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Engineering Accreditation Objectives and their Relationship to the Quality Assurance Standards for Engineering Education Programmes in Ireland

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Key Words

Engineering Education Objectives, Accreditation Criteria, Award Standards, Professional Descriptors

Abstract

All programmes of study in Institutes of Technology in Ireland are subjected to internal programmatic review in five yearly cycles to ensure that the education programmes meet the quality assurance standards and are fit for purpose. In addition engineering and construction programmes undergo voluntary external accreditation by their respective professional bodies. Both processes differ in their focus and intent and the preparation required by the programme teams and managers. The two processes emphasise different aspects of engineering education. From the research literature, it has emerged that these assessment types are used worldwide, in varying ways and in regular cycles, for the quality assurance of engineering education programmes. Both the programmatic review and accreditation processes have evolved and diverged over time. Engineers Ireland has formally accredited all University and Institutes of Technology engineering programmes in Ireland since 1982. Engineering education programmes which satisfy the appropriate criteria laid down in the Engineers Ireland accreditation documents are deemed to meet the education standard required of individuals seeking one of the registered titles of Chartered Engineer, Associate Engineer and Engineering Technician. The Engineers Ireland accreditation process is consistent with international best practice and this is verified by their inclusion in international mutual recognition agreements. Significant consultation has taken place with the gatekeepers of these processes which includes the Registrars and Heads of Faculty in Higher Education Institutions, Quality and Qualifications Ireland (QQI) and the Registrar of Engineers Ireland. Incorporation of the programmatic review and accreditation processes into a single quality assurance process has long been an ambition of these gatekeepers. To achieve this ambition, it is imperative to determine whether it is possible to align the objectives of both processes. Twenty four triangulation documents were prepared comparing the QQI Engineering Award Standards, the QQI Professional Award Type Descriptors and the Engineers Ireland Accreditation Criteria. This allowed for comparison across the three engineering professional titles, their equivalent Irish National Framework of Qualifications levels for the three quality strands of knowledge, skill and competence and the five sub-strands of Mathematics and Sciences, Design and Development, Information Technology, Business Context and Engineering Practice. Even though there are differences in wording between the standards, there is over ninety percent alignment between all three sets of objectives in terms of their intent.

1 Introduction

The definition of the fundamental purpose of engineering education is given in the International Engineering Alliance *Graduate Attributes and Professional Competencies* document as

'*to build a knowledge base and attributes to enable the graduate to continue learning and to proceed to formative development that will develop the competencies required for independent practice'* (International Engineering Alliance (IEA), 2013).

Professional bodies measure the quality of engineering education in two ways. Outcomes evidence based criteria are used to evaluate engineering education programmes and competency based standards are used to assess if engineers can gain professional recognition. Two of the major quality assurance processes used to assess engineering education programmes involves internal higher education Institution programmatic review and external accreditation by the relevant professional body. Both processes have evolved and diverged over time with the programmatic review process emphasising a prospective view over the next five years and the Engineers Ireland accreditation process retrospectively assessing programmes.

These policy driven processes have many stakeholders and gatekeepers with different priorities and expectations but have considerable overlaps. Faculty staff view the programmatic review process as principally a review of the strategic focus and programme delivery statistics of the faculty/department and view the accreditation process as a more rigorous examination of the programme content.

Incorporation of the programmatic review and accreditation processes into a single quality assurance process has long been a desire of the faculty staff and management in Institutes of Technology in Ireland to minimise review fatigue and allow the processes to be completed within the same timeframe. This would strengthen engineering education provision and ensure the sustainability of both processes over time as well as allowing utilisation of a forward and backward lens when reviewing the engineering education programmes.

2 Context and Literature Review

Quality Assurance in Higher Education is the totality of systems, resources and information devoted to maintaining and improving the quality and standards of teaching, scholarship and research and of student's learning experience (The Quality Assurance Agency in Higher Education, 1998).

