater career advancement opportunities to the workers.

Construction

1) Raise awareness of potential career opportunities in the construction sector to encourage greater participation in the sector

Partnerships between industry associations, employers, vocational schools and other education institutions can be effective in promoting careers in the construction sector. By offering well-structured internships, apprenticeships, other training programmes, students can gain good exposure to the industry and experience working in the industry. In addition, industry events and workshops could also be held to raise awareness of the diverse career opportunities available in the construction industry. These events also provide students networking opportunities with industry professionals to learn about the latest industry developments, technologies, and safety measures. Through these initiatives, it is hoped that the public perception of construction as a 3D sector will change which will encourage greater participation in the sector especially among the younger generations.

2) Encourage greater investments in technology and infrastructure

The construction industry in Malaysia lags many countries in the region such as Singapore in terms of technology adoption. The main reasons for this are a lack of financial capacity of the local companies to invest in costly industrial technologies and construction techniques, and the lack of skilled workers required to operate the technologies. While technologies such as BIM and augmented reality have been widely adopted in more developed countries, many local companies and workers in the local construction industry lack exposure to these technologies, given the minimal investments made by the local construction industry. As such, the government, through CIDB, could work with industry associations such as MBAM to provide financial incentives in the form of tax incentives, training grants, and subsidies to encourage wider investment in technologies. With global trends such as green building technologies and automation becoming increasingly popular, investments in these technologies could give the construction sector in Malaysia a competitive edge over its regional competitors and create new jobs in the industry that may be more appealing to the younger generations.

3) Improve workplace safety

To address the public's 3D perception of the construction industry in Malaysia, it is vital for the industry as a whole to improve the safety levels at construction sites. Any accidents could significantly tarnish the image of the construction industry and deter people from working in the sector. The Department of Occupational Safety and Health should work closely with the industry to enhance the existing safety guidelines for all construction activities in Malaysia. Crucially, strong and effective enforcement is required to ensure these guidelines are implemented and adhered to by all construction firms in Malaysia. Consultations feedback revealed that many construction workers in Malaysia do not comply with the proper use of personal protective equipment while working at construction sites despite it being a legal requirement per the Occupational Safety and Health Act 1994. Therefore, in addition to stronger enforcement of workplace safety rules, construction workers should be given additional training on occupational health and safety to educate them on potential hazards at construction sites and ways to reduce occupational risks.

Manufacturing (Food Processing)

1) Upskilling the industry workforce

Common concerns among workers in the Malaysian food processing industry are lack of career advancement opportunities and low wages. Therefore, it is important to bring in greater investments to upskill the workforce, grow the sector, and ultimately create more high-skilled jobs. To do this, the government along with key stakeholders from the industry could provide opportunities for workers to upskill and advance their careers through the provision of training and certification courses. By achieving qualifications of global standards such as ISO 22000 and HACCP, the local food processing industry will be able to attract greater investments which will enable it to overcome issues such as poor working conditions, low wages, and lack of career advancement opportunities. For example, investments in automation and robotics technologies can help reduce laborious tasks and allow greater focus on R&D activities which will create demand for more high-skilled occupations. In addition, the food processing industry in Malaysia should also leverage on its existing knowledge of halal food manufacturing/processing to provide halal certification training and certification for its workers through the Department of Islamic Development (JAKIM), which will allow it to capitalise on the growing demand for halal-certified food product in international markets such as Indonesia and the Middle East region.

2) Raise awareness on the available career pathways in the industry

Raising awareness about the available career pathways in the food processing industry in Malaysia is important to attract and retain talent in the industry, especially as it suffers from a high turnover rate. Examples of raising awareness and uplifting the image of the industry include partnerships between industry association such as FMM and education institutions to introduce available career pathways to students through career fairs and field trips to local food manufacturing factories. At the same time, internship and apprenticeship programmes could also be offered to students for them to gain industrial experience. At the same time, students with good potential could also be offered scholarships by industry employers as an encouragement for them to take up a career in food manufacturing. As more students take up courses that are relevant to the sector, this will increase the level of technical competencies of workers in the long run, and ultimately lead to the creation of higher-skilled roles in the industry.

3) Promote flexible work arrangements

Despite the increased popularity of flexible work arrangements such as working from home, the production nature of the food processing industry makes it difficult for the sector to implement such practices. This is one of the key factors that contributes to the high turnover rate in the industry, with many especially the younger workers switching to jobs in the gig economy in search of better work flexibility and hours. Therefore, it is important for local food manufacturers to acknowledge the increased demand for greater work flexibility and introduce evolving work practices to meet the requirements of the young generation of workers. With the increasing adoption of digitalisation in the production processes, increased flexibility could be offered to roles such as machine operators and maintenance technicians to operate machineries and performance maintenance work remotely. Another way to introduce greater flexibility is to offer flexible scheduling options to the workers. This could include flexible start and end times, as well as rotating work shifts which could be especially beneficial to workers with family responsibilities and other personal obligations.

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Appendix

APPENDIX 1: TOP-DOWN SHORTAGE OCCUPATIONS

MASCO Code	MASCO Job Title	Total indicators available	Number of indicators exceeding threshold	Percentage of indicators passing threshold
1121	Managing Directors And Chief Executives	12	7	58%
1211	Finance Managers	12	6	50%
1212	Human Resource Managers	12	6	50%
1213	Policy And Planning Managers	3	2	67%
1216	Quality Managers	2	1	50%
1219	Business Services and Administration Managers Not Elsewhere Classified	6	3	50%
1221	Sales And Marketing Managers	12	6	50%
1222	Advertising And Public Relations Managers	7	4	57%
1223	Research And Development Managers	3	2	67%
1321	Manufacturing Managers	12	6	50%
1322	Mining Managers	4	2	50%
1511	Information And Communications Technology Managers	12	6	50%
1612	Health Services Managers	2	1	50%
1617	Legal Managers	2	1	50%
1618	Property Managers	2	1	50%
1623	Security Managers	4	2	50%
2112	Meteorologists And Seismologists	2	1	50%
2113	Chemists	8	5	63%
2114	Geologists And Geophysicists	3	2	67%
2121	Mathematicians, Actuaries And Statisticians	3	2	67%
2131	Biologists, Botanists, Zoologists And Related Professionals	2	1	50%
2133	Environmental Protection Professionals	2	1	50%
2134	Pharmacologists, Pathologists And Related Professionals	2	1	50%
2141	Industrial And Production Engineers	12	6	50%
2142	Civil Engineers	12	6	50%
2143	Environmental Engineers	1	1	100%
2144	Mechanical Engineers	12	6	50%
2146	Mining Engineers, Metallurgists And Related Professionals	8	4	50%
2153	Telecommunications Engineers	3	2	67%
2163	Product And Garment Designers	2	1	50%
2172	Ship Deck Officers And Pilots	2	1	50%
2173	Aircraft Pilots And Related Professionals	3	2	67%
2212	Specialist Medical Practitioners	3	2	67%
2251	Veterinarians	1	1	100%
2262	Pharmacists	11	7	64%

