Universities and decision-making: programme and qualification mix – four learning pathways

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Synopsis

The introduction of the Higher Education Qualifications Framework (HEQF) and the updated Higher Education Qualifications Sub-Framework (HEQSF) has caused many South African university departments to rethink their programme qualification mixes (PQMs). In addition to the requirements stated in the HEQSF, a number of other factors have to be taken into consideration by a university department. These factors include, for example, the standards generated by the Engineering Standards Generating Body (ESGB) and subsequently approved by the Engineering Council of SA (ECSA) and the need to prepare students for various categories of professional registration with ECSA. This means that a university department has to choose the correct mix of Learning Programmes (LPs) from the HEQSF menu (which consists of 13 types of LPs). Preparing students for ECSA registration is aligned with the mission of universities, which is to teach and undertake research. However, research and the LPs associated with research go beyond the requirements for current ECSA registration. Assuming that universities offering engineering LPs would elect to prepare students for both ECSA registration and teach them to produce research outputs, which is mostly done at Master and Doctorate levels (NQF Levels 9 and 10), then it follows that academics are more interested in NQF Level 5 to 10 pathways (abbreviated as 'L5-10') rather than the shorter pathways required towards professional registration. (For example, ECSA requires an NQF L5-L7 pathway for registration as a candidate professional technologist. This specific pathway may consist, for example, of two LPs, namely the 360-credit Diploma and the Advanced Diploma.) A L5-L10 pathway is a combination of LPs that will prepare the learner with a NSC (or equivalent qualification at level 4) to Doctoral level (level 10). Universities may choose at least four major pathways from the HEQSF menu in order to educate and develop students from NQF Level 5 to 10. However, various pathways towards registration in the category of candidate with ECSA are also embedded into these four NQF L5-L10 pathways, where each consist of a unique combination of LPs. Each of these pathways has an opportunity cost, and economic reality means that smaller departments may have to choose between the four pathways. Of all the many factors involved in PQM decision-making, the focus of this paper is on the HEQSF requirements, ECSA standards, and ECSA registration and how these, together with the various qualifications and educational LPs provided for by the HEQSF may impact on the PQM decision taken by engineering departments and schools at South African universities. The proposed four NQF L5-L10 'pathway tool' for PQM decision-making may be useful for pointing out the advantages, disadvantages, and applications of the various pathways and combinations of pathways. Rather than deciding from a menu of thirteen qualifications and associated LPs, this article proposes that decision-making be undertaken on the basis of a menu of four main articulated 'NQF L5-L10' pathways (which also include one or more of the ECSA's pathways for professional registration). The proposed 'NQF L5-L10 pathway' tool is an attempt to move one step closer to the aim of achieving a structured decision-making approach for designing a PQM at departmental level.

The ECSA designed standards for some of the 13 LPs that form part of the HEQSF - ECSA have to date not developed competency standards for Levels 9 (Masters) and L10 (Doctorate). If universities design LPs according to these standards, then learners would be eligible to comply with ECSA's educational requirements to register in the categories of candidate Pr Techn., Pr Tech., Pr Cert. Eng., and Pr Eng.

Keywords
Higher Education Qualifications Sub-Framework (HEQSF), educational learning programmes (LPs), educational pathways, programme and qualification mix (PQM), registration in the appropriate candidate category with the ECSA approved standards, PQM decision-making, articulation.

Introduction

Many university departments are rethinking their programme and qualification mixes (PQMs) as a result of the implementation of the new Higher Education Qualifications Sub-Framework (HEQSF). Deciding on a viable PQM for a university department is a complex matter that is influenced by many different factors, requirements and constraints. In addition to the requirements stated in the HEQSF, many other factors, such as market requirements, economic viability, path dependency, articulation, mode of teaching (online learning vs classroom-based education), and university type (e.g. compre-

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hensive, research-intensive, or technology-focused) also have to be considered. One of the implications of the mergers of Rand Afrikaans University with Technikon Witwatersrand to form the University of Johannesburg and the old University of South Africa (Unisa) with Technikon Southern Africa to form the new Unisa is that these comprehensive universities may now offer the B Eng degree. Should they do that? This decision forms part of the decision-making that will determine their future PQMs, the combination of HEQSF-aligned programmes to offer in the future.