Irish Institutes of Technology hold Delegated Authority to make their own awards and are obliged to have regard to quality assurance guidelines issued by Quality and Qualifications Ireland (QQI) (Quality and Qualifications Ireland, 2016). All registered education providers are required to conduct cyclical programmatic reviews of their programmes. In addition, *Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG*) requires that Higher Education Institutions should monitor and periodically review their programmes to ensure that they achieve the objectives set for them and respond to the needs of students and society (European Association for Quality Assurance in Higher Education (ENQA), 2015).

All programmes of study in Institutes of Technology in Ireland are subjected to internal programmatic review which is normally conducted on a faculty or department wide basis and involves a root and branch examination of programmes of study and how they have been delivered in the previous five years and how they plan to be delivered in the subsequent five years (Quality and Qualifications Ireland, 2016). Programmes are changed to include new technologies and new delivery methods whilst ensuring that graduates have the requisite skills and competencies to prepare them for the world of work which is based on Industry and stakeholder consultation.

Accreditation of engineering programmes by professional bodies such as Engineers Ireland (EI), The Society of Chartered Surveyors Ireland (SCSI) and others, are a vital part of ensuring that programmes are fit for purpose and that graduates have the requisite skills to be able to participate fully in their chosen profession (The Royal Institution of Chartered Surveyors (RICS), 2019) (Quality and Qualifications Ireland, 2019) (Quality and Qualifications Ireland, 2017).

Engineering education programmes which satisfy the appropriate criteria laid down in the Engineers Ireland *Accreditation Criteria for Professional Titles* document are deemed to meet the education standard required of individuals seeking one of the Registered titles of Chartered Engineer, Associate Engineer and Engineering Technician (Engineers Ireland, 2014). The accreditation process, as laid down in the document is consistent with international best practice and this is verified by their inclusion in international mutual recognition agreements, such as the Washington accord.

The accreditation process is voluntary and usually embraces a combination of self-evaluation, external peer review based on a site visit, recommendation by the visiting panel and the final decision is made by the responsible Accreditation/Education Board (Engineers Ireland, 2015). The focus of the accreditation process has changed significantly in the last ten years towards the measurement of student achievement of learning outcomes. According to the research literature, this new accreditation process focus has gained worldwide acceptance and is a driving force for ensuring the quality of engineering education programmes.

In 2015, the United Nations General Assembly formally adopted the universal, integrated and transformative 2030 Agenda for Sustainable Development along with a set of seventeen Sustainable Development Goals (The United Nations, 2015). The European Union has committed to implement these goals in their policies. Goal four specifically relates to ensuring inclusive and equitable quality education and the promotion of life-long learning opportunities for all. The EU prioritises the strengthening of education systems as the way to improve educational goals over time including strengthening young people's skills and employability (The European Union, 2020).

In engineering education quality assurance there are two main powerbrokers, the state and the professional bodies, acting as gatekeepers and controllers for the roll out of policy admission to the engineering profession. The processes have a gatekeeper function where admission to a professional elite is controlled by adherence to the relevant policies and procedures. It has emerged from consultation with the relevant gatekeepers and stakeholders to the processes that it is imperative to determine whether it is possible to align the objectives of these processes so that they have the same requirements which would make the possibility of combining them realistic and sustainable over time.

This paper sets out the procedure I created to examine whether the objectives could be aligned and lists the assumptions I made together with the outputs and conclusions from this review.

3 Gatekeeper and Stakeholder Engagement

Significant consultation has taken place with the gatekeepers of these processes. The Technological Higher Education Association (THEA) was established in the early 2000's to represent the Institute of Technology sector. Under THEA, the Council of Heads of School of Engineering (COHSE) was established. Incorporation of the programmatic review process and accreditation process into a single quality assurance process has long been an ambition of the COHSE.

The author prepared a discussion document and comparison analysis of the two processes in consultation with COHSE. The position paper concluded that there is considerable overlap between the programmatic review and accreditation processes and some realignment/amalgamation of the processes would achieve the same outcomes. Three COHSE representatives met with the THEA Council of Registrars and with the Registrar of Engineers Ireland who agreed in principle with the approach and recommended further consultation with QQI.