MASCO Code	MASCO Job Title	Total indicators available	Number of indicators exceeding threshold	Percentage of indicators passing threshold
2264	Physiotherapists	11	6	55%
2265	Dieticians And Nutritionists	2	1	50%
2311	University And Higher Education Teaching Professionals	12	7	58%
2352	Arts Teachers	2	1	50%
2391	Education Method Specialists	1	1	100%
2393	Information Technology Trainers	1	1	100%
2399	Teaching Professionals Not Elsewhere Classified	11	7	64%
2413	Financial Analysts	3	2	67%
2421	Management And Organisation Analysts	12	7	58%
2424	Training And Staff Development Professionals	2	1	50%
2433	Technical And Medical Sales Professionals (Excluding ICT)	2	1	50%
2434	Information And Communications Technology (ICT) Sales Professionals	3	2	67%
2519	Software And Application Developers And Analysts Not Elsewhere Classified	3	2	67%
2521	Database Designers And Administrators	3	2	67%
2522	Information Technology System Administrators	12	6	50%
2523	Computer Network Professionals	3	2	67%
2529	Unclassified	1	1	100%
2619	Legal Professionals Not Elsewhere Classified	2	1	50%
2711	Hotel Professionals	2	2	100%
2712	Restaurant Professionals	2	2	100%
2812	Librarians And Related Information Professionals	6	3	50%
2833	Translators, Interpreters And Other Linguists	2	2	100%
2841	Visual Artists	2	2	100%
2844	Film, Stage And Related Directors And Producers	3	2	67%
2846	Announcers On Radio, Television And Other Media	2	2	100%
2848	Animal Keepers And Trainers	2	1	50%
2849	Creative And Performing Artists Not Elsewhere Classified	2	1	50%
2911	Professional Customs And Border Inspectors	10	5	50%
2912	Professional Taxation And Excise Officials	2	1	50%
2915	Professional Police Officials	9	5	56%
3113	Electrical Engineering Technicians	12	6	50%
3114	Electronics Engineering Technicians	12	6	50%
3115	Mechanical Engineering Technicians	12	6	50%
3117	Mining And Metallurgical Technicians	2	1	50%
3122	Manufacturing Supervisors	10	5	50%
3123	Construction Supervisors	10	5	50%
3131	Power Production Plant Operators	2	1	50%
3133	Chemical Processing Plant Controllers	1	1	100%

MASCO Code	MASCO Job Title	Total indicators available	Number of indicators exceeding threshold	Percentage of indicators passing threshold
3134	Petroleum And Natural Gas Refining Plant Operators	2	2	100%
3141	Life Science Technicians (Excluding Medical)	2	1	50%
3159	Transport Technicians Not Elsewhere Classified	2	1	50%
3211	Medical Imaging And Therapeutic Equipment Technicians	7	4	57%
3212	Medical And Pathology Laboratory Technicians	1	1	100%
3213	Pharmaceutical Technicians And Assistants	11	6	55%
3251	Dental Assistants And Therapists	11	6	55%
3252	Medical Record And Health Information Technicians	1	1	100%
3321	Insurance Agents	12	7	58%
3322	Commercial Sales Agent	10	5	50%
3324	Trade Brokers	2	2	100%
3332	Conference And Event Agents	11	6	55%
3334	Real Estate And Property Agents	11	6	55%
3513	Computer Network And Systems Technicians	2	1	50%
3521	Broadcasting And Audio-Visual Technicians	11	6	55%
3623	Fitness And Recreation Instructors And Programme Leaders	2	2	100%
3631	Photographers	10	8	80%
3632	Interior Designers And Decorators	10	5	50%
3634	Cultural Associate Professionals	1	1	100%
4111	General Office Clerks	9	6	67%
4131	Typists	2	1	50%
4132	Data Entry Clerks	11	6	55%
4212	Bookmakers, Croupiers And Related Gaming Workers	6	3	50%
4223	Telephone Operators	6	3	50%
4225	Enquiry Clerks	10	5	50%
4226	Survey and Market Research Interviewers	2	2	100%
4229	Client Information Workers Not Elsewhere Classified	2	2	100%
4311	Accounting And Book-Keeping Clerks	11	6	55%
4312	Statistical, Finance And Insurance Clerks	11	6	55%
4313	Payroll Clerks	2	1	50%
4321	Stock Clerks	9	5	56%
4323	Transport Clerks	11	6	55%
4411	Library Clerks	2	2	100%
4412	Mail Carriers And Sorting Clerks	10	5	50%
4414	Scribes and Related Workers	2	2	100%
4415	Filing And Copying Clerks	11	6	55%
5131	Waiters	9	5	56%
5132	Bartenders	11	6	55%

