Agensi Kelayakan Malaysia
Malaysian Qualifications Agency

GUIDELINES FOR INDUSTRIAL VERIFICATION OF CURRICULUM (GIVC)

2024 EDITION

Guidelines for Industrial Verification of Curriculum (GIVC)
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Foreword

As the need for skilled and knowledgeable workers continues to increase, it is becoming increasingly important for higher education providers (HEPs) to ensure that their programmes meet the standards and needs of the industry. Curriculum verification by industry is a vital process that helps to ensure that the content and delivery of a programme align with the expectations and practices of the industry and that graduates are prepared for work in their field of study.

The Guidelines for Industrial Curriculum Verification are designed to provide HEPs with a framework for engaging meaningfully and effectively with industry partners in the design and delivery of their programmes. It includes best practices for establishing partnerships, gathering industry input and incorporating industry feedback into the curriculum.

We hope this guideline will be a valuable resource for HEPs as they strive to ensure the relevance and quality of their programmes and prepare their graduates for success in their careers. By following the best practices outlined in this guideline, HEPs can ensure that their programmes meet industry needs and that their graduates are well-prepared to enter the workforce.

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Chief Executive Officer

Malaysian Qualifications Agency (MQA)

February 2024

Glossary

Verification	A process that evaluates whether a product, service or system complies with the regulations, specifications or conditions imposed at the start of a development phase.
Curriculum	A set of courses and learning experiences to help students achieve specific educational objectives.
Task	A typically assigned piece of work that must be finished within a certain time.
Industry	A particular sector or a group of related companies based on their primary business/economic activities, such as agriculture, manufacturing, finance, healthcare, technology and transportation involving the production of goods or services.
Practical	An act of demonstrating competencies that match occupational practices.
Competency	The ability to apply or employ the necessary information, skills and abilities to accomplish 'essential job functions' or tasks successfully in a given work situation.
Knowledge	Information, concepts and facts that a person possesses about a specific subject or topic.
Skill	The practical ability to competently carry out a task/job.
Attitude	A settled way of thinking or feeling about something.

Abbreviations

BOK	Body of Knowledge
CLO	Course Learning Outcome
COPPA	Code of Practice for Programme Accreditation
COPTPA	Code of Practice for TVET Programme Accreditation
CPA	Cognitive, Psychomotor and Affective
HEP	Higher Education Provider
KSA	Knowledge, Skills and Abilities
MOHE	Ministry of Higher Education
MQA	Malaysian Qualifications Agency
MQF	Malaysian Qualifications Framework
MQR	Malaysian Qualifications Register
ODL	Open and Distance Learning
OISP	Occupational or Industry Standards and Practices
SME	Subject Matter Expert
TVET	Technical and Vocational Education and Training

1 Introduction

1.1 Background

1. HEPs need to engage with the industry during the programme design process to ensure the graduates' competencies meet the industry expectations. Such engagement will tremendously help HEPs to be on track and abreast with the rapid development and changes taking place in the industry.
2. Programme development and review should capture market needs to stay relevant with the changing industry landscape, as well as with the requirement of emerging new technologies. The programme will resonate with the needs and demands of the market to offer graduates employment in the field of their study.
3. The guideline provides recommendations on the best practices for industrial curriculum verification to guide HEPs in developing the curriculum systematically and to include the industrial requirements that ensure their graduates are successful in employment.

1.2 Objectives of the guideline

4. The objectives of this guideline are:

    - To guide HEPs and all stakeholders in conducting a systematic approach of industrial engagement and curriculum verification to meet the expectation of curriculum for the industry.
    - To guide HEPs, evaluation panel members, accreditation committees and all stakeholders in the related accreditation process.

1.3 Scope of the guideline

5. This guideline provides a flexible approach that can suit various types of programmes and circumstances, including:
    - Newly developed programmes or curriculum reviews.
    - Technical and vocational education and training (TVET) or academic programmes.
    - Various disciplines, including social science programmes.
    - Undergraduate or postgraduate programmes.
    - Programmes with limited resources.

- Programmes that want to fulfil the requirement of the accreditation/programme standard of having industrial engagement or using industrial standards and practices.

6. This guideline is not meant to dictate how HEPs conduct a curriculum verification. They serve as a guide for conducting an effective curriculum verification process. HEPs can always use alternative approaches if they can fulfil the requirement of related programme standards.
7. The codes of practice in programme accreditation (Code of Practice for Programme Accreditation [COPPA]/Code of Practice for Programme Accreditation: Open and Distance Learning [COPPA-ODL] and, particularly, Code of Practice for TVET Programme Accreditation [COPTPA]) and programme standards, especially from professional bodies, require industrial involvement and consultation in the curriculum design and delivery. This guideline elaborates on how to meet the requirements systematically, without superseding the requirements in the code of practice and standard documents.
8. This document considers curriculum verification of programmes with matching documents of standard requirements and practices related to occupation and industry.
9. This document also considers programmes that do NOT have matching documents of standard requirements and practices related to occupation and industry.

1.4 Outlines of the document

10. In Section 2, the background of curriculum verification is introduced. The section states and discusses the operational definition of curriculum verification by industry. The main elements of the process, such as the concept of education based on the body of knowledge and work competencies, are discussed.
11. In Section 3, the verification process is elaborated. The subsections in Section 3 are arranged according to the process sequence. Related knowledge and examples are provided in the respective subsections.
12. In the Appendices, examples of verification documents are provided.

2 Background

2.1 Operational definition

2.1.1 Curriculum

13. A curriculum is a set of courses and learning experiences to help students achieve specific educational objectives. It includes the course content, structure, arrangement, delivery and assessment.

Curriculum is a set of courses (content, structure, arrangement) and learning experiences (delivery, assessment) to help students achieve specific educational objectives.

Verification is the process of determining whether something is real, correct, or true. It is frequently applied to ensure that a system, component, or product complies with specifications.

Industry refers to a particular sector or group of companies that are related based on their primary business/economic activities, such as the production of goods and services.

Figure 2-1: General definitions of curriculum, verification and industry.

2.1.2 Verification vs validation

14. In the context of quality assurance, two related concepts: validation and verification, are frequently used. They do, however, have distinct meanings and purposes.

15. Verification is determining whether something is real, correct or true. It is frequently applied to ensure that a system, component or product complies with specifications. Verification is done to ensure that a product is developed appropriately throughout the design phase of its development.

16. Contrarily, validation describes assessing a system, component or process during or after the development phase to see if it complies with the stated requirements. The main goal of validation is to guarantee that the system, component or product will operate as intended when utilised in the circumstances for which it was intended.

2.1.3 Industry

17. The industry refers to a particular sector, group of companies and individual experts that are related based on their primary business/economic activities, such as

agriculture, manufacturing, finance, healthcare, technology and transportation involving the production of goods or services.

2.1.4 Occupation

18. Occupation refers to a specific role, profession or trade that individuals engage in to perform tasks, responsibilities or functions related to their area of expertise or specialisation. Persons who perform similar main tasks are considered doing the same type of work and are classified in the same occupational group, regardless of the level of authority, responsibility or work experience.

2.1.5 Industry standard requirements and best practices

19. Industry standard requirements and best practices are specifications of the competencies expected of a worker which underline the expectation of achievement and the amount of knowledge and skills required to perform effectively as described by the industry.
20. Industry standard requirements and best practices are also a set of criteria within an industry related to the widely used and accepted functioning and carrying out of operations followed by the industry members.
21. Standards are developed through a collaborative process involving industry stakeholders, professional organisations, experts, and sometimes governmental or regulatory bodies, following an organisation's standard-setting process that has the mandate to set the standard.
22. Practices are widely accepted guidelines, methods or techniques for efficient task performance in a specific occupation or industry based on expert experiences and empirical evidence.
23. A detailed overview of the different types of standards and practices can be found in Appendix 5: Overview of industry standards and best practices.

2.1.6 Curriculum verification based on industry standard requirements and best practices

24. In the context of this document, curriculum verification based on industry standard requirements and best practices refers to the process of determining whether the curriculum content, structure, arrangement, delivery and assessment cover the specifications provided in the standard requirements and practices related to the industry and its related occupations.

Figure 2-2: Curriculum verification based on industry standard requirements and best practices.

2.2 Education and training for industry and occupation

2.2.1 Body of knowledge and work competency

25. It is important to clarify the differences between different educational approaches in using this guideline. Educational and training programme approaches curriculum design from an academic discipline or work competency point of view. Both perspectives can benefit from this guideline.

26. Discipline-based programmes aim to cover the required body of knowledge (BOK) in a discipline, whereas industrial/occupational-based programmes aim to cover the required competencies in an occupation.

27. Higher degree educational programmes often are disciplined-based. However, with outcome-based education approaches, higher degree programmes also strive to meet the required competencies in related occupations. Figure 2-3 shows some overlap between them in the curriculum.

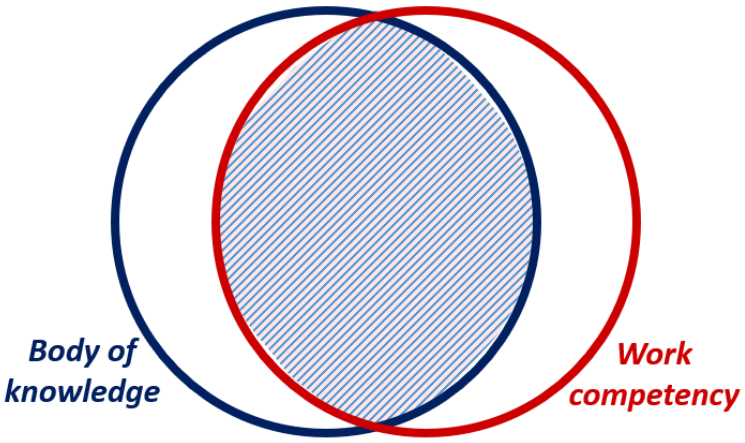


Figure 2-3: There is always some degree of overlap between BOK and work competency in curriculum design.

28. Figure 2-4 and Figure 2-5 illustrate the implementation of industrial/occupational-based programmes and discipline-based programmes. In the figures, theories are academic models or frameworks that are developed to help explain or predict certain phenomena. Practice describes the application of knowledge or skills in a given situation. BOK is the required knowledge in a discipline. Work competency is the required ability to perform a task at work. In most cases, compulsory modules are not part of BOK and work competency, hence, they are indicated in grey colours.

