INTERMIN

REPORT ON TAILORED METRICS AND REFERENCE POINTS FOR QUALITY ASSURANCE AND INTERNATIONAL RECOGNITION OF TRAINING ON RAW MATERIALS RELATED TOPICS

Deliverable 3.2

Horizon 2020

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 776642

Authors

Vitor Correia, Alberto Sánchez and Isabel Fernandez

European Federation of Geologists - EFG

Rue Jenner, 13. 1000 Brussels, Belgium

www.eurogeologists.eu

Project coordination

Manuel Regueiro and Luis Jordá

Spanish Geological Survey. Instituto Geológico y Minero de España- IGME

Calle Rios Rosas 23, 28003, Madrid, Spain

Phone: +34 – 913495700

www.igme.es

Manuscript completed in July 2019

ACKNOWLEDGEMENT & DISCLAIMER

This publication is part of a project that has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 689527.

Lead beneficiary:	EFG
Other beneficiaries:	All consortium members
Due date:	31 July 2019
Nature:	Report
Diffusion	Public (PU)

Revision history	Author/ Verified	Delivery date	Summary of changes
Version 0.1	Vitor Correia	11/06/2019	Initial draft
Version 0.2	Vitor Correia	23/07/2019	Refinement of document and suggested metrics
Version 1.0	Vitor Correia	31/07/2019	Enhancement of contextual information on reference points

Project partners

	INSTITUTO GEOLÓGICO Y MINERO DE ESPAÑA	IGME	ES
	EUROGEOSURVEYS	EGS	BE
	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES	BRGM	FR
	ASOCIACIÓN DE SERVICIOS DE GEOLOGÍA Y MINERÍA IBEROAMERICANOS	ASGMI	ES
	LA PALMA RESEARCH CENTRE FOR FUTURE STUDIES SL	LPRC	ES
	UNIVERSIDAD POLITECNICA DE MADRID	UPM	ES
	EUROPEAN FEDERATION OF GEOLOGISTS	EFG	BE
	MONTANUNIVERSITAT LEOBEN	MUL	AT
	COORDINATING COMMITTEE FOR GEOSCIENCE PROGRAMMES IN EAST AND SOUTHEAST ASIA	CCOP	TH
	AMERICAN GEOLOGICAL INSTITUTE	AGI	US
	THE UNIVERSITY OF QUEENSLAND	UQ	AU
	YOUNG EARTH SCIENTISTS NETWORK	YES	BE
	SVERIGES GEOLOGISKA UNDERSOKNING	SGU	SE

Executive Summary

This report advances a quality assurance (QA) system for education and training in the raw materials area, leveraging the relevance, equity and efficiency of education and training systems pertinent to the raw materials sector.

The QA system for education and training in the raw material area has a direct relation with the international Sectoral Qualifications Framework for the Raw Materials sector (SQF-RM), defined in Intermin Deliverable 3.1 (Correia et al., 2019). The SQF-RM uses level descriptors, defined accordingly with the main areas of activity of the sector: 1) mineral exploration; 2) mineral extraction and processing; and 3) material engineering and recycling. Each qualification specified within the architecture proposed for the SQF-RM is referenced to a specific level on the European Qualifications Framework, describing sets of learning outcomes, i.e. knowledge, skills and autonomy/responsibility. The central link between the SQF-RM and the QA system for education and training in the raw material area is through learning outcomes. The SQF RM level descriptors are readable across a diversity of education and training systems, enabling the QA of qualifications through the realisation of discipline-specific learning outcomes.

The overall objectives of the QA system for education and training in the raw material area are to:

a) Improve the QA functions and responsibilities of accrediting agencies;
b) Cultivate and maintain a culture of quality and excellence within providers of education and training on raw materials topics;
c) Improve the quality of education and training programmes for students and trainees;
d) Ensure clarity and transparency in QA processes and outcomes;
e) Support and foster cooperation of key stakeholders across national borders.

The system is focused on the attainment of ‘quality’ in the following components:

1. Accrediting agencies and the quality management systems they use for carrying out their QA functions;
2. Providers of education and training and their internal QA processes;
3. Education and training programmes and the way they are designed, delivered and assessed

The QA system includes 32 quality standards and 86 guidelines applicable to each of these three components. It also includes simplified, focused on the system components, metrics and reference points advanced for the measurement of performance. These metrics address the effectiveness of the QA system, its excellence and its capacity to respond promptly to changes in context (timeliness).

Despite the high significance and applicability of the QA system for education and training in the raw material area, its success depends on its governance. The governance model suggested assumes that the adoption of the QA system will be voluntary and that the responsible institution for its implementation should be an independent international agency dealing with education and labour.

The validation of the QA system for education and training in the raw material area (and its governance model) calls for extensive consultation and dialogues involving relevant stakeholders, to be promoted by the INTERMIN Consortium. This should start at the earliest opportunity.

Table of Contents

1. INTRODUCTION

Mineral raw materials are crucial for the sustained functioning of modern economies, and the lack of a skilled workforce is a significant problem globally affecting the mineral raw materials industry (Ernst and Young, 2016). Advancing education and training and enhancing the mobility of the workforce are the complementary tools that INTERMIN is developing to tackle this problem. INTERMIN aims to:

- Generate a comprehensive competency model for employment across the raw materials sector;
- Introduce an international qualifications framework for the raw materials sector;
- Develop standard metrics and reference points for quality assurance and recognition of training;
- Create a conceptual framework for the development of joint educational training programmes based on present and future skills' needs;
- Develop and launch an online educational platform that will optimise international interaction and collaboration between stakeholders of the minerals value-chain.

INTERMIN advanced an international sectoral qualifications framework for the raw materials sector (SQF-RM, see deliverable 3.1), hence improving relevance, transparency and coherence between qualifications along the minerals value chain and the corresponding international recognition. The SQF-RM is focused on the areas, subareas, professional roles and sets of key competences of the raw materials sector that were described in INTERMIN's Skills catalogue for the raw materials sector (Regueiro and Jordá, 2019)) and is based on the existing European Qualifications Framework (EQF). The EQF is a standard reference framework that allows qualifications from different countries to be easily compared, using learning outcomes[1] associated with each qualification. This establishes a basis for improving the quality, accessibility, linkages and employers' recognition of qualifications in the raw materials sector, within a country and internationally.

Qualifications and competencies are gained through education and training, and education and training systems unfolded to meet the needs for knowledge and 'know-how' emerging from changes in economies and societies. However, these changes are now more frequent and unpredictable, and the current trend in education and training systems aims to support lifelong learning (ETF, 2015). In this context, informed policymaking and quality assurance systems of education and training are critical to ensure effective responses to changes driven

[1] Learning outcomes are statements that describe the knowledge, skills and autonomy/responsibility students should acquire by the end of a particular assignment, class, course, or training program, and help students understand why that knowledge, skills and autonomy/responsibility will be useful to them. Adapted from *What Are Learning Outcomes?* https://teaching.utoronto.ca/teaching-support/course-design/developing-learning-outcomes/what-are-learning-outcomes/

by technological developments and globalisation, safeguarding the provision of relevant knowledge and know-how for the present and the near future.

This report advances a quality assurance (QA) system for education and training in the raw materials area, leveraging the relevance, equity and efficiency of education and training systems pertinent to the raw materials sector. The proposed QA system includes indicative standards, guidelines and metrics for monitoring and review, designed to facilitate the international recognition of education and training programmes and qualifications.

2. QUALITY ASSURANCE IN EDUCATION AND TRAINING

2.1 Background

With the development of education and training systems and, later on, the 'massification' of education (at primary and lower secondary schooling levels), and public investment in education and training for social progress, quality assurance (QA) mechanisms were introduced by States (at system level) to safeguard education and training quality with a focus on governance, financing, management and efficiency as well as education and training contexts, inputs, processes, outputs and outcomes (ETF, 2015). The approach to QA in the public system of general education is similar in countries that have in common, among others: policies for universal access, types of governance, sources of funding, types of provider institutions, teacher qualification requirements, curricula/contents focussed on basic skills and key competency development, and methods of assessing learning outcomes. The QA approach tends to be centrally controlled or steered in systems characterised by delegation, usually by the Ministry of Education, which sets the norms and regulations (ETF, 2015). To a significant extent QA measures were built into organised learning and are patent in common practices such as setting and achieving standards for: qualifications, qualifications of teachers and other education and training staff, curricula and syllabi, textbooks/materials, inspection of teaching/learning, learning assessment through external examination and certification (ETF, 2015).

At the higher education level, the medieval model of the university as an institution for the education of the elite, with autonomous jurisdiction and under the patronage of the church or the sovereign, remained in place until the 19th century. The political significance of the research function, the proliferation of universities and the commodification of State aid led to a shift from a flat model of collegial governance to a complex form of professional administration and bureaucratisation that facilitated State steerage of QA at the higher education level (Clark, 2006). Accreditation supported this governance shift. The primary driver of accreditation was economic, as higher education became increasingly seen as a significant contributor to national wealth and development. Independent accreditation agencies for the validation of education quality were first established in the United States over 100 years ago. In the 1960s accreditation agencies were set up in Ireland and the UK, and 20 years later there was an exponential growth of these agencies throughout Europe and internationally, mostly set up by, or at the request of, governments. In a way, QA through accreditation and audit of autonomous universities was a forerunner for a paradigm shift concerning the entire education and training system (ETF, 2015).

From the 1980s, government policy in many lead economies, albeit at different times, speeds and degrees of intensity, moved towards market-orientated management of the public sector, as a response to the demand for a lean and more efficient state regime (deregulation), with cost-efficiency as the main driver. The introduction of a New Public Management system in

developed countries, characterised by disaggregation and 'incentivization'[2](Hood, 1991), increased competition between different public agencies and between them and private ones, promoted 'contracting out' and placed emphasis on outcomes. In this context, management by objectives, continuously monitored and expressed by indicators, gave rise to QA mechanisms focused on data collection and usage (Hood, 1991). Arguably, globalisation and digitalisation that propelled the New Public Management system have had the greatest impact on the higher education sector that is increasingly internationalised (ETF, 2015). This paradigm shift has resulted in the need for QA approaches that can cross borders. In Europe, the 'Bologna Process', set up to "increasing the international competitiveness of the European systems of higher education"[3] appeared as a response to this new paradigm. Various regions followed the European example and have developed regional QA frameworks.

Currently, broader models of QA frameworks are in place (Bateman and Coles, 2017), such as the European Standards and Guidelines for QA in the European Higher Education Area (ENQA, 2015) and the International Network for Quality Assurance Agencies in Higher Education Guidelines of Good Practice (INQAAHE, 2016).

Regional QA frameworks that cover education and vocational training include:

- The European Quality Assurance Reference Framework;
- The Pacific Quality Assurance Framework;
- The ASEAN Quality Assurance Framework;
- The East Asia Summit TVET Quality Assurance Framework.

All these frameworks aim to strengthen a culture of QA and improvement within education and training systems, to enhance mutual understanding of quality in qualifications across borders and to promote qualification outcomes. This report outlines the main aspects of the European, Pacific and ASEAN QA frameworks, since these are the most developed.

2.2 The European framework

2.2.1 Quality assurance in higher education

The Bologna Process, launched with the Bologna Declaration[4], is a voluntary process developed to enhance the quality and recognition of European higher education systems and

[2] Incentivization is the practice of building incentives into an arrangement or system in order to motivate the actors within it.