MASCO Code	MASCO Job Title	Total indicators available	Number of indicators exceeding threshold	Percentage of indicators passing threshold
5141	Hairdressers	8	4	50%
5151	Cleaning And Housekeeping Supervisors In Offices, Hotels And Other Establishments	8	5	63%
5152	Domestic Housekeepers	2	2	100%
5153	Building Caretakers	9	5	56%
5169	Personal Services Workers Not Elsewhere Classified	3	3	100%
5211	Stall And Market Salespersons	8	4	50%
5212	Street Food Salespersons	8	5	63%
5221	Shopkeepers	9	6	67%
5222	Shop Supervisors	8	4	50%
5223	Shop Sales Assistants	9	5	56%
5231	Cashiers And Ticket Clerks	9	5	56%
5243	Door-To-Door Salespersons	11	6	55%
5244	Contact Centre Salespersons	9	6	67%
5249	Sales Workers Not Elsewhere Classified	2	2	100%
5322	Hone-Based Personal Care Workers	2	2	100%
5329	Personal Care Workers in Health Services Not Elsewhere Classified	2	2	100%
5414	Security Guards	8	4	50%
6111	Field Crop Growers	8	4	50%
6112	Shrub Crop Growers	8	6	75%
6113	Gardeners, Horticultural And Nursery Growers	8	4	50%
6114	Mixed Crop Growers	8	5	63%
6115	Vegetable Growers	8	5	63%
6121	Livestock And Dairy Producers	8	5	63%
6122	Poultry Producers	8	6	75%
6123	Apiarists and Sericulturists	2	2	100%
6222	Skilled Inland And Coastal Waters Fishery Workers	9	7	78%
6311	Subsistence Crop Farmers	6	3	50%
6331	Subsistence Mixed Crop and Livestock Farmers	2	2	100%
6341	Subsistence Fishermen, Hunters, Trappers And Gatherers	8	4	50%
7125	Plumbers and Pipe Fitters	2	2	100%
7127	Air Conditioning And Refrigeration Mechanics	9	5	56%
7211	Metal Moulders And Coremakers	2	1	50%
7213	Sheet-Metal Workers	5	3	60%
7214	Structural-Metal Preparers and Erectors	2	2	100%
7223	Metal Working Machine Tool Setters and Operators	2	2	100%
7224	Metal Polishers, Wheel Grinders And Tool Sharpeners	2	2	100%
7231	Motor Vehicle Mechanics And Repairers	8	4	50%

MASCO Code	MASCO Job Title	Total indicators available	Number of indicators exceeding threshold	Percentage of indicators passing threshold
7232	Aircraft Engine Mechanics and Repairers	2	2	100%
7233	Agricultural And Industrial Machinery Mechanics And Repairers	9	5	56%
7234	Bicycle and Related Repairers	2	2	100%
7239	Machinery Mechanics And Repairers Not Elsewhere Classified	8	4	50%
7316	Sign Writers, Decorative Painters, Engravers and Etchers	2	2	100%
7317	Handicraft Workers In Wood, Basketry And Related Materials	8	4	50%
7318	Handicraft Workers In Textile, Leather And Related Materials	8	4	50%
7319	Handicraft Workers Not Elsewhere Classified	2	2	100%
7321	Pre-Press Workers	2	2	100%
7323	Print Finishing And Binding Workers	1	1	100%
7411	Building And Related Electricians	9	5	56%
7412	Electrical Mechanics And Fitters	10	6	60%
7421	Electronics Mechanics And Services	10	5	50%
7422	Information And Communications Technology Installers And Services	10	5	50%
7512	Bakers, Pastry And Pasta-Cooks, And Confectionery Makers	10	5	50%
7516	Tobacco Preparers and Tobacco Product Makers	1	1	100%
7623	Shoemakers and Related Workers	2	1	50%
7631	Underwater Divers	1	1	100%
7633	Product Graders And Testers (Excluding Foods And Beverages)	2	1	50%
7634	Fumigators And Pest And Weed Controllers	3	2	67%
8112	Mineral And Stone Processing Plant Operators	4	2	50%
8113	Well Drillers And Borers And Related Workers	2	2	100%
8122	Metal Finishing, Plating And Coating Machine Operators	4	2	50%
8132	Photographic Products Machine Operators	1	1	100%
8152	Weaving and Knitting Machine Operator	1	1	100%
8156	Shoemaking and Related Machine Operators	2	1	50%
8161	Food And Related Products Machine Operators	9	5	56%
8171	Pulp and Papermaking Plant Operators	1	1	100%
8173	Wood Products Machine Operators	10	5	50%
8181	Glass And Ceramics Plant Operators	10	5	50%
8189	Stationary Plant And Machine Operators Not Elsewhere Classified	10	5	50%
8311	Locomotive Engine Drivers	3	2	67%
8321	Motorcycle Riders (Drivers)	9	6	67%
8331	Bus And Tram Drivers	8	4	50%
8332	Heavy Truck And Lorry Drivers	10	5	50%

APPENDIX 2: ECONOMIC SECTORS COVERED IN 2022/2023 MyCOL

Sector	Priority Sub-sectors	MSIC
Section C: Manufacturing	1. Manufacture of food products	10
	2. Manufacture of beverages	11
	3. Manufacture of machinery and equipment n.e.c.	28
	4. Manufacture of other transport equipment	30
	5. Repair and installation of machinery and equipment	33
Section F: Construction	6. Construction of buildings	41
	7. Civil engineering	42
	8. Specialized construction activities	43
Section H: Transportation and Storage	9. Air transport	51
Section M: Professional, Scientific and Technical Activities	10. Architectural and engineering activities; technical testing and analysis	71
	11. Scientific research and development	72

APPENDIX 3: CALL-FOR-EVIDENCE (CFE) SURVEY QUESTIONNAIRE 2022



Call for Evidence (CfE) – Survey 2022

Introduction

TalentCorp Malaysia (TalentCorp) is carrying out a Call for Evidence (CfE) survey of critical occupations in Malaysia. The information collected will provide great support to the Government to monitor the labour market and will contribute to the development of human capital by improving Malaysia's economic competitiveness. For this year, the COL will be focusing on three sectors – Food Processing, Construction and Aerospace to support the development of Malaysia National Skills Registry (MyNSR).

The Study is carried out to ensure the efficiency of labour market, the match between skills demand and supply, enhancement on skills capability of the workforce, as well as the improvement on economic resilience.

The company's response to this survey will be kept **strictly confidential** and will be used solely for the purposes and objectives of improving the labour market operations in the Malaysia's economy.

Ipsos Strategy3 has been appointed to assist in data collection for CfE Survey 2022.

If you have any questions about this survey, please contact any of the officers listed below:

Officer's Contact Details				
No.	Officer	Designation	Contact No.	Email
1	Nursyazwani binti Zulhaimi	Manager, Group Research Development and Policy, TalentCorp	017-200 7559	nursyazwani.zulhaimi@talentcorp.com.my
2	Nurul Izzati binti Kamrulbahri	Assistant Manager, Group Research Development and Policy, TalentCorp	019-611 6917	izzati.kamrulbahri@talentcorp.com.my
3	Didier Chai	Senior Consultant, Ipsos Strategy3	03-2289 3000	Didier.Chai@ipsos.com
4	Cheng Zhi Yeen	Associate Consultant, Ipsos Strategy3	03-2289 3000	Zhiyeen.Cheng@ipsos.com

CfE – Survey 2022

BACKGROUND OF STUDY



A Critical Skills Committee (CSC) jointly chaired by TalentCorp and ILMIA, has been tasked to review the CfE survey and to recommend actions **to resolve inefficiencies in skills shortages and deficits**



The Study aims to develop the Critical Occupations List (COL) for three selected sectors, namely **Food Processing, Construction and Aerospace**.