29. As shown in Figure 2-3, BOK and work competency can be overlapped. The theoretical and practical components of BOK/work competency can be delivered and assessed together. This is shown in the example of an industrial/occupational-based curriculum in Figure 2-4. In the figure, BOK and work competency are shown as overlapping and covered in many of the courses. In the final years, several courses are based purely on work competency and practical components.

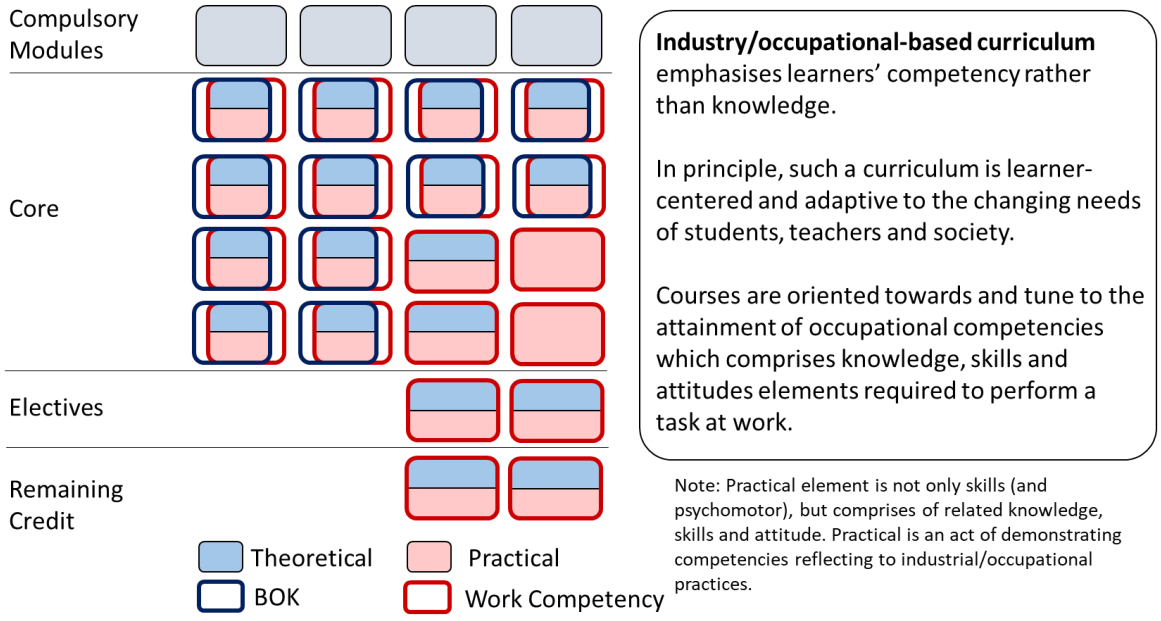


Figure 2-4: In the above example of the industry/occupational-based approach in curriculum design, competencies are packaged as individual courses, and the learning outcomes directly reflect the scope of work activities and the required knowledge, skills and attitudes to complete them.

30. Figure 2-5 shows an example of the curriculum structure of a discipline-based programme. In the curriculum, the progressive shift of emphasis is given from the fundamental knowledge (BOK) in the early stages towards a more applied nature (work competency) in the later stages.

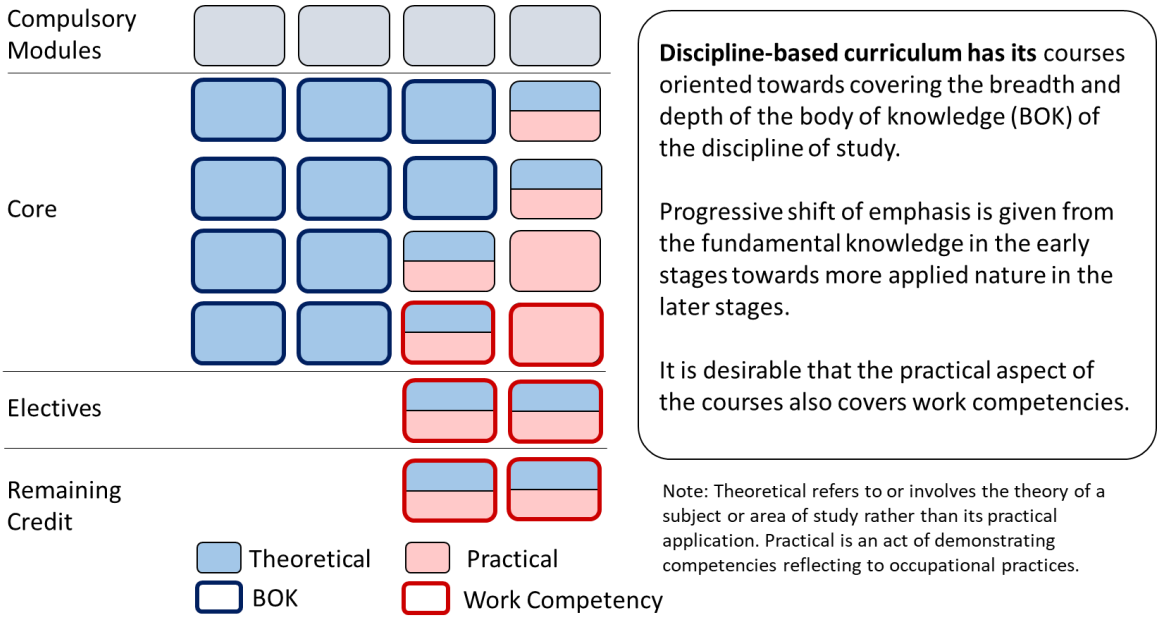


Figure 2-5: An example of a discipline-based approach in curriculum design. Note that emphasis on covering BOK is at the early stage of the curriculum, while emphasis on competency is at the later stages.

31. The Malaysian Qualifications Framework (MQF) 2nd Edition (2017) recognises two sectors, i.e., TVET and academic sectors. The MQF learning outcomes for both sectors are essentially the same, but programmes in the TVET sector tend to be occupational-based, while programmes in the academic sector tend to be discipline-based. This guideline can be used by both TVET and academic programmes.

2.2.2 Task and competencies in industry/occupation

32. One of the main goals of the curriculum design and delivery for industry/occupation is to prepare graduates for work in a particular type and level of occupation. In the context of higher education, the term profession is used interchangeably with occupation. While occupation refers to a person's job in general, profession typically refers to work that requires qualifications through advanced education and training.
33. Job refers to a specific role or position, whereas task refers to the action or activities required to complete the job.
34. A competent worker has the necessary ability, knowledge, skill or attitude to complete a task successfully. In other words, competency is the ability to complete a task using the required knowledge, skills and attitudes.

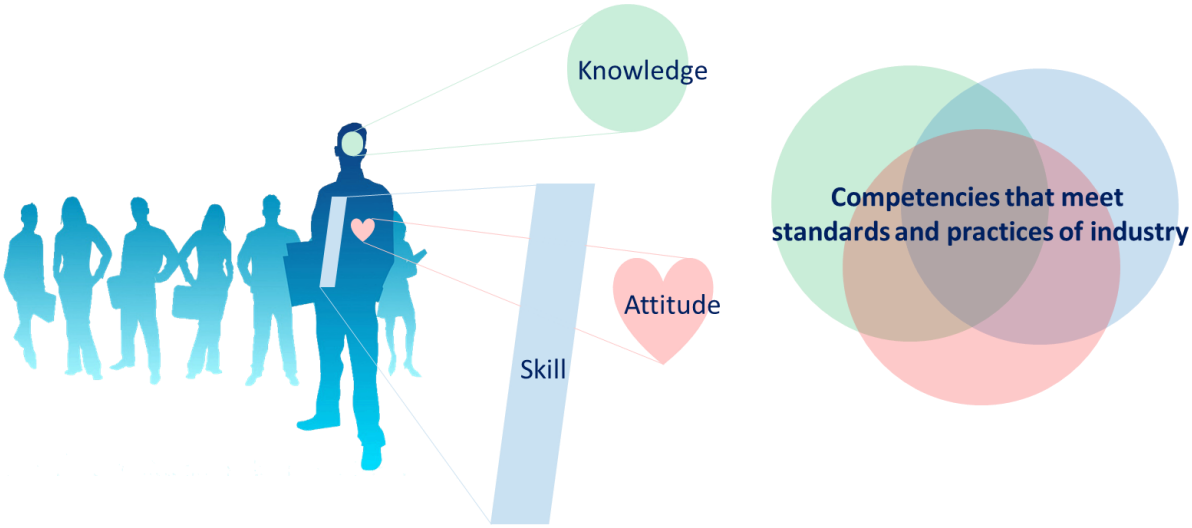


Figure 2-6: A competent worker has the ability to complete tasks effectively using appropriate knowledge, skills and attitude.

Knowledge

35. From the discipline of knowledge point of view, knowledge is any known fact related to the discipline, also referred to as BOK.

36. On the other hand, from a work competency point of view, knowledge is any known fact required to complete a task successfully.

37. What is theoretical vs practical knowledge? The known fact in any discipline is also known as theoretical knowledge. When the knowledge is applied and becomes a common practice in human activities, they are known as practical knowledge. Occupational and industrial tasks, particularly those involving routine and generally defined issues, will be efficient when the worker has practical knowledge. However, theoretical knowledge is also important to face any possibilities when addressing complex and irregular problems.

38. Competencies at any occupational framework level require theoretical and practical knowledge. However, it is expected that the higher level of qualification framework (levels 6, 7 and 8) requires more theoretical knowledge to prepare graduates to face uncertainties and complexities in any given task.

Skills

39. Skill is the ability to perform a task or activity competently and proficiently. Skills can be learned or acquired through education, training or experience, and they can be physical, mental or both. Some examples of skills include:

- Physical skills, such as the ability to play a musical instrument, play a sport or use a particular tool.

- Mental skills, such as problem-solving, decision-making, critical thinking or communication.
- Interpersonal skills, such as the ability to work in a team, lead others or negotiate.
- Technical skills, such as the ability to use software or machinery.

40. Skills are often categorised as either hard skills or soft skills. Hard skills are specific, technical abilities usually associated with a particular job or profession, while soft skills are more general, non-technical abilities that apply to a wide range of situations and professions.

41. MQF learning outcomes list an array of skills, including cognitive skills, functional work skills and personal and entrepreneurial skills. Functional work skills refer to the specific abilities, knowledge and expertise an individual possesses and can apply professionally. These skills are essential for performing job tasks effectively and efficiently, and they vary depending on the type of work or industry. In MQF learning outcomes, functional work skills include practical, interpersonal, communications, digital, numeracy and leadership skills.