[3] Objective mentioned in the Bologna declaration (in full, Joint Declaration of the European Ministers of Education convened in Bologna on 19 June 1999). Retrieved from http://ehea.info/media.ehea.info/file/Ministerial_conferences/02/8/1999_Bologna_Declaration_English_553028.pdf

[4] Ibidem.

to improve the conditions for exchange and collaboration within Europe, as well as internationally. Launched in 1999, the Bologna Process established goals for reform in the participating countries, including a higher education three-cycle degree structure (bachelor, master's, doctorate), and adopted shared instruments, such as the European Credits Transfer and Accumulation System and the European Standards and Guidelines for QA in the European Higher Education Area (EHEA)[5].

The European Network for Quality Assurance in Higher Education (ENQA) was established in 2000 as a policy forum. In their 2001 biennial meeting in Prague (focussed on the follow-up of the Bologna declaration), European Ministers called for closer cooperation and greater degrees of mutual trust between recognition and QA networks. They encouraged all the partners to collaborate on the establishment of a common framework of reference for quality and to disseminate related good practices. In 2002, the Joint Quality Initiative produced the "Dublin Descriptors"[6], which were proposed as generic descriptors for all Bachelor and Master degrees, in relation to the qualification. By 2003 all Bologna signatory countries had established, or were in the process of establishing, agencies responsible for external quality control in some form or another and the majority of higher education institutes were undergoing external QA procedures (ETF, 2015).

The Conference of EU Ministers responsible for Higher Education of 19 September 2003 gave the mandate to ENQA to develop European Standards and Guidelines for QA (ESG) in the EHEA. The European Standards and Guidelines for QA were adopted in 2005 and revised in 2015 (ESG, 2015). These standards and guidelines establish common reference points for QA of higher education, enhancing comparability of QA in the EHEA and facilitating mutual trust and recognition of QA as well as qualifications. The Standards and Guidelines have been divided into three parts:

1. Internal quality assurance;
2. External quality assurance;
3. Quality assurance agencies.

These three parts are interlinked and work on a complementary basis in higher education institutions as well as in agencies and should be read as a whole. The European Standards and Guidelines for QA cover the following points (ESG, 2015):

[5] The EHEA was meant to ensure more comparable, compatible and coherent systems of higher education in Europe. It was implemented in 2010, and it has now 48 participating countries. In the EHEA, students can choose from a wide and transparent range of high-quality courses and benefit from smooth recognition procedures.

[6] The Dublin descriptors offer generic statements of typical expectations of achievements and abilities associated with qualifications that represent the end of each of the Bologna cycle. They are not meant to be prescriptive; they do not represent threshold or minimum requirements and they are not exhaustive; similar or equivalent characteristics may be added or substituted. The descriptors seek to identify the nature of the whole qualification (Bologna Working Group, 2005).

1. For internal quality assurance
    1.1. Policy for QA;
    1.2. Design and approval of programmes;
    1.3. Student-centred learning, teaching and assessment;
    1.4. Student admission, progression, recognition and certification;
    1.5. Teaching staff;
    1.6. Learning resources and student support;
    1.7. Information management;
    1.8. Public information;
    1.9. Ongoing monitoring and periodic review of programmes;
    1.10. Cyclical external QA.
2. For external quality assurance
    2.1. Consideration of internal QA;
    2.2. Designing methodologies fit for purpose;
    2.3. Implementing processes;
    2.4. Peer-review experts;
    2.5. Criteria for outcomes;
    2.6. Reporting;
    2.7. Complaints and appeals.
3. For QA agencies
    3.1. Activities, policy and processes for QA;
    3.2. Official status;
    3.3. Independence;
    3.4. Thematic analysis;
    3.5. Resources;
    3.6. Internal QA and professional conduct;
    3.7. Cyclical external review of agencies.

The European Standards and Guidelines for QA in the EHEA underlines the importance of QA agencies for external review and public accountability[7]. Nevertheless, the internal quality culture is paramount to the provision of relevant learning outcomes, and internal QA is the

[7] For this reason, the EU established in 2008 the European Quality Assurance Register, providing information on quality assurance agencies in Europe that comply with the European Standards and Guidelines for Quality Assurance. It is web-based and freely accessible on https://www.eqar.eu/. The European Quality Assurance Register also guarantees that the European Standards and Guidelines for QA in the EHEA are respected and implemented.

cornerstone for trust and confidence in the operations of institutions throughout the EHEA (EC/EACEA/Eurydice, 2018). The extent to which higher education institutions are required to develop and publish a strategy for internal QA is commonly defined by national legislation. The internal QA and institutional accountability of universities in the EHEA are increasingly established as a legal requirement (*Figure 1*).

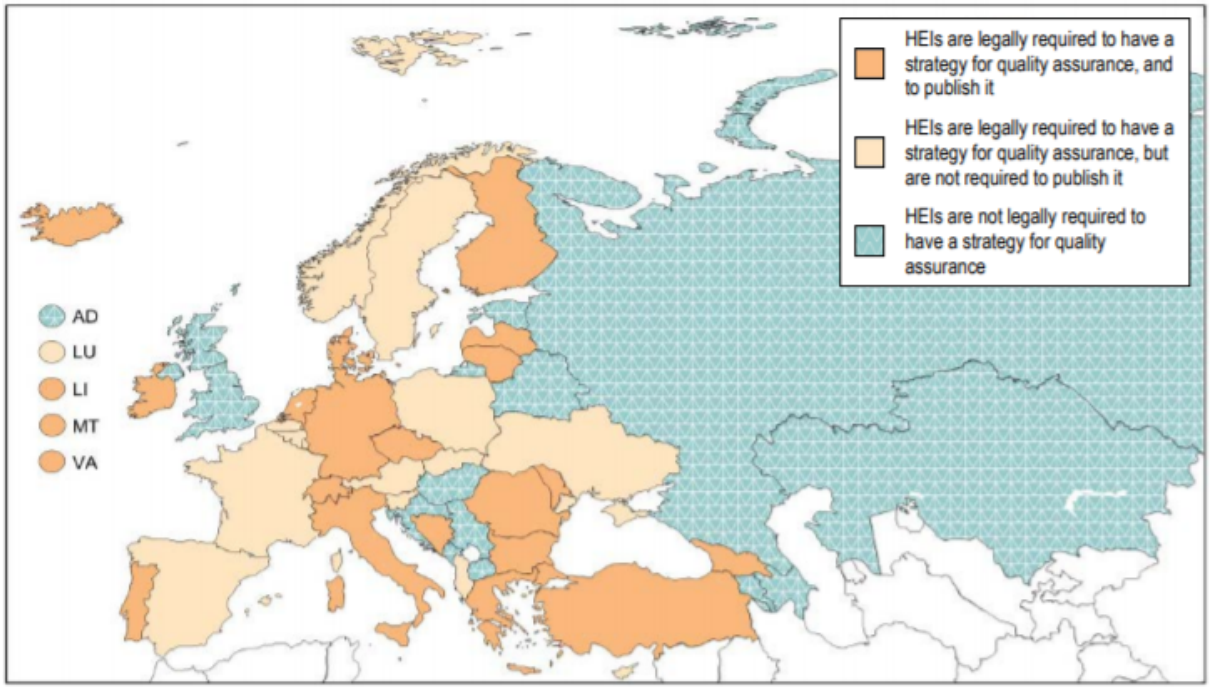
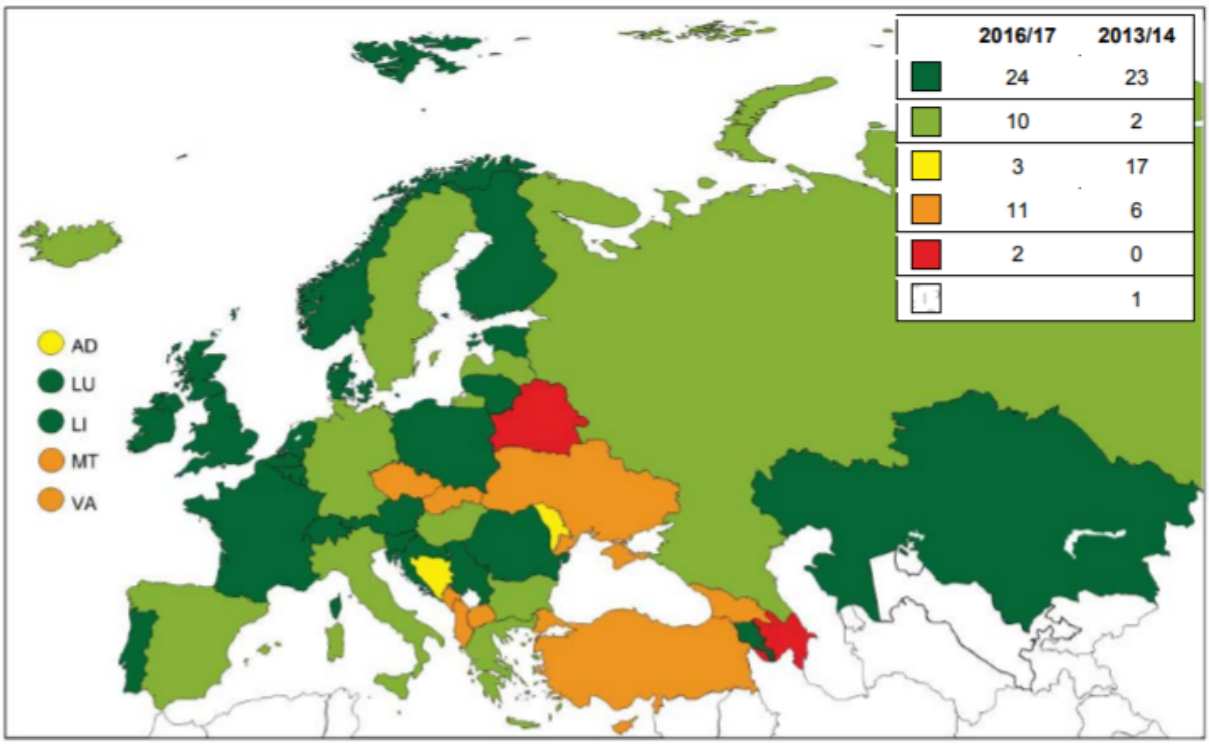


Figure 1 – Requirements for higher education institutions from the EHEA to develop and publish QA strategies, 2016/2017 (source: EC/EACEA/Eurydice, 2018, adapted from BFUG data).

In the EHEA, external QA agencies are legally required to consider the established European Standards and Guidelines for QA in their assessments (Figure 2). According to the Bologna Process Implementation Report of the European Higher Education Area in 2018 (EC/EACEA/Eurydice, 2018), all the elements of the European Standards and Guidelines are evaluated during external QA procedures in 24 countries of the EHEA. In further 10 countries, either there are requirements for European Standards and Guidelines issues to be considered during external QA processes, or in practice, they usually are considered. This group includes countries where the framework for QA is less obligatory in nature, allowing QA to focus on the most relevant issues for higher education institutions and/or programmes. In the remaining 14 countries a QA system is in place, but is not fully aligned with the European Standards and Guidelines for QA. In these systems, while the model for external QA may consider that certain elements need not be directly addressed in external QA processes, it is also possible that improvements could be made to integrate all main aspects of the European Standards and Guidelines. Only two countries have no external QA system in operation.



	A fully functioning quality assurance system is in operation nationwide, in which all higher education institutions are subject to regular external quality assurance by an agency that has successfully demonstrated compliance with the Standards and Guidelines for Quality Assurance in the EHEA (ESG) through registration on EQAR.
	A quality assurance system is in operation nationwide and is aligned to the ESG, but the agency/ies performing external quality assurance are not registered in EQAR.
	A fully functioning quality assurance system is in operation nationwide, but only some higher education institutions are subject to regular external quality assurance by an agency that has successfully demonstrated compliance with the ESG through registration on EQAR.
	A quality assurance system is in operation nationwide, but has not (yet) been fully aligned to the ESG.
	No quality assurance system is in operation.
	Not available

Figure 2 – Stage of development of external QA system in the EHEA, 2016/2017 (source: EC/EACEA/Eurydice, 2018).