The Study would also provide the initial framework for the development of the Malaysia National Skills Registry (MyNSR) through the validation of selected indicators.

BACKGROUND OF SURVEY



What is COL?

The main objective of this survey is to collect information on COL, identify skills imbalances across the selected three industrial sectors in the Malaysian economy, as well as supporting the development of MyNSR framework.



How would COL be used?

The COL will provide information that is useful for investments into training programme, design of incentives to enhance training and apprenticeship programmes, and to set criteria for skills migration.



What does the CfE survey focus on?

The survey examines four different sections related to occupations and skills:

1. Background of company
2. Critical occupations
3. Automation
4. Future anticipated skills and training required for upskilling



What is the contribution of the respondent to this Study?

1. Identify occupations, jobs and the relevant skills that are critical to the sector
2. Justify the criticality of the selected occupations, jobs, and skills
3. Define the challenges in recruitment and hiring process
4. Indicate the potential to automate the selected occupations
5. Suggest required future skills for the selected occupations and training for upskilling / reskilling

Section 1A: Company Background

A1. Respondent Name

A2. Please indicate your preferred title

Title	Code (SA)
YBhg Tan Sri	1
Dato' Seri	2
Dato'	3
Datuk	4
Datin	5
Dr.	6
Mr.	7
Mrs.	8
Ms.	9
Others: _____	99

A3. Company Name

A4. Company SSM Registration No.

A5. Company Address

A6. State

State	Code (SA)
Johor	1
Kedah	2
Kelantan	3
Melaka	4
Negeri Sembilan	5
Pahang	6
Pulau Pinang	7
Perak	8
Perlis	9
Selangor	10
Terengganu	11
Sabah	12

Sarawak	13
W.P. Kuala Lumpur	14
W.P. Labuan	15
W.P. Putrajaya	16

A7. Office Telephone

A8. Mobile Telephone

A9. Email Address

Section 1B: Main Activity of the Company

B1. Which industrial sector best describes your company's business activities? [SA]

B2. Which industrial sub-sector, best describes your company's business activities? [SA]

B3. Which industrial group, best describes your company's business activities? [SA]

B1. Industrial Sector	B2. Industrial Sub-sector	B3. Industrial group	Code	Go to
1. Manufacturing: Food processing & Aerospace	1. Manufacture of food products	Processing and preserving of meat and production of meat products	1	B4
		Processing and preserving of fish, crustaceans and molluscs	2	
		Processing and preserving of fruit and vegetables	3	
		Manufacture of vegetable and animal oils and fats	4	
		Manufacture of dairy products	5	
		Manufacture of grain mill products	6	
		Manufacture of other food products	7	
		Manufacture of prepared animal feeds	8	
	2. Manufacture of beverages	Manufacture of beverages	9	
	3. Manufacture of machinery and equipment n.e.c.	Manufacture of general-purpose machinery	10	
		Manufacture of specific-purpose machinery	11	
	4. Manufacture of other transport equipment	Manufacture of air and spacecraft and related machinery	12	
		Manufacture of military fighting vehicle	13	
		Manufacture of transport equipment n.e.c.	14	
	5. Repair and installation of machinery and equipment	Repair of fabricated metal products, machinery and equipment	15	
		Installation of industrial machinery and equipment	16	

2. Construction	6. Construction of buildings	Construction of buildings	17	B5	
	7. Civil engineering	Construction of roads and railways	18		
		Construction of utility projects	19		
		Construction of other civil engineering projects, excepts buildings	20		
		8. Specialized construction activities	Demolition and site preparation		21
	8. Specialized construction activities	Electrical, plumbing and other construction installation activities	22		
		Building completion and finishing	23		
		Other specialized construction activities	24		
	3. Aerospace: Transportation and storage	9. Air transport	Passenger air transport		25
			Freight air transport		26
4. Aerospace: Professional, scientific and technical activities	10. Architectural and engineering activities; technical testing and analysis	Architectural and engineering activities and related technical consultancy	27		
		Technical testing and analysis	28		
	11. Scientific research and development	Research and experimental development on natural sciences and engineering	29		

B4. What is the size of your company?

<Note to programmer: Only for Code 1 to 16 in Question B3. >

Manufacturing Sector	Code (SA)	Go To
Micro Sales turnover: < RM300,000 OR No. of Full Time Employees: < 5	1	B6
Small Sales turnover: RM300,000 < RM15 mil OR No. of Full Time Employees: From 5 to < 75	2	
Medium Sales turnover: RM15 mil ≤ RM50 mil OR No. of Full Time Employees: From 75 to ≤ 200	3	
Large Sales turnover: > RM50 mil OR No. of Full Time Employees: > 200	4	

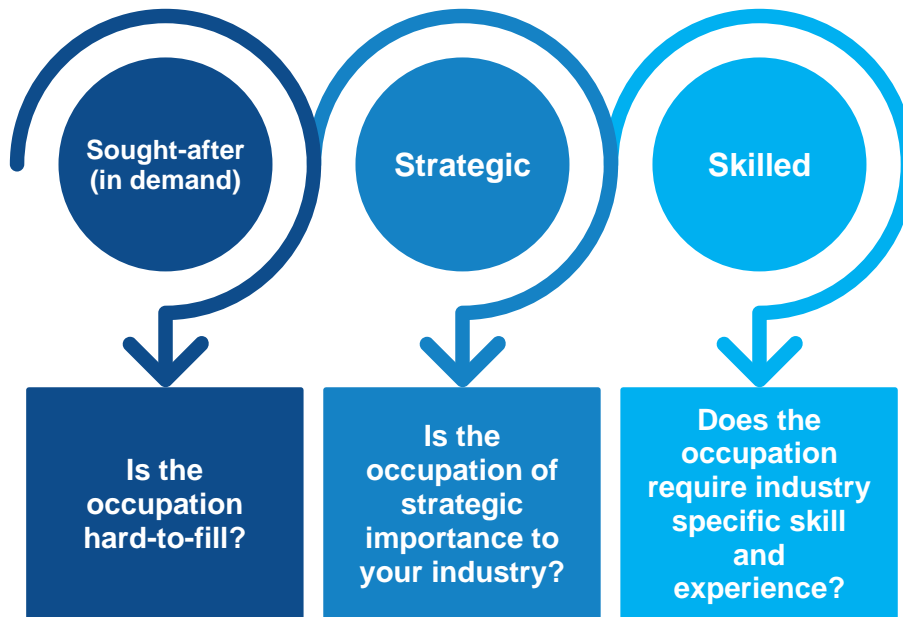
B5. What is the size of your company?