Attitude

42. Attitude in the context of occupational or industrial standards refers to an individual's mindset and behaviour in the workplace. It encompasses a range of characteristics, including how one approaches tasks, interacts with colleagues and supervisors and responds to challenges and setbacks. In MQF learning outcomes, the ability to commit to a set of ethics and professionalism desired by the occupation/profession is emphasised as part of the required attitude.

3 Verification process

43. This guideline acknowledges the various circumstances that educational programmes have concerning curriculum verification. For this reason, the practice of curriculum verification based on industry standard requirements and practices is not limited to the approach recommended by this guideline. One must be cautious of the redundancy of effort and the limitation of resources both the industry and HEP have in the approach.

44. The curriculum verification process refers to the necessary steps to verify whether a curriculum (or part of the curriculum) meets certain standards or criteria.

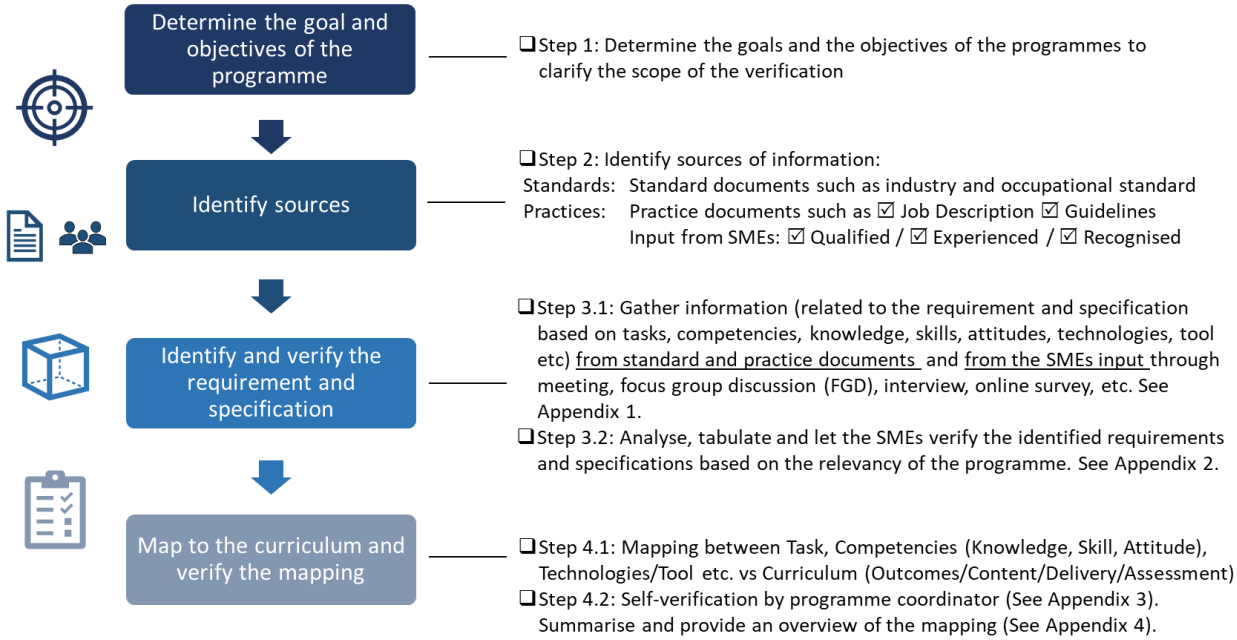


Figure 3-1: The curriculum verification process based on industry standard requirements and best practices.

3.1 Step 1: Determine the goal and objectives of the programme

45. Begin the verification process by understanding and determining the programme's goals and objectives. Ensure that the curriculum committee and subject matter experts (SMEs) involved understand the type of programme, its goal and its objectives.

46. In the context of curriculum verification, the goal and objectives of the programme mainly refer to the type of possible jobs and tasks the graduate is prepared for upon graduation. This is a vital step to prevent biases. Curriculum designers and industry advisory panels might be biased toward their needs, experience and opinions.

47. Having a definite programme goal and objectives will prevent the over-generalisation of certain problems and expectations. The industry advisory panel might raise issues on the lack of competencies of certain graduates from their experience. However, they might be generalising the expectation of competencies between graduates of different fields and levels of qualifications, such as between an engineer and an engineering technologist or between a technologist and a technician.

48. Another common scenario is when certain competencies fulfil the needs of only a minority group in the industry. Competency might be important, but with a limited study period, priority is given to competency needed in the majority of the companies.

3.2 Step 2: Identify sources

49. After confirming the goal and objectives of the programme, the relevant sources for standards and practices are identified. The main types of sources are as follows:
    - Standard documents
    - Practice documents
    - Input from SMEs

3.2.1 Standard documents

50. Industrial (and occupational) standard is a gazetted set of criteria within an industry related to the widely used and accepted functioning and carrying out of operations, as well as the specification of the competencies expected of a worker.

51. An example of a standard that lists the specification of the competencies expected of a worker is shown in Figure 3-2.

Technology Fields	Technology Profiles	Expected Technology Competency
HEALTH & MEDICAL TECHNOLOGY	**Development**	• Technology Planning - Specification - Layout - Site Preparation - Mobilization - Storage • Technology Acquisition • Technology Development - Prototyping - Testing - Clinical Trial • Safety, Standard and Accreditation • Regulatory Compliance
	Manufacturing	• Production & assembly planning and management • Modification and refurbishment • Quality assurance and control

Figure 3-2: An example of competencies expected of a Health & Medical Technologist. (Source: Technology and Technical Accreditation Standard Second Edition – Academic Sector)

52. An example of a standard that lists a set of criteria within an industry related to the commonly acceptable functioning and carrying out of operations followed by the industry members is shown in Figure 3-3.

Thrust	Focus area	Minimum adoption criteria	Adoption criteria task (objective)
Automation	Data collection and processing	Processed data	• Install local sensors at critical equipment/process • Storage of data locally or in cloud • Data collected via sensors, stored, managed, and processed. Real time or near real time data
	Machinery and equipment	Connected and remotely operated	• Equipment, machinery, and computer-based systems are reconfigurable and integrated to allow for quick response, or real time reactivity and cross-function interactions • Organisation's integrated management system which enables end-to-end operations of the industrial Internet-of-Things systems
	Facility (e. g. Heating, ventilation, and air conditioning unit, HVAC)		
	Enterprise (e.g. HR, accounts)	Interconnected (e.g. ERP, MES, PLM, LIMS)	
	Robotics	Autonomous	• Utilise robots to support and relieve the human operator in a safe conjoint or adapt to changes in the working environment

Figure 3-3: An example of an industrial standard from SIRIM Standard Industry 4.0 – Criteria – Organisations' adoption guidelines. (Source: Industry 4.0 – Criteria – Guideline for Adoption by Organisation)

3.2.2 Practice documents

53. Industry practices can be in the form of job descriptions, guidelines, lists of tasks and responsibilities, and others. They can be found in publications and websites of companies, government agencies and trade/professional societies, including in the form of job advertisements. Examples of practice documents are shown in Figure 3-4.

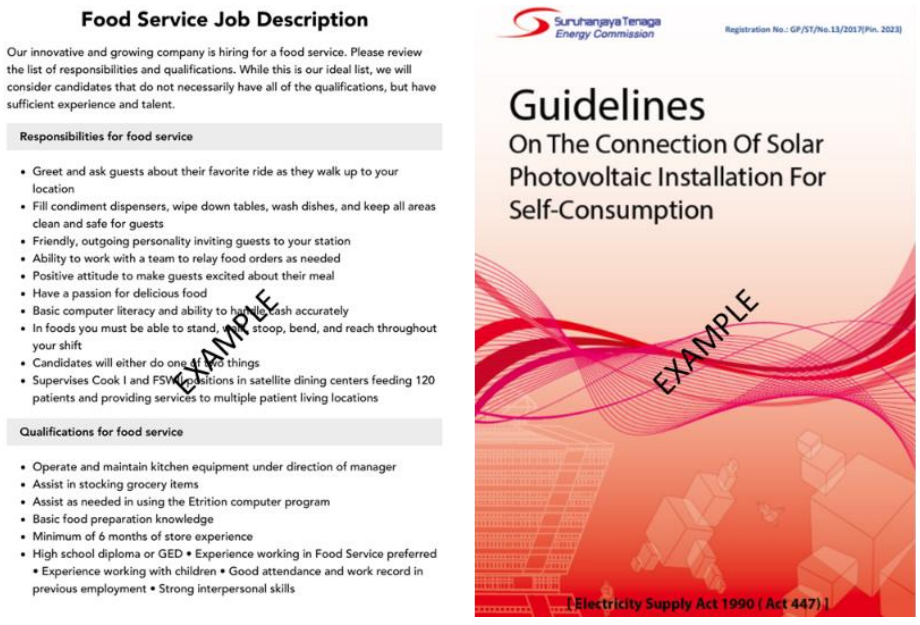


Figure 3-4: Examples of industrial practices documents that can be used as a basis for curriculum development.

54. An example of the content of a guideline in an industry practice is shown in Figure 3-5.

D.	**Connection Requirements**
4.8	For self-consumption purposes, the consumer and registered Electrical Contractor are responsible to ensure there is no electricity generation export to the grid and the system does not adversely impact the quality of electricity supply system from the licensee. The following requirements shall be adhered by the consumer and registered Electrical Contractor:
	(a) purchase and install the appropriate functionality within the inverter with the capability of but not restricted to zero rated energy to grid and generation controller not to exceed the load demand, use of external device or energy storage to mitigate the export of excess energy from consumer's solar PV system to the licensee's network;

Figure 3-5: An example of the requirements of solar panel installations. (Source: Energy Commission's guidelines on the connection of solar photovoltaic installation)

55. Another example of a practice document in the form of a website by the Institute of Labour Market Information and Analysis (ILMIA) is shown in Figure 3-6. It summarises the generic tasks and responsibilities in related professions.