2.2.2 Quality assurance in vocational education and training

Given the blurring of limits between vocational education and training (VET) and higher education, the philosophy, goals and mechanisms of the Bologna Process have an impact on VET in participating countries with varying effect. However, compared with the higher education sector, the VET sector is far more complex as regards organisation, governance, funding and diverse target groups (ETF, 2015).

QA, i.e. detailed administrative and procedural measures to safeguard quality, surfaced as an EU-level policy area with the Council Conclusions of 1995, which invited Member States to improve the quality of VET and develop, with the Social Partners, exchanges of information and experiences to promote methods and tools for the evaluation of quality[8]. European cooperation on QA in VET started in 2001, with the creation of the European forum on quality in VET (jointly set up by the European Commission and the European Centre for the Development of Vocational Training-Cedefop). Subsequent European cooperation led to the definition of common principles, guidelines and tools for quality development, which resulted in the establishment of a Common Quality Assurance Framework for VET, endorsed by the European Council in 2004[9]. In October 2005, the European Network for Quality Assurance in VET was launched, to ease the exchange of experiences, common learning, consensus building and support to further developing the Common Quality Assurance Framework model (ETF, 2015).

In 2009, the European Council and the European Parliament passed a Recommendation[10] establishing a European Quality Assurance Reference Framework for VET (EQARF). The EQARF builds on the work on QA of the Common Quality Assurance Framework and the European Network for Quality Assurance in VET, and complements the European Qualifications Framework (EQF)[11].

The EQARF is a reference framework comprising principles, criteria and a set of quality indicators. It was designed to promote better VET by providing authorities from the EU Member States with common tools for the management of quality, and its adoption is voluntary. The EQARF:

- includes the need for regular monitoring (involving internal and external evaluation mechanisms) and reporting on progress;
- uses common quality criteria and indicative descriptors to underpin the monitoring and reporting arrangements;
- stresses the importance of common indicators to support the evaluation, monitoring and QA of VET systems and providers.

[8] Cannes European Council, Conclusions of the Presidency, 1995. Retrieved from http://aei.pitt.edu/1446/1/cannes_june_1995.pdf

[9] See the Council of the European Union conclusions on quality assurance in vocational education and training. Brussels: Council of the European Union, 2004. Retrieved from http://ec.europa.eu/education/policies/2010/doc/vetquality_en.pdf

[10] Recommendation of the European Parliament and of the Council of 18 June 2009 on the establishment of a European Quality Assurance Reference Framework for Vocational Education and Training. Retrieved from https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2009:155:0001:0010:EN:PDF

[11] The EQF was set up in 2008 as a common reference framework of qualifications, expressed as learning outcomes at increasing levels of proficiency. For more information on this topic see Intermin Deliverable 3.1.

The goals of the EQARF[12] are:

1. To increase transparency and mobility

By establishing a shared understanding among the Member States of what constitutes quality, the EQARF increases transparency, consistency, portability and recognition of qualifications and competencies received by learners across European countries. It creates a common reference tool that enhances exchange and trust, thereby the mobility of workers and learners.

2. To valorise permeability in a lifelong learning perspective

The EQARF focuses on the improvement and evaluation of the outputs and outcomes of VET - in terms of three EU policy priories: increasing employability, improving the match between supply and demand for training, and promoting better access to lifelong training (especially for vulnerable groups). By emphasising 'outcomes' of VET, the EQARF:

- facilitates the permeability of learning paths between VET, general education and higher education aims to support recognition of learning outcomes without extending learners' education and training pathways;
- contributes to overcoming current unemployment problems by addressing the gap between labour market needs and labour force qualifications;
- allows more flexible pathways, enhancing the opportunities for lifelong learning;
- facilitates the recognition of informal and non-formal learning.

3. To make VET more attractive

By ensuring mutual recognition, thereby fostering international, national and sectoral mobility, VET providers can enrich training provision, raise the attractiveness of training programmes and enhance their pan-European reputation. The EQARF, because it is based on outcomes of VET, facilitates cooperation between VET providers and companies. This means that VET providers can strengthen the link between education and training and the labour market.

The quality criteria of the EQARF (Figure 3) follows the methodology of the plan–do–study–act (PDSA) cycle of improvement, an iterative four-step management method used by organisations for the control and continuous improvement of processes and products[13].

[12] Recommendation of the European Parliament and of the Council of 18 June 2009 on the establishment of a European Quality Assurance Reference Framework for Vocational Education and Training. Retrieved from https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2009:155:0001:0010:EN:PDF

[13] The concept of PDCA is based on the scientific method. The scientific method can be written as "hypothesis–experiment–evaluation" or as "plan–do–check". PDSA was made popular by W. Edwards Deming, who is considered by many to be the father of modern quality control For additional information see https://asq.org/quality-resources/pdca-cycle

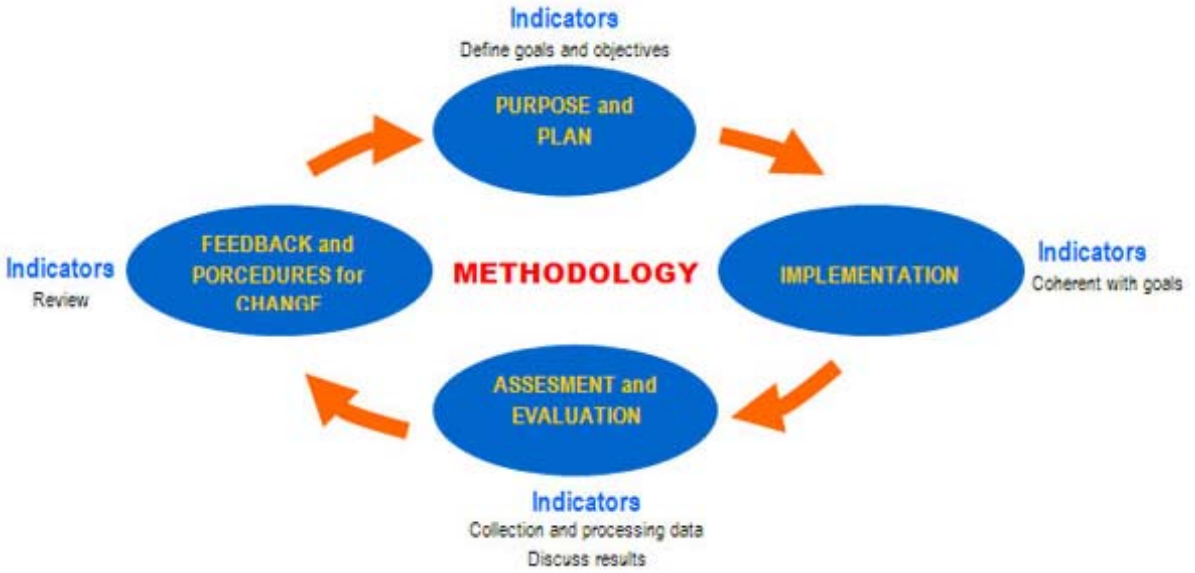


Figure 3 – Quality criteria of the European Quality Assurance Reference Framework for VET (EQARF; source: https://www.eqavet.eu/).

The European Quality Assurance in Vocational Education and Training (EQAVET) quality cycle is applied in the self-monitoring process of VET providers, using EQAVET indicators as a transversal element (Figure 4).

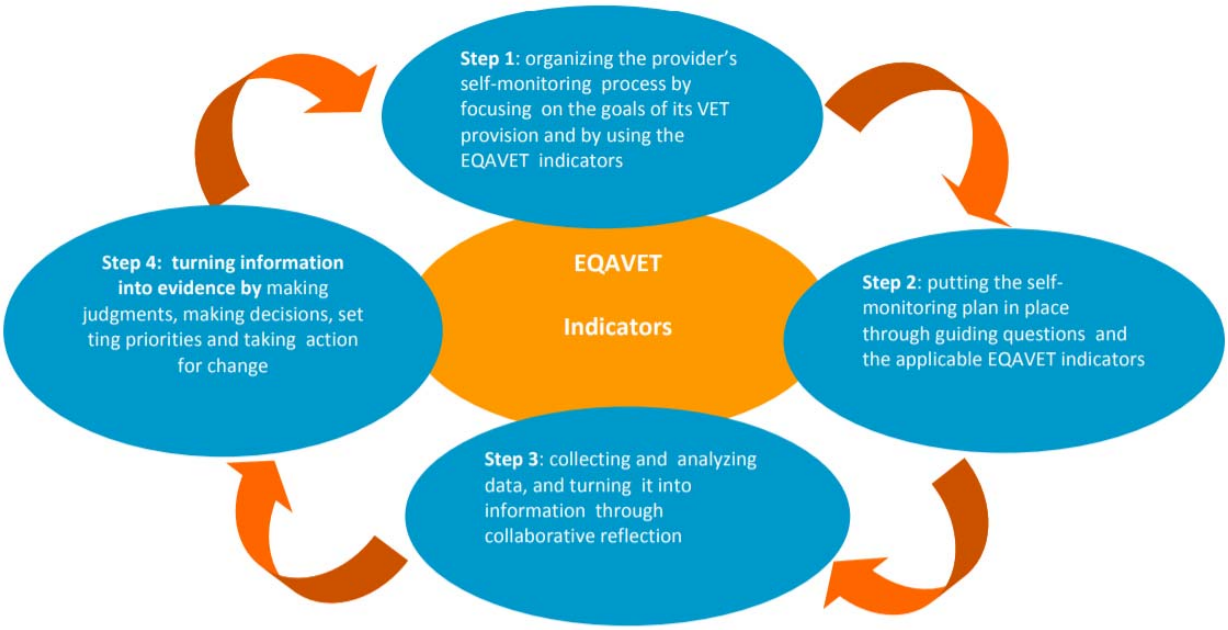


Figure 4 – Self-monitoring process of VET providers, using the EQAVET indicators (source: Galvão, 2011).

The EQARF uses the ten indicators[14], described in Table 1.

Table 1 – Indicators used by the European Quality Assurance Reference Framework for VET, EQARF.

Indicator 1	**Relevance of QA systems for VET providers**: (a) share of VET providers applying internal QA systems defined by law/at own initiative; (b) share of accredited VET providers.
Indicator 2	**Investment in training of teachers and trainers**: (a) share of teachers and trainers participating in further training; (b) amount of funds invested.
Indicator 3	**Participation rate in VET programmes**: Number of participants in VET programmes (1), according to the type of programme and the individual criteria (2). (1) For initial vocational training: a period of 6 weeks of training is needed before a learner is counted as a participant. For lifelong learning: percentage of the population admitted to formal VET programmes. (2) Besides basic information on gender and age, other social criteria might be applied, e.g. early school leavers, highest educational achievement, migrants, persons with disabilities, length of unemployment.
Indicator 4	**Completion rate in VET programmes**: Number of successfully completed/abandoned VET programmes, according to the type of programme and the individual criteria.
Indicator 5	**Placement rate in VET programmes**: a) destination of VET learners at a designated point in time after completion of training, according to the type of programme and the individual criteria (3); b) Share of employed learners at a designated point in time after completion of training, according to the type of programme and the individual criteria. (3) For IVT: including information on the destination of learners who have dropped out.
Indicator 6	**Utilisation of acquired skills at the workplace**: a) information on occupation obtained by individuals after completion of training,

[14] Annex I of the Recommendation of the European Parliament and of the Council of 18 June 2009 on the establishment of a European Quality Assurance Reference Framework for Vocational Education and Training. Retrieved from https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2009:155:0001:0010:EN:PDF

	according to the type of training and individual criteria; b) satisfaction rate of individuals and employers with acquired skills/competencies.
Indicator 7	**Unemployment rate** (4) **according to individual criteria**. (4) Definition according to ILO and OECD: individuals aged 15-74 without work, actively seeking employment and ready to start work.
Indicator 8	**Prevalence of vulnerable groups**: a) percentage of participants in VET classified as disadvantaged groups (in a defined region or catchments area) according to age and gender; b) success rate of disadvantaged groups according to age and gender.
Indicator 9	**Mechanisms to identify training needs in the labour market**: a) Information on mechanisms set up to identify changing demands at different levels; b) Evidence of their effectiveness.
Indicator 10	**Schemes used to promote better access to VET**: a) Information on existing schemes at different levels; b) Evidence of their effectiveness.