<Note to programmer: For ALL codes in Question B3, EXCEPT for Code 1 to 16. >

Services & Other Sectors	Code (SA)	Go To
Micro Sales turnover: < RM300,000 OR No. of Full Time Employees: < 5	1	B6
Small Sales turnover: RM300,000 < RM3 mil OR No. of Full Time Employees: From 5 to < 30	2	
Medium Sales turnover: RM3 mil ≤ RM20 mil OR No. of Full Time Employees: From 30 to ≤ 75	3	
Large Sales turnover: > RM20 mil OR No. of Full Time Employees: > 75	4	

B6. Does your company have any critical occupation?

A critical occupation is defined by three specific criteria:

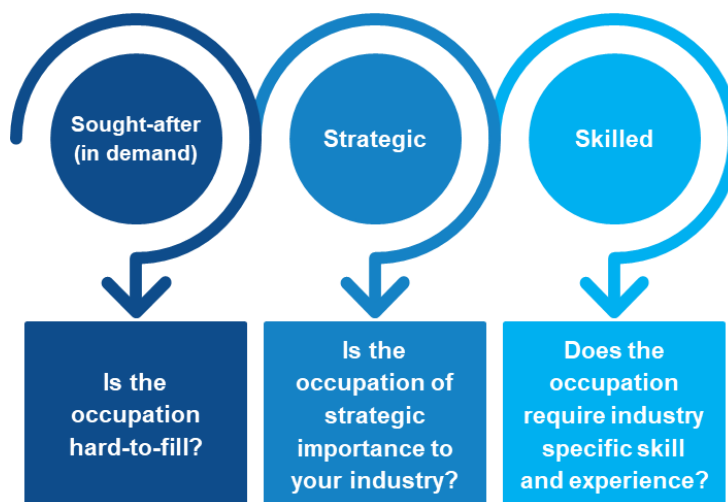


Does your company have any critical occupation?	Code (SA)	Go to:
Yes	1	Continue Section 2
No	2	Survey Terminates. Thank You.

Section 2: Critical Occupations

Instruction:

A critical occupation is defined by three specific criteria:



1. In this section, please nominate the jobs that you deem are critical to your company, based on the three criteria: i.e. sought after, strategic and skilled (see above).
2. Please answer the questions to the best of your ability. All questions are mandatory unless otherwise stated.
3. Read the column titles / questions carefully and fill in the details of critical job positions in the table provided below.

MASCO 2020	Q3. Job Category	Q1. Job Title	Q2. Job Department	Q4. Key Responsibilities / Job Description (Please be as specific as possible) (OE)
	<u>Options:</u> 1 = Managers 2 = Professionals 3 = Technicians & associate professionals 4 = Clerical support workers 5 = Service & sales workers 6 = Skilled agricultural, forestry, livestock & fishery workers 7 = Craft & related trades workers 8 = Plant & machine operators & assemblers [SA]		<u>Options:</u> 1 = Sales 2 = Support 3 = Operations 4 = Management 5 = Admin 97 = Others [SA]	

<i>E.g.</i>	1	<i>Process Engineer</i>	2	<i>Designing chemical processes for palm oil refineries</i>

<Note to programmer: minimum must list 1 job title, max up to 10.>

<Note to programmer: For Q2, please insert text box for code 97. >

<Note to programmer: Q2 – Q27 ask in loop a single page based on the selection in Q1 for each Job title>

<Note to programmer: For each Job Title: Q6 cannot exceed Q5; Sum of Q9a cannot exceed Q8. >

<Note to programmer: If the table is too long to be displayed, please break the table with Q8 and Q9 into next table. >

Instruction:

*In the example below, **12 process engineers** (see Q10) **are needed ideally, by next year (between January 2023 to December 2023).***

MASCO 2020 <i><Note to programmer: This should be auto populated with the MASCO 2020 codes based on the input to Q1></i>	JOB TITLE <i>(Note: please pipe in Job Titles and ID No. listed in Q1)</i>	Q10. What is the total number of employees required <u>between January to December 2023</u> for this position to ensure products / services are met? (OE)
<i>E.g.</i>	<i>Process Engineer</i>	12
ID01		
ID02		
ID03		
ID04		
ID05		
ID06		
ID07		
ID08		
ID09		
ID10		

Instruction:

In the example below, all vacancies for the Process Engineer job position **took an average of 3 months to fill.**

MASCO 2020 <i><Note to programmer: This should be auto populated with the MASCO 2020 codes based on the input to Q1></i>	JOB TITLE <i>(Note: please pipe in Job Titles and ID No. listed in Q1)</i>	Q11. What is the average time taken to fill vacancies for this position? (in months) (OE)
<i>E.g.</i>	<i>Process Engineer</i>	3
ID01		
ID02		
ID03		
ID04		
ID05		
ID06		
ID07		
ID08		
ID09		
ID10		

Instruction:

In the example below, all vacancies for the Process Engineer job position **require these basic skills, specific skills and technology tools to perform the required tasks.**

MASCO 2020	JOB TITLE <i>(Note: please pipe in Job Titles and ID No. listed in Q1)</i>	Q12						Q13.			Q14.		
		a) What are the top 3 basic skills required for this position? <i><Note to programmer: Multi selected type> [SA]</i>						What are the top-3 specific skills that are required for this position? <i><Note to programmer: Show drop down list with text filters for this question Q13). [SA]</i>			What are the top-3 technology tools required for this position? <i><Note to programmer: Show drop down list with description for each answer option. Add text filters for this question Q14.</i>		
		TOP 1 SKILL	Level: TOP 1 SKILL	TOP 2 SKILL	Level: TOP 2 SKILL	TOP 3 SKILL	Level: TOP 3 SKILL	TOP 1 SKILL	TOP 2 SKILL	TOP 3 SKILL	TOP 1 TECHNOLOGY TOOL	TOP 2 TECHNOLOGY TOOL	TOP 3 TECHNOLOGY TOOL
E.g.	Process Engineer	Numeracy	4	Team work	2	Reading	5						
ID01													
ID02													
ID03													
ID04													
ID05													
ID06													
ID07													
ID08													
ID09													
ID10													