The author met with the relevant QQI staff and the Registrar of Engineers Ireland in June 2018 to consider if it is possible/practical to align or combine the programmatic review and Engineers Ireland accreditation processes. A comparison between processes has been completed and areas of similarity and difference highlighted. A small sample of this process comparison is illustrated in Table 1.

Table 1: Comparative Analysis Sample

Process Stage	*Process Activity*	*Programmatic Review*	*Accreditation*
Overview	Cyclic review period	5-7 years	5 years
Responsibility	Overall for the process	Institute Registrar for Academic Council	Engineers Ireland Registrar for the Accreditation Board
Objectives	Objectives set by	QQI and Institute's Academic Council	Engineers Ireland's Accreditation Board
Visit to HEI	Duration (Approx.)	1.5 days	2 days

Discussion took place on the use and roles of QQI Engineering Standards, the potential use of the Professional Award Type Descriptors (PATD's) and EI accreditation processes, similarity of language and purpose of processes. It was agreed in principle that the alignment process should be looked at further. A starting point would be the triangulation of the QQI Engineering Award Standards and QQI Professional Award Type Descriptors with the Engineers Ireland Accreditation Criteria. Consideration was also given to the QQI's policies and criteria for the validation and criteria of higher education programmes.

4 Triangulation of QQI Engineering Standards, QQI PATD's and Engineers Ireland Accreditation Criteria

4.1 Assumptions

The QQI Engineering Award Standards are set out in terms of the knowledge, skills and competence learning outcomes to be acquired by learners before a higher education and training award can be made (QQI, 2014)**.** The standards are based on the level indicators and award type descriptors of the National Framework of Qualifications (NQF) (QQI, 2010). The standards are a reference point for the design of a programme in a specific field of engineering and are further divided into six sub-strands of Mathematics, Science, Information Technology, Design and Development, Business Context and Engineering Practice for each of the NFQ levels 6, 7. 8 and 9.

QQI has also published Professional Award Type Descriptors for the alignment of professional awards at NFQ levels 5, 6. 7. 8 and 9 which outline the typical uses to which the knowledge, skills and competence will be put (QQI, 2014)**.**

Engineers Ireland's *Accreditation Criteria and Professional Titles* document sets out separately the accreditation criteria which apply to engineering education programmes for the three professional titles. The Accreditation Criteria are specified in terms of programme outcomes and programme area descriptors. There are six or seven programme outcomes and six programme area descriptors for each professional title.

The author, based on her knowledge and experience, made various assumptions regarding the triangulation process and the degree of similarity between these documents. In comparing across the three documents, the author made the following assumptions:

(a) NFQ level 6 equates to the level of the Engineering Technician professional title
(b) NFQ level 7 equates to the level of the Associate Engineer professional title
(c) NFQ level 8 and 9 (combined) equates to the level of the Chartered Engineer professional title
(d) The Engineering Award strands of knowledge, skill and competence, the professional award type descriptors and the Engineers Ireland programme outcomes were of a similar nature and could be directly compared
(e) The Engineering Award sub-strands and the Engineers Ireland programme area descriptors are of a similar nature and could be directly compared
(f) The Engineers Ireland discipline-specific technology programme area descriptor was incorporated into comparison tables where relevant and appropriate
(g) The mathematics and science sub-strand was combined to provide a direct comparison with the sciences and mathematics programme area descriptor
(h) The summarised tables 2 and 3 (shown in section 5) have been created by the author to allow for illustration of the comparison tables in this paper and are a close match to the actual comparison documents.

4.2 Methodological Approach

The author prepared Twenty four triangulation documents comparing the QQI Engineering Award Standards, the QQI Professional Award Type Descriptors and the Engineers Ireland Accreditation Criteria. This allowed for comparison across the three engineering Professional Titles, their equivalent National Framework of Qualifications levels for the three strands of knowledge, skill and competence and the five sub-strands of Mathematics and Sciences, Design and Development, Information Technology, Business Context and Engineering Practice.