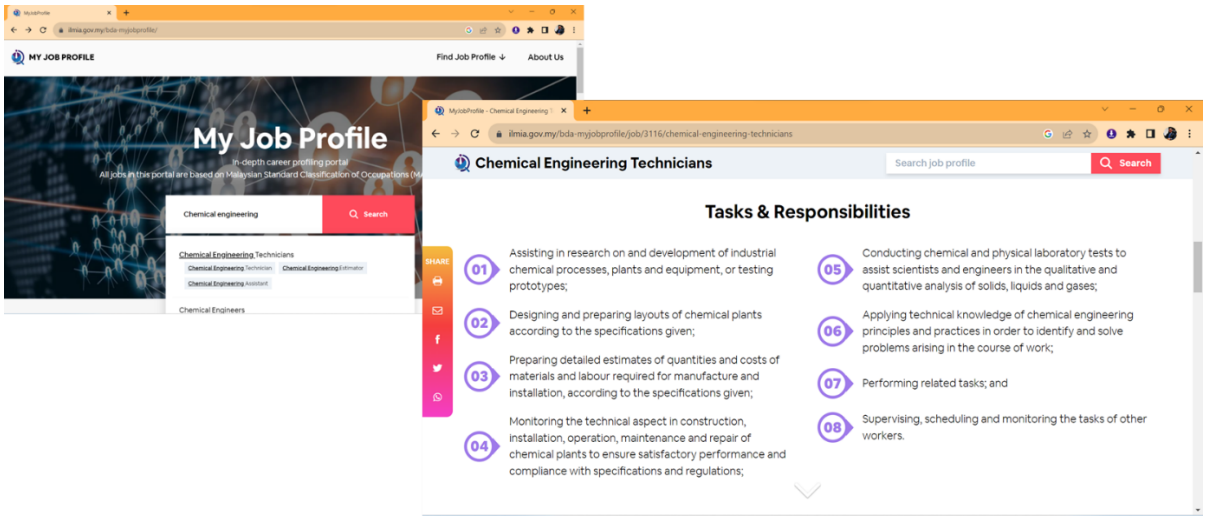


Figure 3-6: An example of a practice document in the government agency website of ILMIA in the My Job Profile portal (https://www.ilmia.gov.my/bda-myjobprofile/).

3.2.3 Input from subject matter experts (SMEs)

56. There are situations where standard and practice documents are unavailable or require additional information and updates. In such a situation, a methodological study of the practices in the occupation and industry can be conducted with the involvement of SMEs.

57. An SME is selected based on his/her:

1. Qualification (based on educational, professional, competency and training certification awarded, etc.) OR
2. Experience (based on the range or type of projects or tasks completed in the work portfolio, the level of responsibility held, etc.) OR
3. Recognition (based on the number or type of awards, honours, achievements and/or invitations to deliver speeches or provide consultations, etc.) in the subject matter relating to specific occupations and industries.

58. Often, a committee of SMEs is formed to ensure the occupational and industry practices represent diverse perspectives. When selecting the committee members, consider:

1. Occupation or industry representation: It is important to choose SMEs who represent a variety of related occupations or industries, as well as different levels of experience within those occupations or industries.
2. Geographic diversity: It may be helpful to include SMEs from different regions to ensure the curriculum is relevant and applicable to diverse geographic areas.
3. Professional background: Consider selecting SMEs with different professional backgrounds, such as educators, practitioners and policymakers, to ensure a well-rounded perspective on the curriculum.
4. Diversity: Consider diversity in terms of gender, race, ethnicity and other personal characteristics to ensure that the committee is representative of the population it serves.

3.3 Step 3: Identify and verify the requirements and specifications

3.3.1 Information gathering

59. Gather information related to the requirements and specifications based on tasks, competencies, knowledge, skills, attitudes, technologies, tools, etc. from:

- Standards, i.e., standard documents.
- Practices, i.e., job descriptions, guidelines or input from SMEs through meetings, focus group discussion, interviews, online surveys, etc.

Examples of critical questions to ask when gathering information are shown in Appendix 1: Information gathering process.

60. Keep a record of the standards (standard documents) and practices (practice documents and input of SMEs). All inputs (including findings from previous studies

and curriculum changes) should be known by the curriculum committee before any change can be made to the curriculum.

3.3.2 Analysis and verification of task and competencies

61. By referring to the information gathered, analyse and verify the:

- requirements and specifications of the task and work competencies.
- other criteria related to the widely used and accepted functioning and carrying out of operations.

Document the verified list of requirements and specification items. Figure 3-7 shows an example of analysed and verified competencies from an industrial standard. An example of the report of standard and practice verification is shown in Appendix 2: Report of standard and practice .

Thrust	Focus area	Minimum adoption criteria	Adoption criteria task (objective)
Automation	Data collection and processing	Processed data	• Install local sensors at critical equipment/process • Storage of data locally or in cloud • Data collected via sensors, stored, managed, and processed. Real time or near real time data

List of requirement and specification items based on standard/practice of related occupation/industry.

Item	Task/activities	Competencies (knowledge/skills/attitude)	Tools/Technology
13	Automating data collection and processing Work activities: - Identify critical equipment/process for sensor installation in IR4.0 - Collect and process data via sensors, store locally/in-cloud, in real time	Automation of data collection and processing (Knowledge: Critical equipment/process, sensor characteristics and work principles, etc Skills: Installation, Programming)	Sensors, cloud storage, real-time processor, programming language

Note: The table of task and competency is verified by SME representatives.

Verified by, xxx, Industry Advisory Panel (1/8/2023)

Figure 3-7: The red box indicates the requirements and specifications from SIRIM Industry Standard: Industry 4.0 – Criteria – Guidelines for adoption by organisations.

Figure 3-8 shows an example of analysed and verified competencies from an industrial practice document.

(a) purchase and install the appropriate functionality within the inverter with the capability of but not restricted to zero rated energy to grid and generation controller not to exceed the load demand, use of external device or energy storage to mitigate the export of excess energy from consumer's solar PV system to the licensee's network;

List of requirement and specification items based on standard/practice of related occupation/industry.

Item	Task/activities	Competencies (knowledge/skills/attitude)	Tools/Technology
14	Solar panel installation Work activities: - analise requirement and specification - procure components - install and setting up inverter	Development and testing – solar panel inverter (Knowledge - Functionality within the inverter for zero rated energy to grid and control not to exceed load demand Skills – Installation and testing)	Suitable controller device

Note: The table of task and competency is verified by SME representatives.

Verified by, xxx, Industry Advisory Panel (1/8/2023)

Figure 3-8: The red box indicates the requirements and specifications of an inverter installation in solar panel installation. (Source: Energy Commission's guidelines on the connection of solar photovoltaic installation)

62. The verified competency document can be a HEP's internal best practice document. It is a good practice that the document is published to be accessible and to benefit others.

3.3.3 Further readings on the analysis of task and competency

63. Various approaches exist to conduct a systematic study to gather information, verify tasks and develop competency profiles from practice documents. Figure 3-9 shows an example of how the competencies profile of tasks in companies are determined.

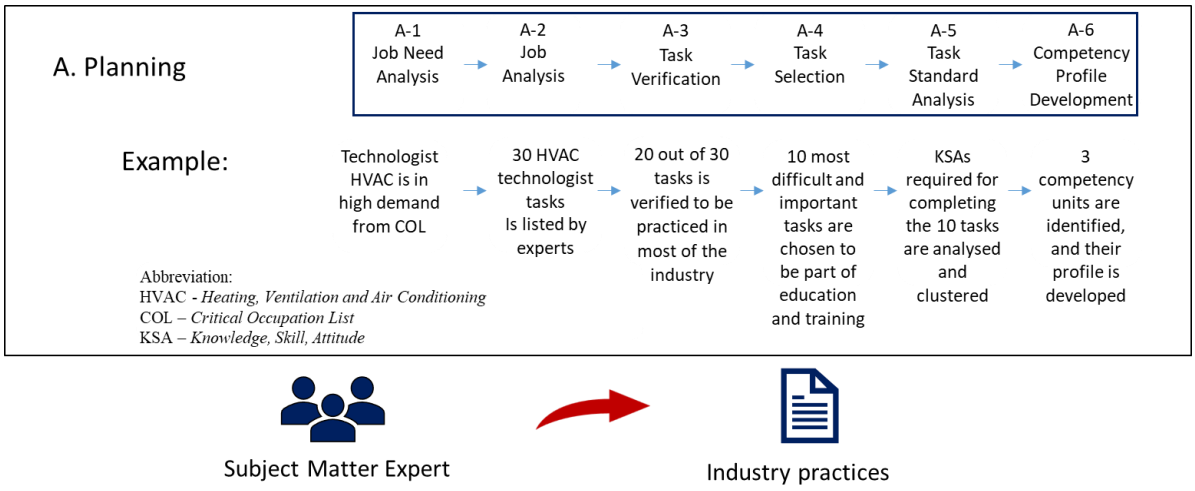


Figure 3-9: An example of a systematic study to identify competency profile based on the Guideline of Good Practice in Curriculum Design and Delivery for TVET programme, Ministry of Higher Education (MOHE).

64. In the figure, a complete process involves job analysis (labelled as A-2) to come up with a list of tasks in the job. This can be achieved through focus group discussions with SMEs or by other means.

65. To ensure that the list is widely required and in high demand, the list of tasks from the job analysis can then be verified by more industrial players through the survey (labelled as A-3). Alternatively, the list of tasks can be verified by other selected experienced industrial experts from leading companies in the relevant industry. Information about the priority in order of importance and in order of difficulty of learning the task can also be determined as part of the survey or interview.

66. Then, the most important and difficult task to learn is shortlisted to be further analysed (labelled as A-4). The knowledge, skills and attitudes (or any other abilities) required to perform the task successfully are analysed (labelled as A-5). This can be done through communications with SMEs or by other means necessary. The identified knowledge, skills and attitudes are clustered together based on the abilities/competencies for completing the different tasks.

67. The competencies required for performing the tasks are finalised and their profile is developed (labelled as A-6). Among others, the profile can detail the work activities and description of the expectations of the work related to the industry.

68. Another alternative for performing a systematic study to gather information is by using secondary data. Nowadays, a lot of widely available information from data analytics is readily available, among others, by related government agencies (such as the Institute of Labour Market Information and Analysis, ILMIA), professional networking websites (such as LinkedIn) and professional and learned societies (such as the Institute of Engineers Malaysia, IEM, and the Institute of Electrical and Electronics Engineers, IEEE).

69. As an example in Figure 3-10, a report titled 'The Future of Jobs' by the World Economic Forum presented a heatmap showcasing the distribution of relevant skills in the mechanical engineering field. The heatmap was produced using data from LinkedIn. A similar systematic study can be conducted by programme developers to determine industry practices.