MASCO 2020 <i><Note to programmer: This should be auto populated with the MASCO 2020 codes based on the input to Q1></i>	JOB TITLE <i>(Note: please pipe in Job Titles and ID No. listed in Q1)</i>	Q15. Is this position hard-to-fill? (Please select code 1 or 2 for each critical job position) <i>Options:</i> Code 1 = Yes Code 2 = No (skip to Q17) (SA)	Q16. What are the top-3 reasons that this position is hard to fill? <i>Options:</i> 1 = Too few applicants or no applicant at all 2 = Applicants lack the required credentials or certification / qualification 3 = Applicants lack relevant job experience 4 = Applicants lack the required technical skills. Please specify the technical skills: _____ 5 = Applicants lack other required skills (e.g. time management, ability to get along with others, teamwork, creativity, problem solving, reading, writing, speaking, maths and logic, etc.). Please specify: _____ 6 = Applicants' expected compensation is beyond the market rate 7 = We cannot afford to pay the market rate for the applicants due to cost-cutting effort post-pandemic 8 = We cannot afford to pay the market rate for the applicants due to poor business/sales 9 = Applicants do not have required digital skills to address the needs post pandemic 97 = Others (please specify): _____ (SA)		
			TOP 1 REASON	TOP 2 REASON (OPTIONAL)	TOP 3 REASON (OPTIONAL)
E.g.	Process Engineer	1	1	5	7
ID01					
ID02					
ID03					
ID04					
ID05					
ID06					
ID07					
ID08					
ID09					
ID10					

<Note to programmer: For Q16, please insert text box for code 97, 4, 5. >

MASCO 2020	JOB TITLE <i>(Note: please pipe in Job Titles and ID No. listed in Q1)</i>	Q17. What were the top-3 strategies your company has used to fill the vacant positions?			
		TOP 1 STRATEGY	TOP 2 STRATEGY (OPTIONAL)	TOP 3 STRATEGY (OPTIONAL)	
<i><Note to programmer: This should be auto populated with the MASCO 2020 codes based on the input to Q1></i>		<i>Options:</i> 1 = Raising wages 2 = Hiring less well qualified applicants 3 = Expanding local recruitment efforts (e.g. wider distribution of job openings, increased presence at career fairs, increased use of recruitment firms, etc.) 4 = Expanding international recruitment efforts 5 = Increasing employees' training 6 = Establishing or expanding partnerships with education or training providers focused on recruitment of graduates 7 = Increasing worker hours or overtime 8 = Convincing workers to delay retirement 9 = Converting part-time workers to full time status 10 = Hiring temporary or contract workers 11 = Outsourcing this job function 12 = Automating tasks performed in this occupation 97 = Others (please specify): _____ 99 = None (SA)			
	<i>E.g.</i>	<i>Process Engineer</i>	1	5	7
	ID01				
	ID02				
	ID03				
	ID04				
	ID05				
	ID06				
	ID07				
	ID08				
	ID09				
ID10					

<Note to programmer: For Q17, please insert text box for code 97. >

MASCO 2020 <i><Note to programmer: This should be auto populated with the MASCO 2020 codes based on the input to Q1></i>	JOB TITLE <i>(Note: please pipe in Job Titles and ID No. listed in Q1)</i>	Q18. Do you think this position is more or less hard-to-fill now than one year ago? <i>Options:</i> 1 = More hard-to-fill 2 = Neither more nor less hard-to-fill 3 = Less hard-to-fill (SA)	Q19. What is the minimum level of qualification needed for this position? <i>Options:</i> 1 = No formal education required 2 = UPSR Level 3 = PMR/PT3 Level 4 = SKM Level 1 & 2 5 = SPM Level 6 = STPM Level / Matriculation / Foundation / Pre-University Program 7 = SKM Level 3 8 = Diploma / SKM Level 4 9 = Advanced Diploma / SKM Level 5 10 = Bachelor's Degree / Graduate Diploma / Graduate Certificate 11 = Master's Degree (by Research or Mixed Mode & Coursework) / Postgraduate Diploma / Postgraduate Certificate 12 = PhD / Doctoral Degree 97 = Others: _____ (SA)	Q20. What is the field of studies / education required for this position? <i>Options:</i> <i><Note to programmer: Show drop down list for this question, drop down list available in next page. ></i>	Q21. What other additional certification is needed for this position? <i><Open Ended></i>	Q22 How many minimum years of industry work experience is required for the role? <i>Options:</i> 1 = 0 to 1 year 2 = 1 2 to 3 years 3 = 3 4 to 5 years 4 = more than 5 years
E.g.	Process Engineer	3	8			
ID01						
ID02						
ID03						
ID04						
ID05						
ID06						
ID07						
ID08						
ID09						
ID10						

<Note to programmer: For Q18, please insert radio button for each option code. >

<Note to programmer: For Q19, please insert text box for code 97. >

<Note to programmer: For Q21, please insert text box for answers. >

Q12. Basic Skills [REFERENCE ONLY]

No	Basic Skills	Description	Proficiency Level	Proficiency Level Description
1	Eg: Numeracy	Using mathematics to solve problems and interpreting mathematical information appropriately.	1	Identify the numerical position of items on a shelf from left to right
			2	Check the weight and length of a product against a job ticket
			3	Count the amount of change to be given to a customer

Q13. Specific Skills [REFERENCE ONLY]

No	Specialist Task
1	Analyse data to assess operational or project effectiveness
2	Analyse data to inform operational decisions or activities
3	Analyse data to inform staffing decisions

Q14: Technology Tools [REFERENCE ONLY]

No	Technology tool	Technology tool Description
1	Accounting software	Software used to support the management of accounts, inventory, and financial transactions.

2	Aviation and marine communication systems	Radio and communications apparatus that enables the communication between vehicle crew/s, or between vehicle and land crew.
3	Air, space, or watercraft guidance systems	GPS and sensor-based guidance, mapping, and surveillance systems.

Q20 Field of Studies / Education Listing (based on National Education Code NEC 2010)

<Note to programmer: Show the below drop-down list for Q20 >

Broad Field	Narrow Field	Detailed Field	Code (SA)
General Programmes	Basic/broad, general programmes	Basic I broad, general programmes	010
	Literacy and numeracy	Literacy and numeracy	080
	Personal skills	Personal skills	090
Arts and Humanities	Arts	Design	214
		Craft skills	215
	Humanities	Religion	221
		Languages	222
		National Language	223
		Other languages	224
Science, Mathematics, and Computing	Physical science	Physics	441
		Chemistry	442
	Mathematics and statistics	Mathematics	461
		Statistics	462
	Computing	Computer science	481
		Computer use	482
Engineering, Manufacturing, and Construction	Engineering and engineering trades	Mechanics and metal work	521
		Electricity and energy	522
		Electronics and automation	523
		Chemical and process	524
		Civil engineering	526
		Material engineering	527
	Manufacturing and processing	Food processing	541
		Applied science	545
	Architecture and building	Architecture and town planning	581
		Building	582
Services	Transport services	Transport services	840
	Security services	Military and defence	863

Section 3: Automation

Instruction:

Automation means using machines to replace work that is previously done by people / human labour.