The comparison documents are two-dimensional tables where the engineering award standards are split into three columns showing strand, strand descriptor and standard expected. The professional award type descriptors are separated into two columns with the descriptor and the standard expected. The comparable accreditation programme outcomes are given in one column showing the standard expected and the reference back to the exact subsection in the accreditation criteria.

5 Key Findings

There are a total of *24 comparison documents* created in the triangulation process as follows:

(a) 3 documents for the level 6/Eng. Tech. award – knowledge, skills. competencies
(b) 3 documents for the level 7/Associate Eng. award – knowledge, skills, competencies
(c) 3 documents for the levels 8 and 9/Chartered Eng. Award – knowledge, skills, competencies
(d) 5 documents for the level 6/Eng. Tech. award for the programme area descriptors – Mathematics and Science, Information Technology, Design and Development, Business Context and Engineering practice

(e) 5 documents for the level 7/Associate Eng. award for the programme area descriptors
(f) 5 documents for the levels 8 and 9/Chartered Eng. award for the programme area descriptors.

Summarised samples of two comparison documents are given on tables 2 and 3, one strand and one sub-strand. The author summarised the tables as they would be too large to present in this paper.

Table 2: Competence Strand – NFQ Level 7/Professional Title Associate Engineer

Engineering Award Standards	*Professional Award Type Descriptors*	*Accreditation Criteria Programme Outcomes*
Context	Exercising autonomy and judgement	b, c(ii), c(iii), d, d(i),
Role	Exercising responsibility	d (ii), d(iii), d(iv), e,
Learning to learn	Working with others	f, f(i), f(ii), f(iii), f(iv)
Insight	Learning and Teaching Attitudes	g, g(i), g(ii), g(iii) (Engineers Ireland, 2014)

Table 3: Engineering Practice Sub Strand – NFQ Levels 8-9/Professional Title Chartered Engineer

Engineering Award Standard	*Engineering Award Sub Strand*	*Accreditation Programme Area Descriptor*
Knowledge breadth	Knowledge of current engineering practice	Familiar with engineering operational practice
Knowledge kind	Engineer's role in society and ethical standards	Awareness of codes of practice and ethics
Skill know how and skill range	Perform a management role in an engineering context	Day to day management of complex engineering projects
Skill know how and skill Selectivity	Apply principles to real engineering problems	Control engineering products or processes

Even though there are differences in wording between the standards and based on the assumptions made, it has emerged that there is a level of agreement between all the documentation of over 90%.

6 Discussion

The benefits of successful achievement of programmatic review and accreditation for the educational provider and graduates include public accountability, guarantee of quality, academic reputation, global professional recognition and registration, international mobility, academic improvement and educational competitiveness. Significant benefits also accrue to the professional bodies who remain the gatekeepers to the engineering profession.

Professional body accreditation policies cannot be enabled without engagement with engineering education programmes and they in turn need the seal of accreditation so that their graduates can be elected into a professional engineering association. The pursuit of accreditation has become mandatory for Higher Education Institutes as the consequences of not being accredited are dire for graduates who would not be able to practice as professional engineers (Said, et al., 2013).

Both quality assurance processes have evolved from humbler beginnings into substantial events and at the same time the importance of engineering education programme review and accreditation has also increased. The length of preparation and implementation of the processes has also increased with time. Many faculty staff have expressed the view that they are constantly reviewing engineering education programmes and are suffering from review fatigue (Kyne, 2019). As the processes have become more complicated, the desire to merge them has become more urgent. To ensure sustainable processes in the long term, some coming together of their objectives and implementation methodology is desirable.

The two processes have objectives that are expressed in a different manner, have different motivations and drivers and have been created by different entities. When comparing across similar levels, the differences are reduced to the point where the intention is the same but the language varies. As has been demonstrated in the comparison tables, these differences are small and could be adjusted to create a single set of objectives for both processes.