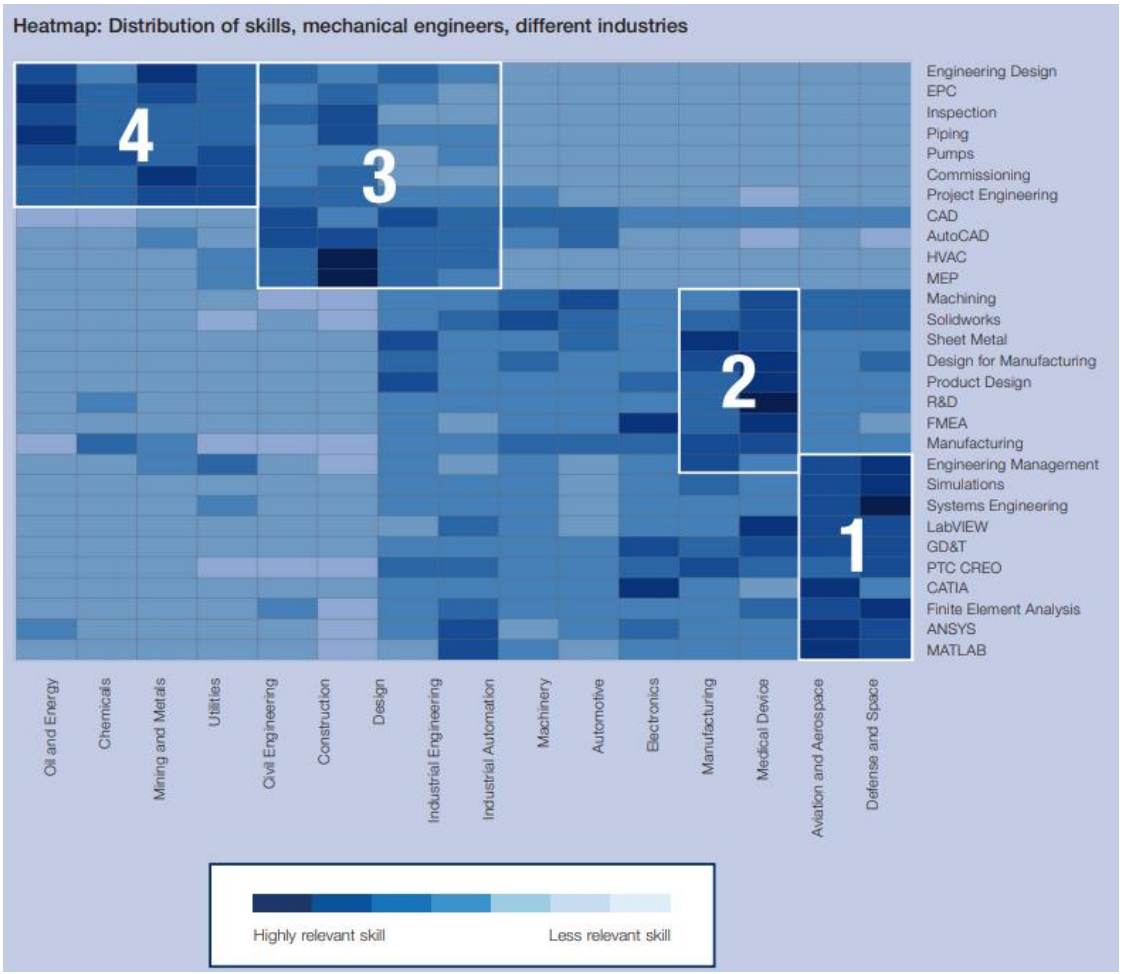
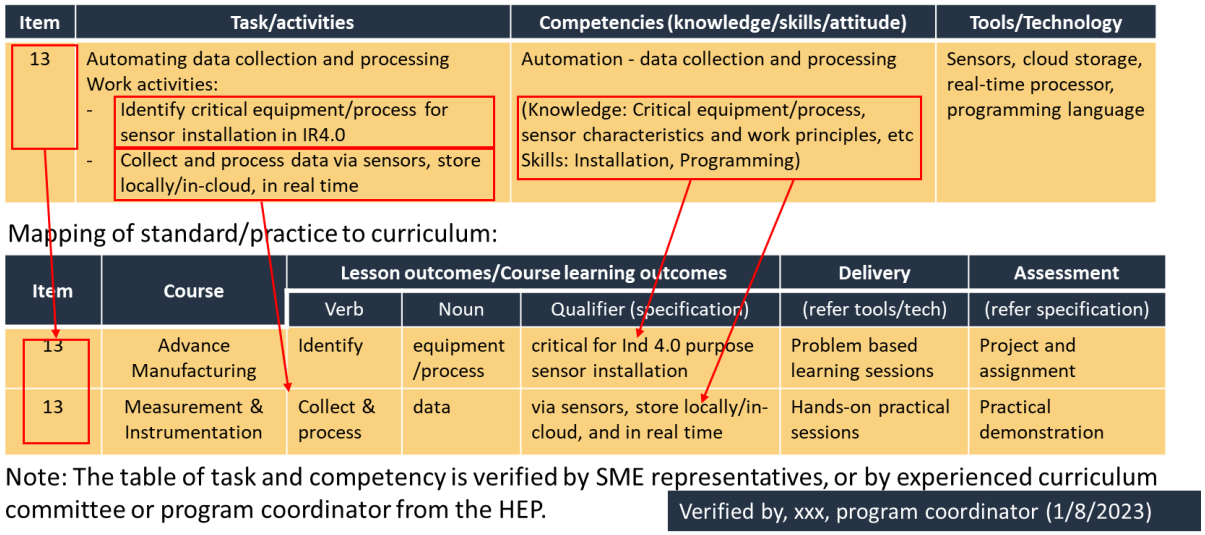


Figure 3-10: An example of an analysis of skills using secondary data from LinkedIn. (Source: The Future of Jobs, World Economic Forum)

3.4 Step 4: Map to the curriculum and verify the mapping

3.4.1 Mapping and verification of mapping

70. At the final stage of the verification process, map the list of requirements and specifications against the curriculum design, delivery and assessment. Document and verify the mapping. Figure 3-11 shows an example of the mapping and its verification.



Item	Task/activities	Competencies (knowledge/skills/attitude)	Tools/Technology
13	Automating data collection and processing Work activities: - Identify critical equipment/process for sensor installation in IR4.0 - Collect and process data via sensors, store locally/in-cloud, in real time	Automation - data collection and processing (Knowledge: Critical equipment/process, sensor characteristics and work principles, etc Skills: Installation, Programming)	Sensors, cloud storage, real-time processor, programming language

Mapping of standard/practice to curriculum:

Item	Course	Lesson outcomes/Course learning outcomes			Delivery	Assessment
		Verb	Noun	Qualifier (specification)	(refer tools/tech)	(refer specification)
13	Advance Manufacturing	Identify	equipment /process	critical for Ind 4.0 purpose sensor installation	Problem based learning sessions	Project and assignment
13	Measurement & Instrumentation	Collect & process	data	via sensors, store locally/in-cloud, and in real time	Hands-on practical sessions	Practical demonstration

Note: The table of task and competency is verified by SME representatives, or by experienced curriculum committee or program coordinator from the HEP.

Verified by, xxx, program coordinator (1/8/2023)

Figure 3-11: An example of analysed and verified curriculum mapping.

71. In the example in Figure 3-11, the learning outcomes are developed based on the competencies and the related knowledge, skills and attitudes required for each competency.

72. The assessment and delivery method are constructively aligned to the learning outcomes, emphasising achieving competency. The delivery refers to the tools and technology in its implementation, while the assessment criteria are aligned to the qualifier (specification).

3.4.2 Summarisation and reporting

73. Summarise the percentage of total credit mapped to standard/practice items and provide an overview of the verified course within a curriculum structure. An example is shown in Figure 3-12.

74. Appendix 3: Report of Curriculum Mapping Verification shows the example of curriculum mapping and verification report. An example of the overview of the verified courses in the curriculum structure is shown in Appendix 4: Overview of content, structure and arrangement.

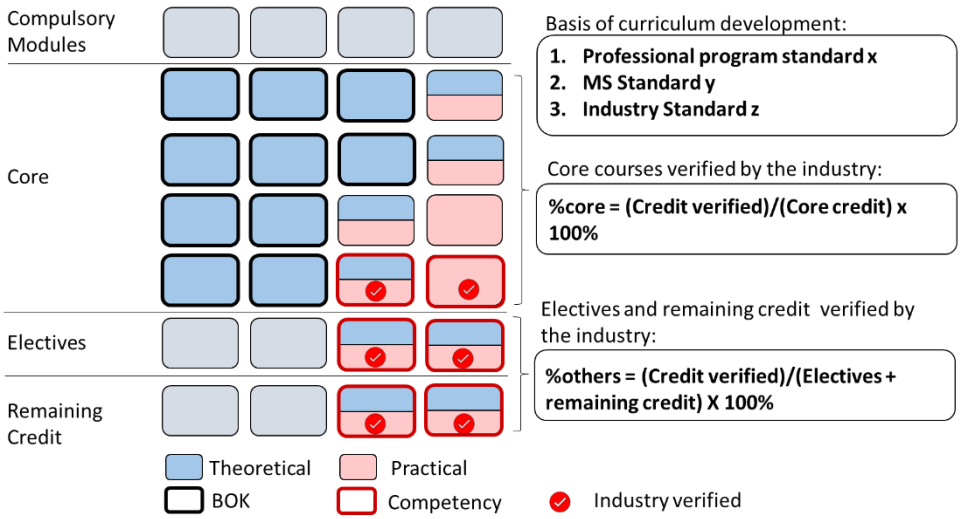


Figure 3-12: An example of a summary of curriculum verification.

75. Programmes are recommended to practice the following industrial curriculum verification activities:

- Establish an internal formal verification procedure and mechanism.
- Apply verification when developing a new programme and when reviewing the curriculum.
- Verify the content, as well as its delivery and assessment.
- Analyse the percentage of courses verified by the industry.
- Present the overview of the content, structure, arrangement and verified courses.
- Analyse and state the percentage of industrial-verified courses. The percentage can be calculated as follows:

$$P_v = \frac{c_v}{c_t} \times 100\%$$

where:

P_v is the percentage of the industry-verified curriculum.

c_v is the number of course credits or course student learning time verified.

c_t is the number of total course credits or total student learning time.

Note: Set the target percentage in adhering to the suggestions or requirements of the relevant codes of practice for programme accreditation, programme standards or guidelines.