According to Galvão (2011), these indicators were not designed for benchmarking, and because they are interlocked, are normally used in a holistic way. They intend to support a culture of QA in VET, and they may be used as a "toolbox" by countries as they work on adapting and developing their VET systems.

2.3 The Pacific framework

The Pacific Quality Assurance Framework (PQAF) is the Pacific's response to the Brisbane Communiqué[15] for a "regional QA framework for the region". The PQAF addresses quality standards for accrediting agencies, all forms of education and training Institutions (such as technical and vocational, tertiary and non-tertiary, and field-specific forms, such as theological education and maritime training), and Programmes (SPC, 2015).

The PQAF is informed by the QA systems of larger countries (Australia, New Zealand and the European Community), as well as the development of Pacific systems. It provides a broad base for accrediting agencies and institutions to compare and inform their own QA policies and processes and is not intended to standardise the QA practices in the Pacific (SPC, 2015).

[15] Issued by the Ministers attending the 2006 Asia-Pacific Education Ministers' Meeting in Brisbane. For more information see https://shelbycearley.files.wordpress.com/2010/06/thebrisbanecommunique.pdf

The PQAF was conceived to provide broad quality principles on the roles and functions of accrediting agencies in monitoring and sustaining quality within post-school education and training institutions. Where the opportunity arises to relate to regional initiatives such as the Pacific Qualifications Framework or the Pacific Register of Qualifications and Standards, the PQAF provides a common quality standard for mutual understanding and implementation (SPC, 2015). The overall objectives of the PQAF are to (SPC, 2015):

- improve the QA functions and responsibilities of accrediting agencies;
- cultivate and maintain a culture of quality and excellence within Pacific institutions of learning;
- improve the quality of programmes for students and other beneficiaries within the region;
- ensure clarity and transparency in QA processes and outcomes;
- provide a measure of accountability for the investment of public and private funding;
- support and foster cooperation of key stakeholders across national borders;
- build professional trust and promote stakeholder confidence in the quality of Pacific education and training.

The priority areas of the PQAF are summarised in Table 2. These areas are direct responses to the challenges faced by education and training in the Pacific region (SPC, 2015).

Table 2 – Priority areas and areas of focus of the PQAF.

Priority areas	Areas of focus
Accrediting agencies and their quality systems (whether sectoral or national)	• Governance and management • The primary function is QA, including goals, objectives, and vision and mission statements • Adequate resources (physical, human and financial) • Independence and autonomy
Institutions of education and training	• Governance and management structure • Vision and mission statements that reflect its goals and objectives • Recruitment, selection and continuing professional development of its personnel • Adequate resources • An internal QA system that builds a culture of quality • Procedures for the design, development, delivery, assessment and review of its programmes
A programme of learning	• A title, outcome and purpose statements • Entry requirements, including pre-requisites and co-requisites • Resources – physical, personnel, financial, learning, etc.

Priority areas	Areas of focus
	• Duration of study and conditions for successful completion • Credit profile and qualification framework level
A module/course of study	• A title and purpose • Learning outcomes or competencies • Resources • Delivery and assessment methodologies • Entry requirements, including pre-requisites and co-requisites • Recognition of prior learning and/or current competencies • Duration of study and requirements for successful completion • Credit value and level on a qualifications framework

The PQAF defines quality standards and guidelines that cover (SPC, 2015):

- Accrediting agencies;
- Institutions and providers;
- Education programmes and their components.

2.3.1 Standards for quality assurance of accrediting agencies

The recognition of an accrediting agency as a standard-setting body is made for a five years period, and will then be reviewed. The recognition is an exercise which will confirm that accrediting agencies have (SPC, 2015):

- Basic structural and operational requirements for establishment and operations;
- Policies, procedures and resources to effectively function as a standard setting body;
- Clear mechanisms for support of its education and training sector and maintain accountability to its stakeholders;
- Strategies to ensure clarity, transparency and consistency in its QA processes;
- A culture of quality.

The PQAF quality standards for accrediting agencies are listed in Table 3 (SPC, 2015).

Table 3 – PQAF quality standards for accrediting agencies.

Accrediting agencies	
Standard 1 Establishment and Recognition	The agency is formally established and recognised as a QA agency for education and training.
Standard 2	The agency has suitable governance, management and

Governance, Management and Structure	organisational structures for the sound performance of its QA functions.
Standard 3 Independence and Autonomy	The agency's evaluations and decisions are based on accurate and authentic evidence and are not influenced by external parties.
Standard 4 External QA Criteria and Processes for High Education Institutions	The agency has well defined and clearly documented processes and criteria for QA of institutions and their programmes.
Standard 5 Internal QA System	The agency has in place processes for internal QA to enhance the quality and integrity of its operations.
Standard 6 Resources	The agency is adequately resourced to function effectively as an external QA organisation.
Standard 7 Representations and Appeals	There are equitable provisions for institutions to seek review of decisions made by the agency on QA processes.
Standard 8 Reporting	The agency informs and responds to the public; demonstrates accountability by reporting openly on review decisions; and on its own performance.
Standard 9 Information Management	The agency collects, manages and analyses data and uses the information to guide decision making.

2.3.2 Standards for quality assurance of institutions

The PQAF recognises that QA is paramount to instilling stakeholder confidence on education and training institutions and emphasises the importance of the cultivation and maintenance of a 'culture of quality', permeating all hierarchical levels, systems, procedures and education programmes. The PQAF contains 13 standards designed for building the capability of institutions to deliver sound education and training services. The objectives of the quality standards for institutions are (SPC, 2015):

- Encourage the institution to meet the expected quality;
- Provide guidance to the institution to develop a culture of quality;
- Ensure all staff contribute to the enhancement of quality in their areas of work;
- Commit the institution to continuous improvement.

The PQAF quality standards for institutions are listed in Table 4 (SPC, 2015).

Table 4 – PQAF quality standards for institutions.

Institutions	
Standard 1 Establishment, Organizational Focus and Structure	The institution's focus is the delivery of quality education and training and its organisational structure are suitable for its purposes.
Standard 2 Governance and Management	The institution has appropriate governance, management structures and personnel for the sound conduct of education and training services.
Standard 3 Programme Development and Review	The institution has a quality strategy for the development, approval, evaluation and periodic review of its programmes.
Standard 4 Learning and Teaching	The Institution creates a conducive learning environment and provides adequate and relevant information that enables learners to be successful in their studies.
Standard 5 Financial Stability	The institution has the financial capacity and mechanisms to sustain the quality delivery of education, training and assessment services.
Standard 6 Staffing	The institution recruits, manages, evaluates and trains staff to ensure the sound delivery and assessment of its education and training services.
Standard 7 Learner Information and Support	Adequate and relevant information and support services are provided to learners.
Standard 8 Physical and Learning Resources	The institution has adequate and appropriate physical and learning resources to support the delivery of its programmes.
Standard 9 Assessment and Moderation	The institution has fair, valid, transparent and effective systems and criteria for assessing learners against the programme outcomes.
Standard 10 Reporting Learner Achievement	The institution adequately and appropriately reports learner achievement.
Standard 11 Research	The institution has a research culture to meet the requirements of degree and post-graduate programmes and qualifications.
Standard 12 Information Management	The institution collects, analyses and uses relevant information for the effective management of its programmes and other activities.
Standard 13 Appeals, Grievances and Complaints Resolution	The institution has mechanisms for handling academic, general discipline and complaints in a fair, accessible and timely manner.

2.3.3 Standards for quality assurance of education programmes and its components

The PQAF considers that QA of a programme and its components[16] is essential in: confirming institutional capacity in developing, delivering and assessing programmes; protecting students from poor-quality programmes; increasing the confidence of the public in the institution's programmes and qualifications; facilitating articulation between programmes of different education and training sectors and institutions; and addressing quality-related issues pertaining to the adaptability, responsiveness and innovativeness of programmes in the production of new knowledge and skills (SPC, 2015).

The PQAF defines distinct standards for QA of education programmes and for programme components.

The PQAF defines ten quality standards for education programmes, based on the following principles (SPC, 2015):

- Academic and training programmes which meet the quality requirements should be offered;
- The primary responsibility for programme quality rests with institutions, and they should establish and sustain effective mechanisms that facilitate programme quality and yield reliable information for self-evaluation, external evaluation, and public reporting.

The PQAF standards applicable to education programmes are listed in Table 5 (SPC, 2015).

Table 5 – PQAF quality standards for education and training programmes.

Programmes	
Standard 1 Qualification Title	The title of the qualification is appropriate and complies with the definitions for qualification title and level.
Standard 2 Purpose Statement	The purpose statement appropriately identifies the need for the qualification.
Standard 3 Outcome Statement	The outcome statement for the qualification reflects the achievement of the stated purpose and specific knowledge, skills, understanding and attitudes acquired by learners.
Standard 4 Entry Requirements	Entry requirements are reasonable for the level and complexity of the qualification.
Standard 5 Components of the Programme	Programme components are relevant, appropriate and collectively contribute to achieving the programme outcomes.

[16] Components of programmes may either be courses, units, papers or modules (SPC, 2015).

Standard 6 Qualification Level	The qualification is assigned an appropriate level on the relevant qualifications framework, which reflects the relationship between its outcome statement and level descriptors of the framework.
Standard 7 Credit Profile	The qualification has a credit value indicative of the volume of learning in totality and its components.
Standard 8 Completion Rules	The requirements for successful completion are clearly stated and consistent with the qualification outcome statement and qualification type descriptors.
Standard 9 Programme Design, Approval and Review	The institution has a quality strategy for the design, approval and review of its programmes.
Standard 10 Assessment and Moderation	Assessment strategies are directly related to learning outcomes being assessed, and information on assessment clearly states how the results of assessment tasks are weighted and combined.

The PQAF ten standards for QA of programme components are listed in Table 6 (SPC, 2015).

Table 6 – PQAF quality standards for education and training programme components.

Programme Components	
Standard 1 Component Title	The component title is consistent with the field of study and indicates how the component relates to other components and the complete qualification.
Standard 2 Purpose	The purpose of the component reflects its relation to the field of study and to the whole qualification.
Standard 3 Learning Outcomes	The learning outcomes describe the specific knowledge, skills, understanding and attitudes a learner will achieve through each component of the programme.
Standard 4 Assessment	Assessment methodology is fair, valid, consistent and appropriate to the learning outcomes and delivery modes.
Standard 5 Entry Requirements	Entry requirements, including any co-requisite, pre-requisite and mature age entry requirements are clearly stated.
Standard 6 Completion Rules	Requirements for the successful completion of the component are clearly stated.
Standard 7 Credit Value	The credit value of the component is clearly stated and relates to the complete qualification.

Standard 8 Level of Component	The level of the component on a qualifications framework is consistent with its learning outcomes and how it relates to other components that make up the complete qualification.
Standard 9 Component developer	Information on the developer of the component is available.
Standard 10 Review Date	The review date of the component is appropriate and pre-defined.