MASCO 2020 <i><Note to programmer: This should be auto populated with the MASCO 2020 codes based on the input to Q1></i>	JOB TITLE <i>(Note: please pipe in Job Titles and ID No. listed in Q1)</i>	Q23. What percentage of the tasks in this occupation could potentially be automated? <u>Options:</u> 1 = 0% 2 = Less than 25% 3 = 25% - 50% 4 = 51% - 75% 5 = More than 75% [SA]	Q24. Are you likely to automate the tasks of this occupation in the coming year? <u>Options:</u> Code 1 = Yes Code 2 = No [SA]	Q25. Please share any comments about this position that planners (universities, organisations, training providers) should know about. (Optional) <i>(open-ended)</i>
E.g.	Process Engineer	3		
ID01				
ID02				
ID03				
ID04				
ID05				
ID06				
ID07				
ID08				
ID09				
ID10				

<Note to programmer: For Q23 and Q24, please insert radio button (single choice) for each option code. >

<Note to programmer: For Q25, please insert text box; open ended. >

Section 4: Future Anticipated Skills and Training required for Upskilling

Instruction:

This section refers to the future skills and training required by workers to meet changing demands in their roles brought upon by anticipated or future industry developments.

MASCO 2020 <i><Note to programmer: This should be auto populated with the MASCO 2020 codes based on the input to Q1></i>	JOB TITLE <i>(Note: please pipe in Job Titles and ID No. listed in Q1)</i>	Q26. What are the future or anticipated skills required for the role? (Within 1-2 years) <i>Options:</i> <i><To include options listed in the following page in a drop-down list></i> <i>97 = Others:</i>	Q27. What type of training is needed for continuous up/reskilling? <i>Options:</i> <i><To include options listed in the following page in a dropdown list></i> <i>97 = Others:</i>
E.g.	Process Engineer	3	
ID01			
ID02			
ID03			
ID04			
ID05			
ID06			
ID07			
ID08			
ID09			
ID10			

<Note to programmer: For Q26, please insert text box for code 97. >

<Note to programmer: For Q27, please insert text box for code 97. >

Q26. Future anticipated skills needed for future job occupation

Food Processing	Automated food manufacturing system maintenance	1
	Automated operation Monitoring	2
	Automated system design	3
	Automation process control	4
	Embedded System Integration	5
	Equipment Maintenance	6
	Internet of Things Management	7
	Data Analytics System Design	8
	Data Synthesis	9
	Business Relationship building	10
	Good Manufacturing Practices Implementation	11
Construction	Computational Design	12
	Design for Manufacturing and Assembly	13
	Design for Maintainability	14
	Integrated Digital Delivery Application	15
	Smart Facilities Management	16
	4D Construction	17
	Cloud data for projects	18
Aerospace	Internet of Things Management	19
	Digital twins	20
	Computer-aided Manufacturing	21
	Cloud security architect	22
	Embedded System Integration	23
	Data Analytics System Design	24

Q27. Types of training needed for continuous up/reskilling

Food Processing	Training on Technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI)	1
	Training on Occupational Safety and Health (OSH)	2
	Training on Computer Aided Manufacturing (CAM)	3
	Training on Food Safety	4
Construction	Training in Technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI)	5
	Training on occupational safety and health (OSH)	6
	Training on Computer Aided Design (CAD)	7
	Training on Industrialised building system (IBS)	8
	Training on Building Information Modelling (BIM)	9
Aerospace	Training on Technology (AI, Connected Hardhats, Smart infrastructure, VR, AR, AI)	10
	Training on Occupational Safety and Health (OSH)	11
	Training on Computer Aided Manufacturing (CAM)	12
	Training on cybersecurity	13

END OF SURVEY

Thank you very much once again for your feedback and participation in this study. If you have any questions, please feel free to contact us.

-THANK YOU

APPENDIX 4: CONSULTATION DISCUSSION GUIDE



COL Consultation 2022 – Discussion Guide

Interviewees Details

Government / Association / Company Name	Representative Name	Designation	Email	Telephone No.

Introduction

As part of the efforts under the 11th Malaysia Plan to address skills mismatches in the labour market, the Critical Skills Monitoring Committee (CSC) was established, jointly led by TalentCorp, MoHR, ILMIA and DOSM. The primary objective of CSC is to develop a Critical Occupations List (COL) to serve as a platform for the coordination of human capital development policies. The COL is an evidence-based list of occupations in Malaysia that reflects the most-sought after and hard-to-fill occupations by industry in order to identify skills imbalances across the Malaysian economy.

Ipsos Strategy3 has been engaged by TalentCorp to develop the 7th edition of the COL 2021/2022. As part of the study, we are conducting consultation sessions with government stakeholders, industry associations and key industry players to better understand industry views on the critical occupations and the recruitment challenges industries are facing.

This discussion session will take approximately 60 minutes to be completed.

Section 1: General Labour Market Trends

1. How did your industry perform in the past year? How was the performance as compared to the previous 3 years? How did covid-19 impact your industry?

2. What are the current and emerging trends in your industry, locally and globally? For the global trends that are not prominent in Malaysia yet, do you think it would be adopted by the companies here within the next 1-2 years?

3. Is the existing talent pool within the industry ready to address these trends? If no, what are the skills gaps?

4. Does your industry face any employment challenges in the past one year? If yes, what are the key challenges faced? (e.g. low supply of talent with specific technical skills, candidates are more interested to work in other industries)

5. What are the measures taken by the industry to overcome these employment challenges in the past one year?

6. What were the key employment trends in your industry in the past year? Are these (employment) trends causing a temporary change in demand or supply of talent in your Industry?