- Keep a record of the process (meeting minutes, verified competency requirement and specification list, verified curriculum mapping) for future reference.
- Share the verified competency requirement and specification list.
- Produce a concise industrial curriculum verification report such as the example shown in Appendices 1 to 4 as proof of the curriculum design based on standards and practices related to occupation and industry. Use the report as evidence in the accreditation process.

76. The HEP can declare that the programme is verified by the industry (for example, stating 'Bachelor of Industrial Electronics Technology is industry verified') if the programme meets the requirement of 50%-70% practical component subject to the level of the programme (i.e., 50% for a bachelor's and higher-level degree, 60% for an advance diploma and diploma level and 70% for a certificate level). If the percentage is less than the suggested percentage, only the verified courses can be declared as verified (for example, stating 'Courses A, B and C are industry verified').

3.4.3 Further readings on mapping of task and competency into curriculum

<u>Curriculum design and development</u>

77. Figure 3-13 shows an example of a systematic approach to developing a curriculum from competency.

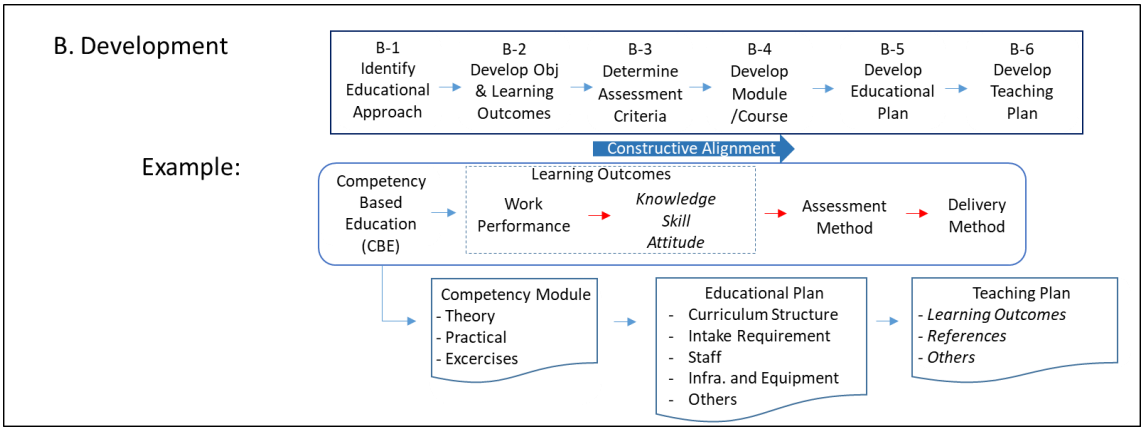


Figure 3-13: An example of a systematic approach to developing curriculum from competency in the Guideline of Good Practice in Curriculum Design and Delivery for TVET programme, MOHE.

78. According to COPTPA, TVET programmes must use Occupational or Industry Standards and Practices (OISPs) that are certified, recognised and endorsed by the Malaysian Qualifications Agency (MQA) and the Department of Skills Development (DSD) as their basis for curriculum development. OISPs shall be used as a

benchmark in determining an individual's performance in a specific field/discipline. The standards underline the expectation of achievement and the amount of knowledge and skills required to perform effectively as described by the industry. Be aware that the use of certain standards is bound by the terms and conditions of related laws and regulations.

79. COPPA, COPPA-ODL and professional programme standards also require academic programme developers to get industry input to ensure the curriculum is aligned with the industry and current occupational needs. Academic programmes aligned with industry needs are more likely to produce prepared graduates for the workforce. Industry or occupational standards can guide the skills and knowledge required for specific occupations or industries, allowing academic programmes to tailor their curriculum accordingly.

80. The course learning outcomes (CLOs) can be written in curriculum development to match the competency profile. There are variations in practice on how a CLO is written but it is common to use the competency as a course name, with its related work activities and elements of knowledge, skills and abilities (KSA) elements recorded in the CLOs. The CLOs are written with a verb representing the ability (e.g., apply), a noun representing the object of the related KSA (e.g., robotics programming) and a qualifier representing the scope of work activity (e.g., for robot development using Robot Operating System).

81. Due to common practice by HEPs in associating CLOs with cognitive, psychomotor and affective (CPA) learning domains, the difference between KSA and CPA is worth noting. In curriculum design, KSA is the object to be learned and practised. On the other hand, the CPA domain is the 'classification of learning types'. The cognitive learning domain classifies the type of thinking abilities, the psychomotor learning domain classifies the type of motor ability and the affective learning domain classifies the feeling ability. For example, the principle of the electromagnet is a 'type of knowledge', whereas 'memorising' the principle of the electromagnet is a 'type of thinking ability' in the cognitive domain.

Curriculum delivery

82. The standard and practice criteria for curriculum delivery and implementation include the method of delivery, the inclusion of industry best practices (tools and techniques during work), the work environment (safety and sustainability) and the industry support in delivery.

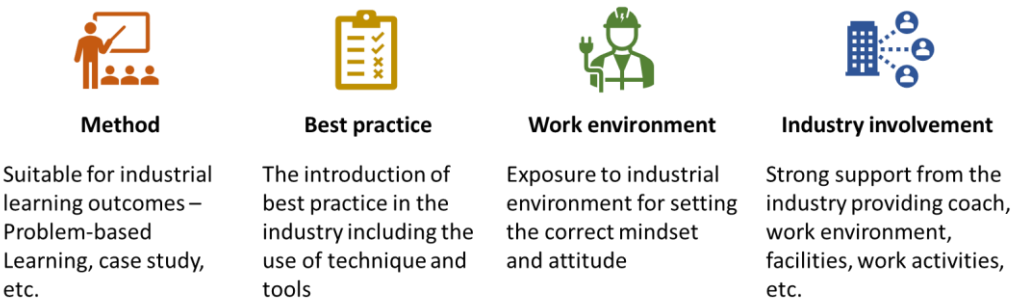


Figure 3-14: Elements to consider when planning for curriculum delivery.

Assessment

83. Competency-based assessment evaluates an individual's skills and abilities based on specific competencies or defined standards. This type of assessment focuses on demonstrating competency in real-world situations rather than in theory, hence, the proof is evidence-based. Candidates actively participate in the assessment process and can negotiate the assessment type, timing and location. The goal is to evaluate if the individual is competent, i.e., having the necessary skills and knowledge to perform a job or task effectively.

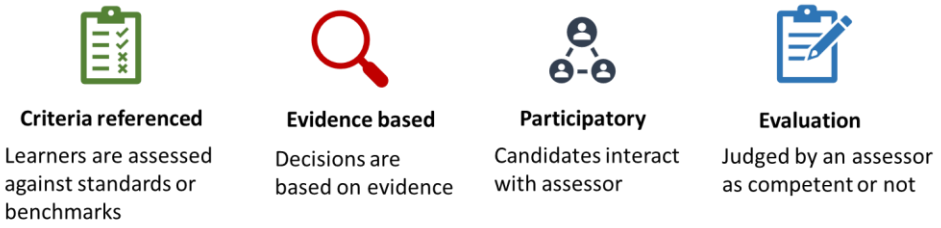


Figure 3-15: Elements to consider when planning for assessment.

84. Competency-based assessment is based on specific criteria from actual performance. The assessment uses instruments/tools/equipment that are established with the involvement of the industry (competency levels, benchmarks for good performance, individual assessments, judgements of competency, etc.). It serves as a tool for guiding subsequent learning and grading in the form of formative and summative assessment.

Criteria	Proficient	Developing	Beginning
Process	Student performs task within stipulated time by using the correct procedure.	Student performs task by using the correct procedure but not within the stipulated time	Student performs task but not within stipulated time nor by using the correct procedure
Output	The final output meets ALL requirements and specification.	The final output meets ONLY the MAIN requirements and specification.	The final output meets SOME of the main requirements and specification.

Figure 3-16: An example of how an assessment rubric considers the requirements and specifications of related standards and practices.

4 Conclusion

85. An essential step in ensuring that educational programmes prepare students for success in their chosen industries is curriculum verification by industry. Educators can learn a great deal about the information and abilities crucial for workplace success by incorporating industry professionals in the verification process.

86. In addition to helping to guarantee that students are learning the skills they need to thrive in the workplace, this can also assist in keeping the curriculum current and relevant. Creating precise and quantifiable learning outcomes is a crucial component of curriculum verification by industry. The construction of the course materials and examinations should be based on these outcomes, which should reflect the sector's needs.

87. Adhering to various standards and practices can ensure a successful curriculum verification process. This requires the involvement of SMEs in the verification procedure, maintaining constant contact with partners and offering students continuing support in attaining the competencies needed.

88. In conclusion, curriculum verification by industry is a crucial procedure that enables us to ensure that educational programmes equip students with the competencies they need to succeed in the workplace.

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Appendix

Appendix 1: Information gathering process

The following questions can be used to gather requirements and specifications in occupational and industry practice from engagement with SMEs, as well as when analysing available standard and practice documents:

1. What is lacking in the current graduates?
2. What are the common tasks in the workplace that are relevant for graduates from the programme?
3. What are the expected/required capabilities/competencies for graduates to perform the tasks?
4. What are the important knowledge/skills/attitudes/abilities needed?
5. What supporting tools/technology can be included in the curriculum delivery that is commonly used, recently gaining popularity or will soon be useful in the practices?
6. What are the expected assessment criteria related to the competency?

Note:

- The questions are examples only.
- Use qualitative interviewing skills or structured or semi-structured questions to probe for further information from the SMEs.
- Supporting forms that are similar to Table 1 in Appendix 2: Report of standard and practice which query necessary information can be used during information gathering to assist data gathering and facilitate the analysis.

Appendix 2: Report of standard and practice verification

EXAMPLE ONLY

REPORT TITLE: Analysis of occupational/industrial standards/practices relevant to programme x.

BACKGROUND

1. Date of exercise: xx/yy/zz
2. List of references:
   - Primary data: SME engagement documents
     Doc1: Minute of meeting, Meeting name, Date
     Doc2: Focus group discussion report, Meeting name, Date
     Doc3: Survey form A, Date
   - Secondary data: Standard/Practice documents
     Doc4: Programme standard Yyy
     Doc5: Industry standard Xxx
3. List of people involved in the exercise:

FINDINGS

The data from SME input and related standard/practice documents is analysed and tabulated in Table 1.