The PQAF quality standards provide comprehensive instructions and guidelines that simplify their adoption, facilitating the collaboration among accrediting agencies and providers of education and training. Hence, the PQAF enables international benchmarking with other QA mechanisms, supports the mobility of learners and labour and the international recognition of qualifications and competencies.

2.4 The ASEAN framework

The Association of Southeast Asian Nations (ASEAN) was formally established by the Bangkok Declaration in 1967 with the agreement of six countries and later was joined by four others. With a current population of 625 million, the ASEAN aspires to be a stable, prosperous and highly competitive economic region in which there is a free flow of goods, services, investment and skilled workers towards equitable economic development as well as reduced poverty, social and economic disparity[17].

The ASEAN Community Vision 2025[18] recognises that economic growth and human resources development in each ASEAN economy depends on a sustainable and continuous process of life-long learning, skills development, and employability. Since there will be intensive mobility and exchange of labour within the ASEAN market, one of the key success factors of this process is the recognition of people's competencies and skills.

In 2008, with the aim of harmonising and creating a higher education common space, the ASEAN Ministers of Education endorsed the "Proposal on the Structured Framework for Regional Integration in Higher Education in SEA: the Road towards a Common Space". This document underlined the importance of creating a higher education common space, alongside a regional QA framework and a regional credit system, to facilitate student mobility (AQAN, 2016). In the same year, the ASEAN Members decided to create the ASEAN Quality Assurance Network (AQAN) to share good practices of QA in higher education, collaborate

[17] ASEAN Community Vision 2025, retrieved from https://asean.org/wp-content/uploads/2015/11/67.-December-2015-ASEAN-2025-Forging-Ahead-Together-2nd-Reprint.pdf
[18] Ibidem.

on capacity building and facilitate the recognition of qualifications and cross-border mobility throughout the region. The AQAN was formally established six years later, in 2014.

Also in 2014, following the established roadmap, the ASEAN countries approved the ASEAN Quality Assurance Framework for Higher Education for the Southeast Asian region. In the following year, the framework was renamed ASEAN Quality Assurance Framework (AQAF).

The AQAF consists of four sets of interrelated principles (AQAN, 2016):

1. External Quality Assurance Agencies;
2. External Quality Assurance Standards and Processes;
3. Institutional Quality Assurance;
4. National Qualifications Frameworks.

Each principle focuses on core statements. The AQAN uses generic principles and is not prescriptive. Its purpose is to serve as a common reference point for QA agencies and higher education institutions as they strive towards harmonisation amidst the diversity of higher education systems, cultures and traditions within the region. The AQAN also aims to facilitate the implementation of national qualifications frameworks in the ASEAN Member States.

In 2016, there were ten different qualifications frameworks within the ASEAN Economic Community (Bateman, 2016), with different purposes, legislative basis and accountability approaches. This context is a barrier that should be resolved by 2025, according to the ASEAN Community Vision 2025[19], that prescribes the alignment of all qualifications' frameworks within the ASEAN Economic Community upon the integration of one ASEAN market.

The alignment might be facilitated by the adoption and adaptation of the European higher education and VET systems. The ASEAN initiatives towards harmonisation of higher education systems show parallelism with the European context (Figure 5), and this may facilitate the harmonisation of systems within the ASEAN community in a short period.

A relevant initiative that illustrates the active cooperation between the EU and the ASEAN community is the ASEAN Quality Assurance Forum. The Forum is jointly conducted by the German Academic Exchange Service, the German Rectors´ Conference, the University of Potsdam, the ASEAN Quality Assurance Network, the ASEAN University Network, the European Association for Quality Assurance in Higher Education (ENQA), and the Regional Centre for Higher Education and Development and aims at developing capacity in the field of QA in the ASEAN region.

[19] Ibidem.

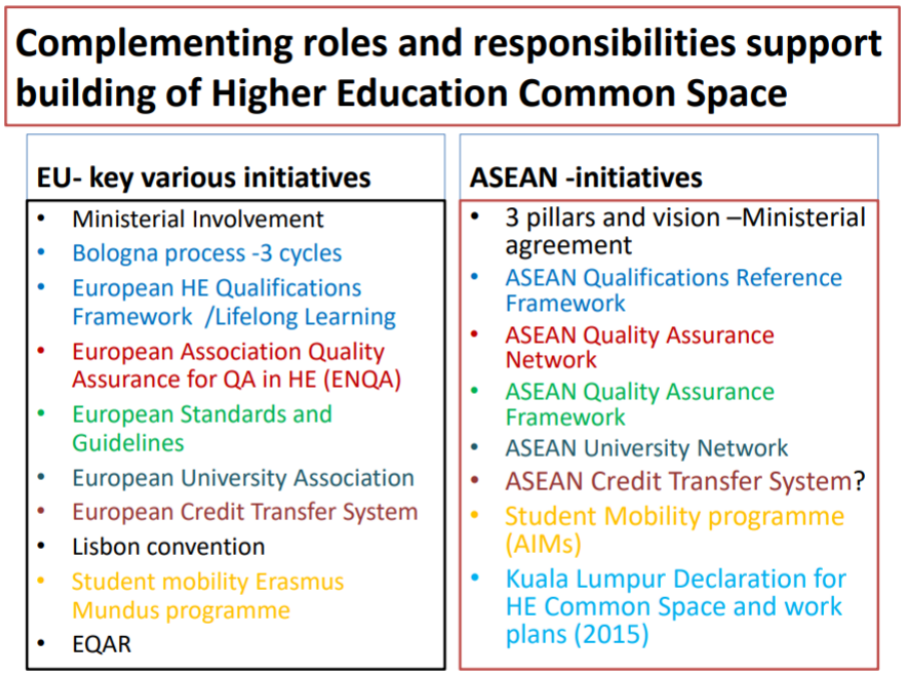


Figure 5 – Comparison of EU and ASEAN initiatives addressing the higher education framework (source: Fahmi, Zita Mohd, 2016. Presentation made at the ASEAN University Network International Conference 27 28 March 2016, Kuala Lumpur).

Currently, each ASEAN economy faces difficulties in recognising individual competency and skills across-borders because of the absence of guidelines that can be used as a reference (Bateman, 2016). This problem has a bigger impact on VET and life-long learning frameworks. Without the existence of such guidelines and a commonly accepted certification system, it is anticipated that there will be many issues potentially encountered by ASEAN economies related to human resources management such as: (i) recruitment; (ii) project requirements; (iii) qualification compliance; and (iv) competency/skill standards (Bateman, 2016).

3. QUALITY ASSURANCE IN THE RAW MATERIALS SECTORAL QUALIFICATIONS FRAMEWORK

The Sectoral Qualifications Framework for the Raw Materials sector (SQF-RM), advanced in Intermin Deliverable 3.1 (Correia et al., 2019), established a basis for improving:

1. International comparability and mutual recognition of qualifications;
2. Training programmes and validation processes;
3. International recognition of skills and certification processes;
4. Identification of the competencies of job candidates;
5. Professional development choices made by employees or other people interested in working in the raw materials industry;
6. The mobility of learners and workers.

To embrace the existing broad spectrum of approaches to the regulation of professions within the raw materials sector, the SQF-RM uses as a reference the European Qualifications Framework. This reference covers the partial and compound qualifications attained by the formal general, vocational and higher education systems.

The level descriptors of the SQF-RM are detailed accordingly with the main areas of activity of the sector: 1) mineral exploration; 2) mineral extraction and processing; and 3) material engineering and recycling. Each qualification defined within the architecture proposed for the SQF-RM is referenced to a specific level on the European Qualifications Framework, describing sets of learning outcomes, i.e. knowledge, skills and autonomy/responsibility.

The central link between the SQF-RM and its QA system is through learning outcomes. The SQF-RM level descriptors defined in Intermin Deliverable 3.1 (Correia et al., 2019) are readable across a diversity of education and training systems, enabling the quality assessment of qualifications through the realisation of discipline-specific learning outcomes.

The proposed QA measures of the SQF-RM considers:

a) Validation of qualifications and/or standards;
b) Accreditation and audit of education and training institutions;
c) Quality assurance of assessment leading to the award of qualifications.

Since the QA system of the SQF is still in an early stage, the role of QA bodies or agencies in the implementation of the SQF-RM is crucial, as recognised in Intermin Deliverable 3.1 (Correia et al., 2019). The report suggests the involvement of several bodies and agencies having international scope and coverage in the QA of the SQF-RM, including industry standard-setting bodies, self-accrediting and/or awarding providers, professional awarding

bodies, government agencies responsible for validation and monitoring of vocational training providers and courses, and international standard-setting agencies.

Intermin Deliverable 3.1 (Correia et al., 2019) also highlights that accreditation is the key feature of the SQF-RM QA, because it is during the process of accreditation, whether organised by a higher education institution, a vocational training provider, a professional body, an industry company or an external agency, that the learning outcomes for a specific programme are linked to those laid down in the level descriptors of the SQF-RM. Moreover, the accreditation process provides a level playing field that limits the barriers to the acknowledgement of new skills, new qualifications and different types or kind of knowledge.

Confidence in the QA of the SQF-RM ensures that learners/trainees and employers trust qualifications and that qualifications facilitate international mobility and progression within and between education and training systems. For this reason, the QA mechanisms of the SQF-RM must be developed, implemented, tested and enhanced, and this should be a priority of the body that will undertake the governance of the SQF-RM.

It is evident that the principal agents for QA of education and training in the raw materials area (whether in relation to higher education, VET or general education), have an important role to play in advancing the implementation of the learning outcomes-based SQF-RM. In this context, the QA system for education and training in the raw materials area advanced in this document is interlinked with the QA of the SQF-RM.

4. QUALITY ASSURANCE SYSTEM FOR EDUCATION AND TRAINING IN THE RAW MATERIALS AREA

4.1 Purpose and objectives

The use of learning outcomes increasingly informs education and training policies and practices, with the aim of increasing the transparency of qualifications, strengthen their accountability and promote active learning (Murray, 2013). For this reason, the QA system for education and training in the raw material area has a direct relation with the SQF-RM and encompasses academic and vocational learning outcomes.

The QA system for education and training in the raw materials area aims to ensure that education and training meet the requirements for 'quality' that are expected by relevant stakeholders. Quality is a complex, multi-dimensional and often subjective concept, as it is most often determined by different stakeholders under usually very different circumstances. In assuring the quality of education and training activities, 'quality' is understood to mean any of the following: 'excellence', 'fit for purpose', 'continuous improvement', 'achieving thresholds' and 'enhancement' (Bateman and Coles, 2017). QA is the set of planned and systematic processes that provide confidence in the design, delivery and award of qualifications within an education and training system. QA ensures that relevant policies and procedures are thoroughly developed and clearly communicated to all relevant personnel for implementation (Bateman and Coles, 2017).

The overall objectives of the QA system for education and training in the raw materials area are to:

a) Improve the QA functions and responsibilities of accrediting agencies;
b) Cultivate and maintain a culture of quality and excellence within providers of education and training on raw materials topics;
c) Improve the quality of education and training programmes for students and trainees;
d) Ensure clarity and transparency in QA processes and outcomes;
e) Support and foster cooperation of key stakeholders across national borders.

4.2 Level of implementation

INTERMIN was launched to generate a comprehensive competency model for employment across the raw materials sector, supported by a tailored international qualifications framework (the SQF-RM described in Intermin Deliverable 3.1 [Correia et al., 2019]), and by standard metrics and reference points for QA and international recognition of training and qualifications, facilitating the mobility of professionals.