Probe in terms of:

- Hiring freeze
- Layoff of employees
- Focus on upskilling or retraining of existing employees
- Increase hiring of digital talent (e.g. for e-commerce, digital transformation, software /application development)

Section 2: Critical Occupations

7. Please nominate occupations that are critical to your industry. Critical as defined by “industry-specific skills” that are “of strategic importance to your industry” and “skills that are hard to find”. Critical occupations meet the following criteria: skilled, sought-after, and strategic.

8. What are the main work activities or task performed for the roles?

No.	Job Title	Main work activities or tasks performed
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

9. Why are these jobs to be hard to fill? Are there specific reasons for the lack of talent in this industry? (e.g. Not enough applicants, applicants lack credentials or certificates, relevant job experience, expected compensation is beyond the market rate, etc.)

No.	Job Title	Reasons for hard to fill
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

10. a) What are the specific qualifications, competencies or niche skills needed for those jobs (e.g. HACCP, IKM chemist licentiate, IEM registered professional engineer)?

b) Are the skills/qualification hard to get or unavailable? If yes,

- How long does it take to acquire them?
- Where can potential candidates acquire the skills or certification?

No.	Job Title	Specific qualifications / competencies / niche skills required	Hard to get or unavailable?	How long to acquire the skills/qualification	Where to acquire the skills/qualification
1			<input type="checkbox"/>		
2			<input type="checkbox"/>		
3			<input type="checkbox"/>		
4			<input type="checkbox"/>		
5			<input type="checkbox"/>		
6			<input type="checkbox"/>		
7			<input type="checkbox"/>		
8			<input type="checkbox"/>		
9			<input type="checkbox"/>		
10			<input type="checkbox"/>		

11. What level of experience (number of years of experience) is most sought after for these hard to fill occupations?

12. How has your industry been impacted by the critical shortage?

13. What has the industry done to reduce the shortage? (e.g. provide training to employees, work closely with higher education/training institutions for talent supply, provide better salary or remuneration package)

No.	Job Title	Level of experience most sought after (no. of years)	Impact of critical shortage	Measures taken to reduce shortage
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

14. [Note: Moderator to compare current critical occupations mentioned against last 5 years COL list. Ask this question if the occupation has occurred for 4-5 times previously.]

<Job title> has been in the COL list for 4 years or more.

- a) In your opinion, what is the key bottleneck for talent shortage?
 b) What else can be done to resolve the talent shortage issue?

No.	Job Title	Occurred in COL 4-5 times	Key Bottleneck	What else can be done
1		<input type="checkbox"/>		
2		<input type="checkbox"/>		
3		<input type="checkbox"/>		
4		<input type="checkbox"/>		
5		<input type="checkbox"/>		
6		<input type="checkbox"/>		
7		<input type="checkbox"/>		
8		<input type="checkbox"/>		
9		<input type="checkbox"/>		
10		<input type="checkbox"/>		

15. What are the areas that the government can help to support?

Section 3: Automation and Future Anticipated Skills and Training

16. Are there major automation/technology disruption trends in your industry?

Definition of Automation: Using machines to replace work done by people

17. Would automation/technology disruption trends lead to a reduction in the number of workers required?

If yes,

- What percentage of reduction is most likely within next 3 years?
- Do you think new jobs would be created? What would be the new jobs? What are the skills required for these new jobs?

18. What type of training is needed for continuous up/reskilling?

Section 4: Awareness and utilisation of COL

19. Are you aware of the COL before this session? Is the awareness within the industry high?

20. Do you use the previous COL? If yes, how frequent do you use them and how do you use them?

Section 5: Applications of the Critical Occupations List

Demand side questions – for industry representatives

21. What is your view of the previous COL? [[Show a sample page of 2020/2021 COL](#)]

22. In your opinion, in what manner can the 'Critical Occupations List' be used more effectively in the process of addressing the critical occupations needs of your industry?

23. Would your company/association be open to participate in an annual self-disclosure exercise to spell out the (1) Critical occupations requirements; (2) Fine tune the job description and skills requirements of the industry?

END OF DISCUSSION

Thank you very much once again for your feedback and participation in this study. If you have any questions, please feel free to contact us.

-THANK YOU-

APPENDIX 5: STAKEHOLDERS THAT TOOK PART IN CONSULTATION

No.	Associations / Companies
1	Adeka Foods (Asia) Sdn. Bhd.
2	Ahmad Zaki Resources Berhad (AZRB)
3	Ambitious Strategy Enterprise
4	Axtrium Sdn. Bhd.
5	Civil Aviation Authority Malaysia (CAAM)
6	Construction Industry Development Board (CIDB)
7	Construction Research Institute of Malaysia (CREAM)
8	D'viation Group
9	Encorp Berhad
10	Federation of Malaysian Manufacturers (FMM)
11	Galaxy Aerospace (M) Sdn. Bhd.
12	GE Aviation
13	Halal Development Corporation Berhad (HDC)
14	HICOM-Teck See Manufacturing Malaysia Sdn. Bhd.
15	IJM Construction Sdn. Bhd.
16	Mafipro Sdn. Bhd.
17	Master Builders Association Malaysia (MBAM)
18	National Aerospace Industry Coordinating Office (NAICO)
19	Rex Canning Co. Sdn. Bhd.
20	Rosfaniaga Services Sdn. Bhd.
21	Satujaya Sdn. Bhd.
22	Singularity Aerotech Asia Sdn. Bhd.
23	S P Setia Berhad
24	Spirit Aerosystems Malaysia Sdn. Bhd.
25	STRAND Aerospace Malaysia
26	Sunway Construction Group Bhd.
27	Tastiway Sdn. Bhd.
28	UMW Holdings Berhad
29	WCT Holdings Berhad

APPENDIX 6: SOURCES OF INFORMATION UTILISED IN VALIDATION

No.	Associations / Companies
1	Construction Industry Development Board (CIDB)
2	Galaxy Aerospace (M) Sdn. Bhd.
3	Department of Skills Development
4	Jabatan Pendidikan Politeknik dan Kolej Komuniti (JPPKK)
5	Malaysian Space Agency (MYSA)
6	Master Builders Association Malaysia (MBAM)
7	Malaysian Investment Development Authority (MIDA)
8	Ministry of Economy
9	Ministry of Higher Education
10	Ministry of Human Resources (MOHR)
11	National Aerospace Industry Coordinating Office (NAICO)
12	Singularity Aerotech Asia Sdn. Bhd.
13	Social Security Organization (SOCSO)
14	Spirit Aerosystems Malaysia Sdn. Bhd.
15	STRAND Aerospace Malaysia
16	Syarikat Pembinaan Yeoh Tiong Lay Sdn. Bhd.