Table 1: List of occupational/industrial standards/practices that are relevant to programme x

Item	Task	Competencies (knowledge/skills/attitude)	Tools/technology	Standard & practices
1				Doc1: No.1
2				Doc5: Pg 6

Please note that the conducted exercise had several limitations as follows:

1. The items identified are limited to information from the references from Malaysia's source.

The criteria and specifications listed in the table are according to the criteria standards/practices of ……

Prepared by

……

(Curriculum committee member)

Verified by

……

(SME representative)

Note:

- This form is an example only. A HEP can use any other format to document the verification process.

Appendix 3: Report of curriculum mapping verification

EXAMPLE ONLY

REPORT TITLE: Mapping between the standard/practice item and programme x curriculum

BACKGROUND

1. Date of exercise:
2. List of people involved in the exercise:

FINDINGS

A summary of the findings is shown in Table 2 and/or Table 3.

The percentage of total credit mapped to the standard/practice item = 8 cr / 120 cr = 6.7%

VERIFICATION

The curriculum has sufficiently met the requirement and specification of the standards/practices stated in Table 1: List of occupational/industrial standards/practices that are relevant to programme x.

Prepared by	Verified by
……	……
(Curriculum committee member)	(Programme coordinator/SME representative)

Table 2: Mapping between courses and standard/practice item

EXAMPLE ONLY

Course (credit)	Course Learning Outcome (CLO)			Delivery	Assessment	Standard & practices
	Verb	Noun	Qualifier	Method and tools	Method and criteria	Mapped to:
Aaa (3)						Table1: Item x
Bbb (2)						Table1: Item x
Ccc (3)						Table1: Item x

The percentage of total credit mapped to the standard/practice item = 8 cr / 120 cr = 6.7%

Table 3: Mapping between topic/lesson outcome in a course and standard/practice item

Week	Topic/Lesson outcomes	Standard/Practice item	Delivery hours (alternatively, student learning time can be used)	
			Theoretical	Practical
1		N/A	2	3
2		N/A	2	3
3		N/A	2	3
4		N/A	2	3
5		N/A	2	3
6		N/A	2	3
7		N/A	2	3
8		Table 1: Item x	2	3
9		Table 1: Item x	2	3
10		Table 1: Item x	2	3
11		Table 1: Item x	2	3
12		Table 1: Item x	2	3
13		Table 1: Item x	2	3
14		Table 1: Item x	2	3
	Total hours		14	21
	Percentage of total hours mapped to the standard/practice item		35/70 X 100% = 50%	

Note:

1. This form is an example only. A HEP can use any other format to document the verification process and decide to verify at any level of detail depending on suitability.
2. The example in Table 3 shows the mapping between weekly topic/lesson outcomes against Table 1: List of standard/practice items.
3. Constructive alignment ensures that the assessment is linked to the delivery.

Appendix 4: Overview of content, structure and arrangement

EXAMPLE ONLY

Compulsory Modules (10 credits)	Co-curriculum 1 (1 cr)	Co-curriculum 2 (1 cr)	Philosophy & Current Issues (2 cr)	Apprec. of Ethics & Civilization (2 cr)	Malaysia Economy (2 cr)	Leadership & Human Relations (2 cr)		
Core (83 credits) Note: All course carries 3 credits unless stated otherwise.	Materials	Solid Mechanics	Vibrations	Instrumentation & Control	Manufacturing Engineering	Robotics Technology	Final Year Prj 1	Final Year Prj 2
	Statics & Dynamics	Mechanical Design	Fluid Mechanics	Thermo & Heat Transfer	PLC & Automation	Pneumatic & Hydraulic Tech ✓	Integrated Design Project 1	Integrated Design Project 2
	Circuits and Devices	Digital and Analogue Electronics	Signals & System	Microprocessor System	Microcontroller Technology	Power Electronics & Drives	Engineer & Society (2 cr) ✓	Engineering Seminar (1 cr)
	Introduction to Mechatronics	Computer Aided Engineering		Communication systems				
						Ind Training (Special sem) (5 cr)		
Electives (18 credits)						IOT Design and Installation ✓	Deep Learning Programming ✓	Industry 4.0 Adoption ✓
						Robot Programming ✓	Innovation Management ✓	Data Analytics ✓
Remaining Credit (15 credits)	Engineering Mathematics 1	Engineering Mathematics 2	Differential Equations	Engineering Statistics 3				
			Computer Programming					

Name of programme:
Bachelor in Mechatronics Eng
Prepared by:
Ahmad Danial, Mechatronics HOD
Sign: xx **Date:** 15/6/23

Verification based on:
From standards and best practices
1. Lead company X professional certification
2. SIRIM 50:2021 Social accountability requirements
3. SIRIM 36:2020 Industry 4.0 Maturity level
4. ISO 56002:2019 Innovation Management

From SME Panel Study
5. Robot programming (Python and Robot Operating System)
6. IOT design and installation

% Core:	%E&RC:	%Total:
7%	55%	15%

Legend:
- Theoretical
- Practical
- Competency-based
- Knowledge-based (BOK)
- ✓ Industry verified

EXAMPLE ONLY

Compulsory Modules (10 credits)	Co-curriculum 1 (1 cr)	Co-curriculum 2 (1 cr)	Philosophy & Current Issues (2 cr)	Apprec. of Ethics & Civilization (2 cr)	Malaysia Economy (2 cr)	Leadership & Human Relations (2 cr)		
Core (83 credits) Note: All course carries 3 credits unless stated otherwise.	Introduction to International Relations	Understanding Society	International Relation Theories	Social Theory	Applied Research in Social Science	Application of Management Practice	International Management Practice 1	International Management Practice 2
	People, Place and Social Difference	Culture Diversity	International Conflict and Resolution	Organisation, Cooperation and Integration	Research Methodology	Data Analysis and Reporting	International Research Practice 1	International Research Practice 2
	International Politics and Economy	International Contemporary Issues	International Law and Organisation	Critical Review in International Conflicts	Case Study Analysis	Social Psychology	International Society and Agencies	International Seminar (1 cr)
	Foreign Policy and Diplomacy	The Politics of Civilisation		International Digitalisation				
						Corporate Social Responsibility		
Electives (18 credits)						Internal and External Relations	Analysis of the United Nation Role	Humanities Internship
						Global Engagement	Global Management	Political Engagement
Remaining Credit (15 credits)	Sociology	ICT	Organisational Psychology	Qualitative Data Analysis				
			Quantitative Data Analysis					

Name of programme:
Bachelor of Social Science in International Relations

Prepared by:
Mariam Abdullah, Social Sc HOD

Sign: xx **Date:** 15/6/23

Verification based on:

From standards and best practices

1. MyJob Profile, Institute of Labour Market Information and Analysis (ILMIA)
2. Malaysia's Foreign Policy
3. Malaysian International Law

From SME Panel Study

4. International Public Relations Association (IPRA)
5. International Relations Council

% Core:	%E&RC:	%Total:
11%	55%	21%

Legend:

- Theoretical
- Practical
- Competency-based
- Knowledge-based (BOK)
- Industry verified

Appendix 5: Overview of industry standards and best practices

1. Industry associations or professional organisations define occupational standards to ensure that employees are qualified and competent. These standards guide training and development programmes and can be used as a basis for performance evaluations.
2. Industry standards and practices are criteria used to ensure consistent quality and safety across organisations and companies within an industry. Examples include ISO and OSHA standards, which are used to ensure safety in the workplace. The use of standards and practices is limited and subject to laws and regulations that take effect in using the standards and practices.
3. Occupational and industry standards and practices can be accessed from various sources depending on the industry and country. Here are a few potential sources:
    a. Government websites: Many countries have government agencies responsible for developing and maintaining occupational standards. These agencies often make their standards available on their websites.
    b. Industry associations: Industry associations or trade groups may develop and maintain occupational standards for their particular industry. These organisations may make their standards available on their websites or through membership.
    c. Accrediting bodies: Accrediting bodies may develop occupational standards as part of their accreditation process. These standards may be available on their websites or through their member institutions.
    d. Training and certification organisations: Organisations that offer training and certification programmes may develop occupational standards to guide their curriculum and assessments. These organisations may make their standards available to the public.
    e. International organisations: International organisations, such as the International Labour Organisation (ILO), may develop and promote recognised occupational standards across multiple countries.
4. Industry or occupational standards can help ensure that academic programmes are consistent in their approach and delivery and meet certain quality standards, benefiting both students and employers.

Occupational standard

5. According to UNESCO-UNEVOC, occupational standards define the skills, abilities and attitudes necessary for effective workplace performance, ensuring compliance with legal requirements and industry best practices.
6. The purposes of occupational standards include:

    a. Ensuring quality: Occupational standards define the knowledge, skills and abilities required to perform a job effectively. By establishing these standards, academic programmes can ensure that their workforce meets a certain level of quality and proficiency.
    b. Promoting consistency and developing job descriptions: Occupational standards help promote consistency in job performance across different employees and organisations. This can help ensure that products and services meet a certain level of quality, which in turn, can enhance the reputation of the industry or sector.
    c. Facilitating training and development: Occupational standards can be used to develop training and development programmes that help employees acquire the knowledge, skills and abilities required for their job. By providing a clear framework for training, occupational standards can help improve the effectiveness of these programmes and ensure that they meet the needs of both the employer and the employee.
    d. Supporting workforce mobility: Occupational standards provide a common language and framework for job performance that can be recognised across different organisations and industries. This can help facilitate workforce mobility, allowing employees to move between jobs and organisations more easily.
    e. Facilitating certification and credentialing: Occupational standards can be used to develop certification and credentialing programmes that formally recognise an individual's knowledge, skills and abilities in a particular area. This can help improve the credibility of the industry or sector and enhance the reputation of the individuals who hold these credentials.
    f. Conducting performance appraisals and managing succession plans.

7. Occupational standards enable employers to recruit specific workers, improve the match between employees and positions and aid in interview guides, industry requirements, certification programmes and succession plans.

8. Evaluating academic curriculum in the industry includes work activities, processes and competencies. Here is a brief overview of each:

    a. Work activities: Work activities refer to the tasks, functions or operations that are commonly performed in the industry or field. Evaluating an academic curriculum may involve reviewing it to ensure it covers the essential work activities students must perform in their future jobs.
    b. Processes: Processes refer to the methods, procedures or workflows used to complete work activities in the industry or field. Evaluating an academic curriculum may involve reviewing it to ensure it covers the essential processes students must understand and use in their future jobs.
    c. Competencies refer to the knowledge, skills and abilities required to effectively perform work activities and processes. Evaluating an academic curriculum may involve reviewing it to ensure it covers the essential competencies students must develop to succeed in their future jobs.