Hence, the level of implementation of the QA system for education and training in the raw material area is international. However, because different countries in the world have contrasting capacities and resources allocated to QA of education and training, the breadth and adaptability of the proposed QA system for education and training in the raw materials area is broad.

Considering the above-mentioned factor, the QA system for education and training in the raw materials area defined in this document uses as a reference the Pacific Quality Assessment Framework (PQAF; SPC, 2015) described in Section 2.3. The PQAF is well adapted to distinct/contrasting contexts, that range from the absence of a common standard for assessing quality within an agency, an institution, a country and across the region to well-developed regional qualifications frameworks and their corresponding QA procedures, applicable to diverse categories of education and training.

Henceforth, the scope, principles and standards described for the QA system for education and training in the raw materials area that are detailed in the following sections were adapted from the PQAF.

4.3 Scope

The QA system for education and training in the raw materials area is focused on the attainment of 'quality' in the following components:

a) Accrediting agencies and the quality management systems they use for carrying out their QA functions;
b) Providers of education and training and their internal QA processes;
c) Education and training programmes and the way they are designed, delivered and assessed.

4.4 Principles

The following principles guide the application of the QA system for education and training in the raw materials area:

a) Integrity: the QA system is based on ethical and transparent practices and procedures that instils mutual trust, confidence and understanding of education and training systems all over the world;
b) Evidence-based: all findings and conclusions are based on factual evidence that is accurate and directly related to the area being investigated;

c) Independence: any QA activity being conducted (e.g. accreditation or audit) must be implemented by people who are independent of the area under review, and they must remain impartial until the activity is completed; the reports and conclusions of a QA activity are not influenced by external parties;
d) Confidentiality: any information collected is protected from unauthorised access and use, and the privacy of informants is protected;
e) Balanced reporting: any report produced must be complete, accurate and objective, covering both the strengths and weaknesses of a system or process; all audit reports must highlight the facts supported by adequate evidence;
f) Fit for purpose: The QA system for education and training in the raw materials area can be applied to any agency, institution or programme. The purpose will guide how the QA system for education and training in the raw materials area is applied, irrespective of the size, context, resources or complexity. The goal is to obtain accurate and authentic evidence for continuous improvement.

4.5 Quality standards

Regardless of the type of programme — academic, technical and vocational, or apprenticeships — the QA system for education and training in the raw materials area will provide a common ground for understanding and implementing quality teaching and learning.

The quality standard and guidelines cover the following three components of the QA system:

1. Accrediting agencies;
2. Providers of education and training; and
3. Education and training programmes.

4.5.1 Standards and guidelines for accrediting agencies

The recognition of an accrediting agency as a *standard-setting body* requires a periodic assessment to confirm that the agency has:

- The basic structural and operational requirements for establishment and operations;
- The necessary policies, procedures and resources to effectively function as a standard-setting body;
- Specific mechanisms for support of the raw materials education and training sector;
- Strategies to ensure clarity, transparency and consistency in its QA processes; and
- A culture of quality.

Standard A1: Establishment and recognition

The agency is formally established and recognised as a QA agency for education and training.

Guidelines:

1.1 The agency is established by a legal or equivalent instrument which specifies its functions and powers;

1.2 The purpose of the agency is to set standards for education and training provision and programmes;

1.3 The organisation has vision, mission, goals and objectives that are consistent with its purpose.

Standard A2: Governance, management and structure

The agency has suitable governance, management and organisational structures for the sound performance of its QA functions.

Guidelines:

2.1 The agency has a governing body whose members are suitably qualified, experienced and represents the various sectors of education and training;

2.2 The governing body has a strategic role in providing directions on effective management of its operations;

2.3 The members of the management board are appropriately qualified and experienced;

2.4 There is a well-defined organisational structure which reflects the nature of positions and personnel required to carry out the functions of the agency.

Standard A3: Independence and autonomy

The agency's evaluations and decisions are based on accurate and authentic evidence and are not influenced by external parties.

Guidelines:

3.1 The agency's decisions on QA processes are fair, consistent and based on pre-defined and publicised criteria;

3.2 The performance of the agency's operations and functions are undertaken without discrimination and/or external influence;

3.3 The agency has in place mechanisms to manage conflicts-of-interest in the work of its governing body, management and staff.

Standard A4: External QA criteria and processes for Higher Education Institutions

The agency has well defined and documented processes and criteria for QA of higher education institutions and their programmes.

Guidelines:

4.1 The agency's QA strategies incorporate international guidelines;

4.2 The QA policies, procedures, guidelines and requirements are pre-defined and publicly available;

4.3 There is evidence of stakeholder involvement in the development of standards and criteria for QA;

4.4 The QA reports prepared by the agency are accessible to stakeholders.

Standard A5: Internal QA system

The agency has in place processes for internal QA to enhance the quality and integrity of its operations.

Guidelines:

5.1 The agency's policies and procedures on internal QA demonstrate its accountability to its stakeholders and are publicly available;

5.2 The agency reflects a commitment to its internal QA by:

a) Having an internal quality management system that guides its operations and ensures all persons involved in its activities are competent, act professionally and ethically;

b) Protecting against intolerance and discrimination of any kind;

c) Conducting regular self-reviews by adequately qualified and experienced personnel;

d) Making accessible reports on its QA to the stakeholders; and

e) Ensuring the production of its annual and audited financial reports regularly.

5.3 The agency is affiliated to and collaborates with regional and international QA agencies and networks.

Standard A6: Resources

The agency is adequately resourced to function effectively as an external QA organization.

Guidelines:

6.1 The agency has an adequate level of physical, financial and human resources to carry out its functions and responsibilities;

6.2 The agency has adequate staff for the conduct of its functions;

6.3 The agency has a pool of qualified and trained assessors and auditors;

6.4 The agency has strategies and provisions for professional development and training of its permanent and temporary staff and experts.

Standard A7: Representation and appeals

There are equitable provisions for institutions to seek review of decisions made by the agency on QA processes.

Guidelines:

7.1 There are clearly defined provisions for institutions to seek review of the decisions made by the agency;

7.2 The policies and procedures on review are fair and publicly available;

7.3 There is an independent, transparent and fair review process.

Standard A8: Reporting

The agency informs and responds to the public, demonstrates accountability by reporting openly on review decisions and its performance.

Guidelines:

The agency reports:

8.1 Are clear, factual, detailed and supported by authentic evidence; and

8.2 Contain decisions, recommendations, actions required for improvement and their timeframe and reasons.

Standard A9: Information management

The agency collects, manages and analyses data and uses the information to guide decision-making.

Guidelines:

9.1 The agency systematically maintains records of official data, decisions and outcomes of its processes;

9.2 Data is analysed, and results are used in the overall development of the education and training sector.

4.5.2 Standards and guidelines for providers of education and training

Providers of education and training are critical agents of the design and delivery of education and training programmes. Through the application of these standards, providers of education and training will demonstrate a commitment to continuously improving the quality of their educational provisions and to maintain it at expected levels. The standards and guidelines will assist an institution in:

- Improving operational transparency and accountability to its stakeholders;
- Enhancing its reputation as the preferred destination for quality education and training;
- Continuous self-reflection and analysis of its policies and procedures for constant improvement.

Standard B1: Establishment, organisational focus and structure

The institution's focus is the delivery of quality education and training, and its organisational structure is suitable for its purposes.

Guidelines:

1. The institution is constituted and legally recognised in a defined jurisdiction;
2. The institution has clearly stated its vision, mission, goals and functions which:
    a) Reflect a desire to develop, sustain and improve the quality of education and training;
    b) Guide decision-making in planning, resource allocation and programme development and delivery.
3. There is a well-defined and understandable organisational structure that reflects the provision of education and training, and administrative, financial and support services;
4. The key responsibilities of distinct positions are specified.

Standard B2: Governance and management

The institution has appropriate governance, management structures and personnel for the provision of education and training services.

Guidelines:

1. There is an experienced or qualified governing body for all of the institution's activities;

2. The institution has appropriate management structures and personnel who are appropriately trained, experienced, responsible and accountable for the decisions they make.

Standard B3: Programme development and review

The institution has a quality strategy for the development, approval, evaluation and periodic review of its programmes.

Guidelines:

1. There are documented strategies and guidelines for the development, approval, evaluation and review of the education and training programmes;
2. There is adequate evidence of relevant stakeholder support (industrial, professional, technical, academic and community) in the design, development and review of programmes;
3. There are provisions to ensure that the outcomes of programme monitoring and review processes are utilised for continuous improvement.

Standard B4: Learning and teaching

The institution creates a conducive learning environment and provides adequate and relevant information that enables learners to be successful in their studies.

Guidelines:

1. The institution establishes and maintains a sound, stable and well-organised learning environment;
2. The institution effectively integrates Information Communications Technology to enhance learning and teaching/training;
3. Varied and innovative teaching strategies including practical and fieldwork are utilised in the delivery of the institution's programmes;
4. There is an effective feedback system for evaluating the quality of teaching and training delivery in all modes and sites.

Standard B5: Financial stability

The institution has the financial capacity and mechanisms to sustain the quality delivery of education, training and assessment services.

Guidelines:

1. The institution has the financial capacity to sustain its operations;
2. The institution conducts and reports financial transactions following sound financial management practices.

Standard B6: Staffing

The institution recruits, manage, evaluate and train staff to ensure the proper delivery and assessment of its education and training services.

Guidelines:

1. The institution is appropriately staffed to achieve its mission and goals;
2. There are policies and processes on selection, recruitment, training, evaluation, appraisal, promotion and discipline of staff;
3. The institution has systems for dissemination of all relevant information to its faculty to ensure their commitment to its vision, mission and values.

Standard B7: Learner information and support

The institution has adequate and appropriate physical and learning resources to support the delivery of its programmes.

Guidelines:

1. The institution makes available current and accurate information about itself, all its programmes and other services it offers for leaners and stakeholders to make informed decisions;
2. The institution has policies and procedures on selection and admission of learners and provision of learner support; and
3. The institution makes available information on admission criteria and requirements, programme outlines, assessment and completion requirements.

Standard B8: Physical and learning resources

The institution provides adequate and relevant information and support services to learners.

Guidelines:

1. The institution has adequate and appropriate physical and learning resources to deliver all its programmes;
2. There are mechanisms for the periodic review and acquisition of resources.

Standard B9: Assessment and moderation

The institution has fair, valid, transparent and effective systems and criteria for assessing learners against the programme outcomes.

Guidelines:

1. The Institution's regulations and policies on assessment and moderation (internal and external) are explicit, transparent, fair and have provisions on reassessments, special assessments, reporting assessment outcomes, appealing assessment decisions, progression and completion, and unacceptable practices on evaluation;

2. There are mechanisms to ensure that the:

a) Volume, timing, weighting and nature of assessments are appropriate and aligned to learning outcomes/performance criteria;

b) Requirements for assessment and marking criteria are made accessible to students;

c) Feedback on assessment is constructive and communicated to learners promptly.

Standard B10: Reporting learner achievement

The institution adequately and appropriately reports learner achievement.

Guidelines:

The institution's policies and procedures for reporting learner achievement include:

a) Nature of assessment outcomes reported with the institution's grading scale;

b) Information about credit aggregates and transfer processes;

c) Conditions for issuance of qualifications and results upon completion or partial completion of programmes; and

d) Displaying the logo of the accrediting agency on its qualifications.

Standard B11: Research and innovation

The institution has a research and innovation culture to meet the requirements of degree and post-graduate programmes and qualifications.

Guidelines:

The institution has established structures, policies and procedures on research and innovation (where appropriate) to:

a) Meet education and training requirements for degree and post-graduate programmes;

b) Encourage staff to dedicate time and resources to research and innovation that informs the development, delivery, assessment and review of their projects;

c) Facilitate the development of a research and innovation culture.