The single set of objectives will allow for an enhanced sustainable development focus in engineering education by ensuring the engineers role in society, the code of ethics, the complexity of real engineering projects, etc., are central in the quality assurance processes by ensuring their inclusion in engineering education curricula and improvements in teaching and learning practices. Engineering graduates will have the knowledge, skills and competence to actively support sustainable development in their engineering careers.

7 Conclusion

In Institutes of Technology there are many methods used to measure the quality assurance of engineering education programmes but the two major cumbersome processes are programmatic review and accreditation. Both processes differ in focus and intent but have considerable overlaps.

This paper explores the possibility of the alignment or combination of the programmatic review and accreditation objectives for engineering education programmes in Ireland. Comparisons across the three engineering professional titles and their equivalent National Framework of Qualifications levels has demonstrated that creating the same objectives across the two quality assurance processes is achievable.

The benefit to the engineering community of bringing the programmatic review and accreditation processes into a single process would be a reduction of process overlaps, significant saving in time and effort while ensuring both processes occur in the same time period. The single set of objectives could facilitate the alignment or combination of the processes to maintain the quality assurance of engineering education programmes as highlighted in the United Nations fourth sustainable development goal.

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Bibliography

Engineers Ireland, 2014. *Accreditation Criteria for Professional Titles.* [Online]
Available at: http://www.engineersireland.ie

Engineers Ireland, 2015. *Procedure for the Accreditation of Engineering Education Programmes.* [Online] Available at: http://www.engineersireland.ie

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: European Association of Institutes in Higher Education (EURASHE).

International Engineering Alliance (IEA), 2013. *Graduate Attributes and Professional Competencies.* [Online] Available at: http://www.ieagreements.org

Kyne, M., 2019. *Professional Body Accreditation and the Quality Assurance of Engineering Education Programmes.* [Online] Available at:
https://warwick.ac.uk/fac/sci/wmg/mediacentre/wmgevents/eern

QQI, 2010. *Irish National Framework of Qualifications (NFQ).* [Online] Available at:
https://nfq.qqi.ie

QQI, 2014. *Award Standards-Engineering.* [Online] Available at: http://www.qqi.ie

QQI, 2014. *Professional Award Type Descriptors (Award Class: Professional) for the alignment of professional awards at NFQ levels 5,6,7,8,and 9.* [Online] Available at: http://www.qqi.ie

Quality and Qualifications Ireland, 2016. *Core Statutory Quality Assurance Guidelines.* [Online]
Available at: http://www.qqi.ie

Quality and Qualifications Ireland, 2016. *Sector Specific - Insitute of Technology QA Guidelines.* [Online] Available at: http://www.qqi.ie

Quality and Qualifications Ireland, 2017. *Professional Body Accreditation in Higher Education Institutions in Ireland.* [Online] Available at: http://www.qqi.ie

Quality and Qualifications Ireland, 2019. *Accreditation Approval of Higher Education Programmes by Professional Bodies: QQI Insights.* [Online]
Available at: http://www.qqi.ie

Said, S. M. et al., 2013. Accreditation of Engineering Programmes: an evaluation of current practices in Malaysia. *International Journal of Technology and Design Education,* Volume 23, pp. 313-328.

The European Union, 2020. *The Sustainable Development Goals, international co0operation and development.* [Online] Available at: https://ec.europa.eu/europeaid/policies/sustainable-development-goals_en

The Quality Assurance Agency in Higher Education, 1998. *Quality Assurnace : a new approach,* London: Higher Quality, the bulletin of the QAA No.4.

The Royal Institution of Chartered Surveyors (RICS), 2019. *RICS Global Accreditation - Policy and Process.* [Online] Available at: http://www.rics.org

The United Nations, 2015. *Sustainable Development Goals.* [Online]
Available at: http://www.un.org/sustainabledevelopment/sustainable-development.goals