9. Examples of Malaysian and International Occupational Standards are listed below:

    a. Malaysia
        - Technology and Technical Accreditation (TTAC) Standard
        - Engineering Technology Accreditation Council (ETAC) Standard
        - Engineering Accreditation Council (EAC) Standard
        - National Occupational Skills Standards (NOSS)

    b. International
        - International Standard Classification of Occupations (ISCO)
        - International Labour Standards (ILS)
        - International Compliance Association (ICA)

Industry standard

10. Industry standards are widely accepted requirements for standard functioning and operations in various production fields. They facilitate global and domestic competitiveness, develop goals and serve as a quality check for industries like automotive.
11. A variety of different types of content are commonly used and recognised within a particular industry or field. Some examples include:

    a. Technical specifications and documentation: These documents describe the technical features and requirements of a product or system, such as

schematics, diagrams, user manuals and software documentation. Technical specifications are often used in engineering, electronics and software development industries.

b. Regulatory documents: These are documents that government agencies require to ensure compliance with laws and regulations. Examples include safety data sheets for hazardous materials, product labelling requirements and environmental impact reports.

c. Training materials are used to teach employees or customers about a particular product or service. They may include instructional videos, slide presentations, handbooks or online courses.

d. Marketing and advertising materials are used to promote a product or service to potential customers. Examples include brochures, product catalogues, advertising copy and social media posts.

e. Research reports and publications: These documents present the results of scientific or market research studies. They may be used in healthcare, biotechnology and market research industries.

12. Contents of industry standards are recognised, accepted by experts, subject to quality control and required by law.

13. Here are examples of Malaysian and International Industry Standards:

a. Malaysia

- Malaysian Standard (MS): This is a series of standards developed by the Department of Standards Malaysia (DSM) covering a range of products, processes and services. MS standards are developed in consultation with industry stakeholders and designed to ensure quality, safety and efficiency.
- Malaysian Sustainable Palm Oil (MSPO) Certification: This is a certification programme for sustainable palm oil production in Malaysia. It sets environmental, social and economic sustainability standards in the palm oil industry.
- Construction Industry Development Board (CIDB) Standard Forms of Contract: These are standard contracts developed by CIDB for use in the construction industry in Malaysia. They provide a standardised approach to contractual terms and conditions, helping to reduce disputes and ensure fairness in contract negotiations.

b. International

- International Organisation for Standardisation (ISO)

- American National Standards (ANS)
- Good Manufacturing Practices (GMP)
- Hazard Analysis Critical Control Point (HACCP)

14. The programme should consider the limitation of using industry standards. Here are some common limitations:

    a. Narrow focus: Industry standards often have a narrow focus and may not address all aspects of a particular industry or sector.
    b. Lack of flexibility: Industry standards can be prescriptive and inflexible, making it challenging for organisations to adapt to changing circumstances or emerging trends.
    c. Outdated: Industry standards can become outdated, particularly as new technologies, practices or regulations emerge. This can make it challenging for organisations to stay up-to-date and remain compliant with the latest standards.
    d. Lack of universal adoption: Industry standards may not be universally adopted, creating inconsistencies or confusion across different regions or markets.

Technical standard

15. Related to point 11 (a) in industry standards, technical standards are developed by industry organisations to ensure products, processes, services and systems meet performance, safety and quality requirements.
16. Technical standards encompass software development, hardware design, manufacturing processes, safety, environmental regulations and various industries.
17. Technical standards promote consistency, interoperability, safety and technology adoption, thereby reducing costs, improving efficiency and facilitating trade.
18. The technical standard outlines guidelines, specifications and requirements for performance, quality, safety or interoperability in specific industries. Some common elements of a technical standard may include:

    a. Scope and Purpose: A clear statement of the intended use and scope of the standard.
    b. Normative References: A list of other standards, regulations or guidelines that are referenced in the standard.
    c. Definitions: A list of definitions and terms used in the standard.
    d. Requirements: A set of specific requirements that must be met to comply with the standard.

e. Test Methods: Procedures for testing and evaluating compliance with the standard.
f. Verification and Validation: Methods for verifying and validating compliance with the standard.
g. Maintenance and Review: Procedures for maintaining and reviewing the standard over time.

19. The purpose of a technical standard is to provide a consistent and reliable set of guidelines or requirements that enable manufacturers, service providers and users to achieve a certain level of quality, safety or interoperability.

20. There are many examples of technical standards, depending on the industry or field of application. Here are a few examples:

a. ISO 9001: This is a quality management standard developed by the International Organization for Standardization (ISO). It provides a set of requirements for a quality management system, including documentation, processes and procedures, that organisations of any size and type can use to ensure customer satisfaction and continuous improvement.
b. IEEE 802.11: This is a standard for wireless local area networks (WLANs) developed by the Institute of Electrical and Electronics Engineers (IEEE). It specifies the physical and data link layer protocols for wireless device communication.
c. IEC 61000: This is a series of standards developed by the International Electrotechnical Commission (IEC) that addresses electromagnetic compatibility (EMC) issues in electrical and electronic equipment. It provides guidelines for minimising electromagnetic interference (EMI) and ensuring that electronic devices can operate in different electromagnetic environments.
d. ASTM D1238: This is a standard test method developed by the American Society for Testing and Materials (ASTM) for measuring thermoplastic melt flow rate (MFR). It provides a standardised method for evaluating the viscosity of molten plastics and can be used to compare different materials or to ensure consistency in manufacturing processes.
e. ANSI/ASHRAE Standard 62.1: This is a ventilation standard developed by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) and the American National Standards Institute (ANSI). It provides guidelines for indoor air quality and ventilation rates in commercial and institutional buildings.

21. The programme should consider the limitations of using technical standards. Here are some common limitations:

- The scope: Technical standards focus on specific technology, potentially limiting their applicability to other areas.
- Adoption period: Technical standards develop slowly, especially in industries with resistance or competing standards.
- The flexibility: Due to emerging technologies, established technical standards can be challenging to update.
- Coverage: Technical standards may not cover all aspects, requiring additional development.

Industry best practices

22. Industry best practices are widely accepted guidelines, methods or techniques for efficient task performance in a specific industry based on expert experiences and empirical evidence.
23. In cases where occupational and industry standards are unavailable or outdated, large companies with significant influence can be a reference of best practices for curriculum development.
24. Professional certification is one of the best practices in the industry. Industry leaders and professional societies usually establish training and certification programmes. The rest of the industry recognises the competency of personnel who have completed the programme.
25. The programme should consider the limitations of using industry best practices. Here are some common limitations:

- Limited scope: Industry best practices are often developed based on the experiences and knowledge of a relatively small group of experts, and they may not account for all the variations and nuances of different organisations and situations.
- Resistance to change: Industry best practices can become entrenched and resistant to change, even in the face of emerging trends or new technologies that could improve efficiency or effectiveness.
- Lack of flexibility: Industry best practices can be prescriptive and inflexible, making it challenging for organisations to adapt to changing circumstances or emerging trends.

- Lack of innovation: Relying too heavily on industry best practices can stifle innovation and creativity and prevent organisations from developing innovative problem-solving approaches.
- Cultural differences: Industry best practices may not be universally applicable or accepted, particularly across regions or cultures. Organisations may need to tailor best practices to suit their local environment's unique needs and circumstances.

Advisor panel committee

26. Advisory panel can consist of industry representatives, alumni, Government Agencies and Industry-led Bodies (ILB).
27. Advisory panel comprises industry experts and stakeholders that advise companies, organisations or government agencies.
28. The responsibilities of industry advisory panels vary from providing feedback on specific projects to addressing broader industry issues or challenges.
29. Industry advisory panels offer valuable insights, opportunities and challenges for organisations, which must be diverse, balanced, unbiased and based on evidence and expertise.
30. The programme should consider the limitation of getting input from the Advisory Panel Committee. Here are some common limitations:

    - Bias: The programme should ensure that members of the industry advisory panel are free of biases, perspectives and agendas that could affect their recommendations or feedback.
    - Limited representation: The programme should ensure that the composition of an industry advisory panel reflects the full diversity of the industry or its stakeholders, broadening the breadth of perspectives and input.
    - Time constraints: Members of an industry advisory panel may have limited time or availability to participate, which could affect the quality or quantity of input provided.
    - Limited impact: The recommendations or feedback provided by an industry advisory panel may not always be acted upon or may have limited impact, particularly if other competing priorities or constraints exist.
    - A deficiency of transparency: The recommendations or feedback provided by an industry advisory panel may not always be transparent or may be subject to confidentiality or non-disclosure agreements, which could limit the ability of others to access or use the information.

31. Organisations may need to ensure that the panel is representative of the full diversity of the industry, provide adequate support and resources to its members and commit to acting on the recommendations or feedback provided.

List of panel members

NO.	PANEL MEMBERS	ORGANISATION / INSTITUTION
1.	Associate Professor Ts. Dr. Muhammad Fahmi Bin Miskon (Chairman)	Universiti Teknikal Malaysia Melaka (UTeM)
2.	Ir. Ts. Dr. Wan Mohd Faizal bin Wan Abd Rahim (Standard Writer)	Universiti Malaysia Perlis (UniMAP)
3.	Professor Dr. Hj. Mohamad Abdullah@Don bin Hj. Hemdi	Taylor's University
4.	Associate Professor Ts. Dr. Mimi Mohaffyza binti Mohamad	Universiti Tun Hussein Onn Malaysia (UTHM)
5.	Dr. Mohd Akmal bin Rohiat	Universiti Tun Hussein Onn Malaysia (UTHM)
6.	Mr. Kumaran Nair	Malaysian-German Chamber of Commerce and Industry (MGCC) - *representative of MGCC until February 2024*
NO.	**REPRESENTATIVES**	**MINISTRY**
1.	Mr. Chandra Mohgan s/o Lechman	Department of Higher Education, Ministry of Higher Education (MOHE)
2.	Associate Professor Dr. Airil Haimi bin Mohd Adnan	Department of Higher Education, Ministry of Higher Education (MOHE) - *representative of MOHE until February 2024*
3.	Mdm. Nurul Awanis binti Muhammad	Department of Polytechnic & Community College Education, Ministry of Higher Education (MOHE)
4.	Ts. Dr. Sulaiha binti Ali	Department of Skills Development, Ministry of Human Resource (MOHR)

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