Standard B12: Information management

The institution collects, analyses and uses relevant information for the effective management of its programmes and activities.

Guidelines:

1. The institution has mechanisms for the collection and management of data on learners' details, assessment results/outcomes, course completion and progression rates, employability of graduates, evaluation of programmes and learning resources;
2. There are mandatory procedures for personal data protection of learners and staff;
3. Data is analysed and effectively utilised for the continuous improvement of the institution and its programmes.

Standard B13: Appeals, grievances and complaints resolution

The institution has mechanisms for handling academic, discipline and general complaints in a fair, accessible and timely manner.

Guidelines:

1. There are clearly defined provisions for raising grievances and seeking review of the decisions made by the institution;
2. The policies and procedures on review are fair and publicly available;
3. There is an independent, transparent and fair review process.

4.5.3 Standards and guidelines for education and training programmes

QA of education and training programmes is essential in:

- Confirming institutional capacity in developing, delivering and assessing programmes;
- Protecting students from poor-quality programmes;
- Increasing the confidence of the public in the institution's programmes and qualifications;
- Facilitating articulation between programmes of different education and training institutions;
- Addressing quality-related issues related to the adaptability, responsiveness and innovativeness of programmes in the production of new knowledge and skills.

The process for the QA of a programme provides answers to the following questions:

a) How well does the programme design lead to the achievement of the learning outcomes, stakeholder demands and strategic purpose?

b) How well do the programme delivery methods and assessment match the identified needs of learners and the aim of the qualification?

c) To what extent the programme enables graduates to pursue intended educational, employment, community and cultural outcomes?

Standard C1: Qualification title

The title of the qualification is appropriate and complies with the definitions for qualification title and level.

Guidelines:

The title:

a) Is consistent with the purpose, content, type and level of the qualification;

b) Indicates the subject area of the programme; and

c) Complies with the level descriptors and learning outcomes.

Standard C2: Purpose statement

The purpose statement appropriately identifies the need for the qualification.

Guideline:

The purpose statement identifies why the programme was designed and what need it was to address.

Standard C3: Outcome statement

The outcome statement for the qualification reflects the achievement of the stated purpose and specific knowledge, skills and autonomy/responsibility acquired by learners.

Guidelines:

The institution demonstrates this by ensuring the outcome statement:

1. Reflects the level assigned to the qualification and describes knowledge and skills (or learning outcomes) the learner has achieved;

2. Is aligned to a unique level of the SQF-RM and its level descriptors and:

a) Improves understanding about the qualification in describing achievement;

b) Allows for meaningful comparison with other qualifications; and

c) Enhances articulation and provide pathways to other qualifications or employment opportunities.

Standard C4: Entry requirements

Entry requirements are reasonable for the level and complexity of the qualification.

Guidelines:

The institution demonstrates this by ensuring that:

1. Entry and selection criteria and requirements (including co-requisite and pre-requisite requirements) are fair, reasonable and clearly stated;
2. There are provisions for cross credits, credit transfer and recognition of prior learning;
3. Entry restrictions (if any) and their reasons are stated and are non-discriminatory.

Standard C5: Components of the programme

Programme components (units, papers or modules) are relevant, appropriate and collectively contribute to achieving the programme outcomes.

Guidelines:

The institution demonstrates this by ensuring that:

1. The components are clearly defined and appropriate for the level, type, credit value and qualification;
2. The descriptor for each component states the following:
    a) title;
    b) purpose;
    c) learning outcomes and defined competencies;
    d) pre-requisites;
    e) delivery modalities, including work-based components;
    f) assessment methodologies;
    g) duration;
    h) completion rules;
    i) credit value;
    j) the level of the SQF-RM.

Standard C6: Qualification level

The qualification is assigned an appropriate level on the SQF-RM, underlying the relationship between its outcome statement and level descriptors of the SQF-RM.

Guidelines:

The institution demonstrates this by ensuring that:

1. The qualification level complies with the level descriptors and credit profile; and

2. Is appropriate in terms of the complexity of the learning outcomes and the volume of learning.

Standard C7: Credit profile

The qualification has a credit value indicative of the volume of learning in totality and its components.

Guidelines:

The institution demonstrates this by ensuring that:

1. The credits for the components at various levels are exposed;

2. The credit profile complies with the definition of the qualification type;

3. The total credit is the aggregate of credit components.

Standard C8: Completion rules

The requirements for successful completion are stated and consistent with the qualification outcome statement and corresponding level descriptors.

Guidelines:

The institution demonstrates this by:

1. Specifying the requirements for programme completion, including:
    a) Maximum and minimum periods (if any);
    b) Programme structure and the progression through the programme;

2. Demonstrating how the learner achievement for individual components will be reflected in the overall award of the qualification; and

3. Specifying the grading system for the complete diploma.

Standard C9: Programme design, approval and review

The institution has a quality strategy for the design, approval and review of its programmes.

Guidelines:

The strategies and instructions on programme design, development and review ensure that:

1. The components and learning outcomes constitute a coherent programme whose purpose meets the outcome of the qualification;

2. The programme and its components meet the needs of stakeholders (industrial, professional, technical, academic and community);

3. Where necessary, core courses and electives are clearly stated;

4. The institution has a strategy for continuous review of its programmes.

Standard C10: Assessment and moderation

Assessment strategies are directly related to learning outcomes being assessed, and information on assessment clearly states how the results of assessment tasks are weighted and combined.

Guidelines:

The assessment strategy clearly states:

1. The assessment tasks, requirements and activities to be completed;

2. Opportunities for re-assessment, where necessary;

3. Assessment moderation (internal and/or external) arrangements where the institution has multiple campuses or other similar arrangements;

4. Work, practical and field-based assessment tasks that are integrated into the total programme and component assessment, where relevant; and

5. The grading system for the recognition of various levels of performance.

4.6 Quality assurance metrics and reference points

Performance measures provide details on how well a process or procedure works, if goals are met, if clients are satisfied and if products or services produced by an organisation meet established quality standards.

There are several performance measures addressing education and training programmes (e.g. the percentage of students completing a course), but there is no international level agreement addressing the measurement of the performance of the components of the QA system (accrediting agencies, providers of education and training and education and training programmes).

Complex or multidimensional measures are too difficult or costly to assemble regularly. For this reason, the parameters advanced herein for the measurement of the performance of the components of the QA system for education and training in the raw material area are simplified. The metrics and reference points advanced in the following sections can be used

to measure the effectiveness of accrediting agencies, providers of education and training and education and training programmes, their excellence and their timeliness.

4.6.1 Effectiveness metrics and reference points

The assumption for the metrics used to measure the effectiveness is that the involvement of stakeholders in the development of standards and criteria for QA of accrediting agencies, providers of education and training and education programmes increases the effectiveness of the QA system, because it reduces the gap between stakeholders' (organisations or/and individuals) expectations and reality.

Table 7 details the effectiveness metrics and reference points considered for each component of the QA system for education and training in the raw material area.

Table 7 – Effectiveness metrics and reference points considered in the QA system.

Component of the QA system	Effectiveness metrics	Reference points
Accrediting agencies	Number and relevance of stakeholders and stakeholders' groups consulted in the development of standards and criteria for QA	Evidence that at least one relevant stakeholder from each of the following reference groups was consulted for the development of standards and rules for operational procedures: 1. Clients 2. Local government; 3. Interest groups; 4. Industry.
Providers of education and training	Number and relevance of stakeholders and stakeholders' groups consulted in the development of the design, enhancement and review of programmes	Evidence that at least one relevant stakeholder from each of the following reference groups was consulted for the development of standards and criteria for design, enhancement and review of each education and training programme: 1. Clients 2. Regulators; 3. Professional associations; 4. Industry.
Education and training programmes	The qualification title complies with the SQF-RM level descriptors and learning outcomes	The qualification title can be associated with a single learning level descriptor of the SQF-RM.

4.6.2 Excellence metrics and reference points

Excellence metrics express the degree to which each element of the QA system meets expectations. Table 8 details the quality metrics and reference points outlined for each component of the QA system for education and training in the raw material area.

Table 8 – Excellence metrics and reference points considered in the QA system.

Component of the QA system	Excellence metrics	Reference points
Accrediting agencies	Existence of a pool of qualified and trained assessors and auditors	The agency's pool of assessors and auditors includes at least one expert on each of the main areas of activity of the raw materials sector: 1. mineral exploration; 2. mineral extraction and processing; and 3. material engineering and recycling.
Providers of education and training	Innovative teaching strategies including practical and fieldwork are utilised in the delivery of the education and training programmes	Practical and fieldwork occupies at least 25% of the education and training programmes' time (comprising all its components – e.g. courses, units, papers, modules).
Education and training programmes	The outcome statement for a qualification reflects the achievement of the stated purpose and specific knowledge, skills and autonomy/responsibility by learners	The outcome statement for a defined qualification is associated to a single level of the SQF-RM and its level descriptors.

4.6.3 Timeliness metrics and reference points

Timeliness measures the capacity of the components of the QA system for education and training in the raw material area to respond promptly to changes driven by external factors (e.g. changes in context, market or regulations). Table 9 details the timeliness metrics and reference points considered.

Table 9 – Timeliness metrics and reference points considered in the QA system.

Component of the QA system	Timeliness metrics	Reference points
Accrediting agencies	Existence of provisions for continuing professional development and training of permanent and temporary staff and experts	All agency's staff and experts dedicate at least 60 hours per year to Continuing Professional Development (CPD) activities, and the agency collects and keeps CPD records.

Component of the QA system	Timeliness metrics	Reference points
Providers of education and training	Existence of internal communications procedures that ensure the dissemination of all relevant information to providers' staff.	There is (at least) one formal established communication and dissemination media/procedure that conveys relevant information to the provider's faculty at least once every four months.
Education and training programmes	Existence of an appraisal/feedback system for evaluating the suitableness of teaching and training delivery in all modes and sites	All education and training programmes are accessed at least once every four years to check their adaptability, responsiveness and innovativeness in the production of new knowledge and skills.

4.7 Monitoring and evaluation

Changing of skills' sets and qualifications required by the raw materials industry and new forms of education delivery and programmes will call for continuous monitoring and alignment of the QA system for education and training in the raw materials area with industry needs, social expectations and international standards.

Against this background, and notwithstanding continuous improvement, the QA system for education and training in the raw materials area should be subject to regular reviews to ensure continuing relevance and currency. This should be a priority of the QA system governance.

4.8 Governance of the QA system for education and training in the raw materials area

The governance model of the QA system for education and training in the raw materials area must guarantee the coordination of policies across multiple stakeholders, with emphasis on governments (country legislators and regulators), industry, unions, accrediting agencies and providers of education and training from different countries and regions. It must also respond to emerging industry needs, including future skills required and be aligned with the SQF-RM.

An essential condition to favour the dissemination and acceptance of the QA system for education and training in the raw materials area is that it is a voluntarily system, meaning it cannot be imposed; on the contrary, it will have to be voluntary implemented by governments, accrediting agencies and providers of education and training. Assuming this, and the recommendations made for the governance of the SQF-RM (Correia et al., 2019), the governance and management of the QA system for education and training in the raw materials area should be allocated to an independent international agency dealing with education and labour. The desk research on possible bodies that could assume this responsibility highlighted two possible options:

1. The International Labour Organisation (ILO). ILO has a tripartite structure that gives an equal voice to workers, employers and governments to ensure that the views of the social partners are closely reflected in labour standards and in shaping policies and programmes. Its main aims are to promote rights at work, encourage decent employment opportunities, enhance social protection and strengthen dialogue on work-related issues.

2. The United Nations Educational, Scientific and Cultural Organization (UNESCO). UNESCO is a specialized agency of the United Nations. Its purpose is to contribute to peace and security by promoting international collaboration in education, sciences, and culture. UNESCO runs five major programs, on education, natural sciences, social/human sciences, culture and communication/information. UNESCO is already engaged in several education and geosciences programmes across the world.

The identification and reference to the ILO and UNESCO does not exclude other possible options that might be identified by the INTERMIN Consortium.

The governance structure of the QA system for education and training in the raw materials area shall foster co-ownership and shared responsibility by governments, industry, unions, accrediting agencies and providers of education and training. It must also respond to emerging industry needs, including future skills needed, and adjust/redesign education and training programmes and the corresponding learning outcomes, in line with the SQF-RM qualifications and level descriptors. Considering this background, the governance of the SQF-RM shall encompass:

- Upkeeping and reviewing quality standards and guidelines;
- Upkeeping and reviewing QA metrics and reference points;
- Defining audit points for compliance;
- Continuing monitoring and alignment of the QA system with industry needs, social expectations and international standards;
- Policy coordination across multiple stakeholders;
- Disseminating the QA system for education and training in the raw materials area.

5. CONCLUSIONS

Recognition of individual competency and skills across-borders without guidelines that can be used as a reference is problematic and hinders the mobility of people, ideas and knowledge.

Acknowledgement of this reality pushed the start of the Bologna Process and the reform of the European Higher Education Area (EHEA), that began in 1999, and the creation of European Standards and Guidelines for quality assurance (QA) in the EHEA, encompassing the 48 countries of the European continent[20]. Despite the more significant complexity[21] of vocational education and training, the philosophy, goals and mechanisms of the Bologna Process fostered the creation of the European forum on quality in vocational education and training (jointly set up by the European Commission and the European Centre for the Development of Vocational Training-Cedefop). Subsequent European cooperation led to the definition of shared principles, guidelines and tools for quality development, which resulted in the establishment of a Common Quality Assurance Framework for vocational education and training in 2004.

The European example was followed in the Pacific region, where the foundations of the Pacific Quality Assurance Framework were laid in 2006, and in the Southeast Asia, where the ASEAN Ministers of Education founded the ASEAN Quality Assurance Network in 2008, to share good practices of QA in higher education, collaborate on capacity building and facilitate the recognition of qualifications and cross-border mobility throughout the region. The above-mentioned QA frameworks define quality standards and guidelines that address education programmes, institutions that provide education and training and external quality assurance/certification agencies, and their implementation follows the methodology of the plan–do–study–act (PDSA) cycle of improvement[22].

These regional QA frameworks include quality standards and guidelines, enhancing comparability of QA in the corresponding regions and facilitating mutual trust and recognition of QA as well as qualifications.

The international QA system for education and training in the raw material area advanced in this report encompasses academic and vocational learning outcomes. The overall objectives of the QA system for education and training in the raw material area are to:

[20] Members of the EHEA have to be party to the European Cultural Convention and to declare their willingness to pursue and implement the objectives of the Bologna Process in their own systems of higher education. For more information see http://www.ehea.info/page-members.
[21] As regards to organisation, governance, funding and diverse target groups.
[22] PDSA was made popular by W. Edwards Deming, who is considered by many to be the father of modern quality control For additional information see https://asq.org/quality-resources/pdca-cycle

a) Improve the QA functions and responsibilities of accrediting agencies;
b) Cultivate and maintain a culture of quality and excellence within providers of education and training on raw materials topics;
c) Improve the quality of education and training programmes for students and trainees;
d) Ensure clarity and transparency in QA processes and outcomes;
e) Support and foster cooperation of key stakeholders across national borders.

However, different countries in the world have various capacities and resources allocated to QA of education and training, and this limits their ability to implement the QA system for education and training in the raw material area. In this context, the breadth and adaptability of the proposed QA system need to be broad. The regional QA framework that is better adapted to contrasting realities is the Pacific Quality Assessment Framework described in Section 2.3. of this report. Henceforth, the scope, principles and standards of the QA system for education and training in the raw materials detailed in this report are based on the Pacific Quality Assessment Framework.

The QA system for education and training in the raw materials is focused on the attainment of 'quality' in the following components:

a) Accrediting agencies and the quality management systems they use for carrying out their QA functions;
b) Providers of education and training and their internal QA processes;
c) Education and training programmes and the way they are designed, delivered and assessed.

The QA system includes quality standard and guidelines applicable to each of these three components. The 9 standards and 28 guidelines applicable to accrediting agencies were designed to confirm that an agency has:

- The basic structural and operational requirements for establishment and operations;
- The necessary policies, procedures and resources to effectively function as a standard-setting body;
- Specific mechanisms for support of the raw materials education and training sector;
- Strategies to ensure clarity, transparency and consistency in its QA processes;
- A culture of quality.

The 13 standards and 33 guidelines applicable to providers of education and training were designed to assist institutions in:

- Improving operational transparency and accountability to its stakeholders;
- Enhancing its reputation as the preferred destination for quality education and training;
- Continuous self-reflection and analysis of its policies and procedures for constant improvement.

The 10 standards and 25 guidelines applicable to education and training programmes are essential in:

- Confirming institutional capacity in developing, delivering and assessing programmes;
- Protecting students from poor-quality programmes;
- Increasing the confidence of the public in the institution's programmes and qualifications;
- Facilitating articulation between programmes of different education and training institutions;
- Addressing quality-related issues related to the adaptability, responsiveness and innovativeness of programmes in the production of new knowledge and skills.

Since complex or multidimensional measures are too difficult or costly to assemble regularly, the metrics and reference points advanced for the measurement of the performance of the components of the QA system for education and training in the raw material area are simplified and focused on the system components. The metrics and reference points address the effectiveness of the QA system, its excellence and its capacity to respond promptly to changes in context (timeliness).

These metrics, and the all QA system, should be subject to regular reviews since changing of skills' sets and qualifications required by industry and new forms of education and programmes delivery will call for continuous monitoring and alignment with industry needs, social expectations and international standards.

Despite the high significance and applicability of the QA system for education and training in the raw material area, its success depends on its governance. The governance model suggested assumes that the adoption of the QA system will be voluntary and that the responsible institution for its implementation should be an independent international agency dealing with education and labour. The governance priorities include:

- Upkeeping and reviewing quality standards and guidelines;
- Upkeeping and reviewing QA metrics and reference points;
- Defining audit points for compliance;
- Continuing monitoring and alignment of the QA system with industry needs, social expectations and international standards;
- Policy coordination across multiple stakeholders;
- Disseminating the QA system for education and training in the raw materials area.

Finally, it is important to stress that the QA system for education and training in the raw material area advanced in this report has a direct relation with the international Sectoral

Qualifications Framework for the Raw Materials sector (SQF-RM), defined in Intermin Deliverable 3.1 (Correia et al., 2019). The SQF-RM uses level descriptors, defined accordingly with the main areas of activity of the sector: 1) mineral exploration; 2) mineral extraction and processing; and 3) material engineering and recycling. Each qualification specified within the architecture proposed for the SQF-RM is referenced to a specific level on the European Qualifications Framework, describing sets of learning outcomes, i.e. knowledge, skills and autonomy/responsibility. The central link between the SQF-RM and its QA system is through learning outcomes. The SQF-RM level descriptors are readable across a diversity of education and training systems, enabling the QA of qualifications through the realisation of discipline-specific learning outcomes.

The validation of the QA system for education and training in the raw material area (and its governance model) calls for extensive consultation and dialogues involving relevant stakeholders, to be promoted by the INTERMIN Consortium. This should start at the earliest opportunity.

6. BIBLIOGRAPHY

ASEAN Quality Assurance Network (AQAN), 2016. *ASEAN Quality Assurance Framework*. AQAN, Malaysia. https://www.share-asean.eu/sites/default/files/AQAF.pdf (Accessed 29 April 2019).

Bateman, A., 2016. *ASEAN Guiding Principles for Quality Assurance and Recognition of Competency Certification Systems*. Bateman & Giles Pty Ltd. https://asean.org/storage/2012/05/ASEAN-Guiding-Principles-for-Quality-Assurance-and-Recognition-of-Competency-Certification-Systems1.pdf (Accessed 30 April 2019).

Bateman, A., Coles, M., 2017. *Towards Quality Assurance of Technical and Vocational Education and Training*. UNESCO, France. ISBN 978-92-9223-582-6

Bologna Working Group, 2005. *A Framework for Qualifications of the European Higher Education Area*. Bologna Working Group Report on Qualifications Frameworks. Copenhagen, Danish Ministry of Science, Technology and Innovation. http://www.aic.lv/ace/ace_disk/Bologna/Bergen_conf/Reports/EQFreport.pdf (Accessed 4 June 2019).

Clark, W., 2006. *Academic charisma and the origins of the research university*. University Chicago Press.

Correia, V., Sánchez, A., Fernandez, I., 2019. *International Qualification Framework for the Raw Materials Sector*. Deliverable 3.1 H2020 INTERMIN Project, Grant Agreement 776642.

Ernst and Young, 2016. *Top 10 business risks facing mining and metals 2016-2017*. http://www.ey.com/Publication/vwLUAssets/EY-business-risks-in-mining-and-metals-2016-2017/%24FILE/EY-business-risks-in-mining-and-metals-2016-2017.pdf (Accessed 29 April 2019).

European Commission/EACEA/Eurydice, 2018. *The European Higher Education Area in 2018: Bologna Process Implementation Report*. Luxembourg: Publications Office of the European Union. https://eacea.ec.europa.eu/national-policies/eurydice/sites/eurydice/files/bologna_internet_0.pdf (Accessed 3 June 2019).

European Training Foundation (ETF), 2015. *Promoting Quality Assurance in Vocational Education and Training - the ETF Approach*. Luxembourg. Publications Office of the European Union. https://www.etf.europa.eu/sites/default/files/m/B77049AC22B5B2E9C125820B006AF647_Promoting%20QA%20in%20VET.pdf (Accessed 29 April 2019).

European Association for Quality Assurance in Higher Education (ENQA), 2015. *Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG).*

Brussels, Belgium. https://enqa.eu/wp-content/uploads/2015/11/ESG_2015.pdf (Accessed 29 April 2019).

Galvão, M. 2011. *VET providers' self-monitoring by using the EQAVET toolbox of indicators (A Guide for National Reference Points)*. EQAVET. https://www.eqavet.eu/Eqavet2017/media/Documents/GUIDE-VET-providers-self-monitoring-by-using-the-EQAVET-toolbox-of-indicators.pdf (Accessed 3 June 2019).

Hood, C., 1991. *A public management for all seasons*. Public Administration, 69 (Spring), pp. 3−19. http://newdoc.nccu.edu.tw/teasyllabus/110041265941/Hood%20NPM%201991.pdf (Accessed 3 June 2019).

Murray, J., 2013. *Quality Assurance in Qualifications Frameworks*. Issues paper to support the Dublin Conference, organised by Quality and Qualifications Ireland (QQI), on behalf of the Irish Presidency of the European Council, with the support of the European Commission. http://www.eu2013.ie/media/eupresidency/content/documents/QQI-Presidency-Paper-Publication-(12-March).pdf (Accessed 3 June 2019).

Regueiro, M., Jordá, L., 2019. *Skills Catalogue for the Raw Materials Sector*. Deliverable 1.1 H2020 INTERMIN Project, Grant Agreement 776642.

Secretariat of the Pacific Community (SPC), 2015. *The Pacific Quality Assurance Framework*. Suva, Fiji. https://www.eqap.org.fj/getattachment/work/Pacific-Register-of-Qualifications-and-Standards/PQAF-Final-Revisions.pdf.aspx (Accessed 29 April 2019).