Competency standards approved by ECSA are the prime requirement to be considered by departments offering engineering-related programmes and an important factor when deciding on a PQM. The inclusion or exclusion of Work-Integrated Learning (WIL) is also an important HEQSF-related provision that has to be taken into consideration by university departments.

The word 'pathway' is to be found in a number of ECSA documents. 'Pathway' means the combination of educational LPs that must be followed to attain a specific goal (e.g. compliance with the educational requirements for professional registration as engineer, certificated engineer, technologist, and technician). Academic staff at universities have two major responsibilities: tuition and research. Research and the LPs associated with research go beyond the requirements for current ECSA registration. Assuming that universities offering engineering LPs would elect to both prepare students for ECSA registration and teach them to produce research outputs, which is mostly done at Masters and Doctorate Levels (NQF Levels 9 and 10), then it follows that academics are more interested in NQF Level 5 to 10 pathways (abbreviated as 'L5-10') rather than the shorter pathways required towards professional registration. (For example, ECSA requires an NQF L5-L7 pathway for registration as a candidate professional technologist. This specific pathway may consist, for example, of two LPs, namely the 360-credit Diploma and the Advanced Diploma.) A L5-L10 pathway is a combination of LPs that will prepare the learner with a National Senior Certificate (NSC) (or equivalent qualification at exit level 4) to Doctoral level (exit level 10).

This paper does not focus on all the factors, requirements, and constraints that may impact, in various ways, on the PQM decision, but attempts to investigate the proposed 'NQF L5-L10 pathways method' or tool to simplify PQM decision-making while considering only some of the factors, requirements, and constraints such as the requirements specified by the ECSA and the HESQF. For this purpose, I have identified four main pathways (for NQF L5-L10) from the HEQSF document for developing and educating someone from National Senior Certificate (NSC) to doctoral level. In this article, I shall show that these NQF Level 5 to 10 pathways, combined with the various pathways leading to registration with the appropriate candidate category with the ECSA, are important tools that can be used in the complex PQM decision-making process. These pathways are proposed as a method for reducing the complexity of decision-making (from the broad menu of thirteen HEQSF qualifications) to one of deciding between articulated pathways to achieve various goals while considering various factors, requirements, and constraints that may impact on the PQM decision of a department. In essence, I have generalized and expanded ECSA's pathways for professional registration to a proposed 'pathway tool' in order to reduce the complexity of PQM decision-making by one level. Instead of deciding from a menu of qualifications and associated programmes allowed by the HEQSF, I shall propose, in this article, that decision-making be done from a menu of articulated NQF L5-L10 pathways that incorporate HEQSF-compliant ECSA pathways for engineering practitioners.

Background information

A PQM of a university is a list, menu, or mix of approved LPs and qualifications that will be subsidized by the Department of Higher Education and Training (DHET). A university department or school has to follow a certain procedure to get its programmes on to such a list. In the future, the PQM of South African universities may consist only of programmes provided for by the HEQSF.

The HEQF was gazetted by the South African Minister of Education in 2007 and is an integral part of the National Qualifications Framework (NQF). It was updated in January 2013 and is now called the HEQSF. Universities are allowed to offer qualifications at NQF Levels 5 through 10. The thirteen types of qualifications that form part of the HEQSF menu are listed in Table I. It is important to note that Universities of Technology (UoTs) – the former technikons – and comprehensive universities are particularly affected by the HEQSF because national diplomas have been replaced by diplomas and the B Tech-degree has been excluded from the HEQSF. See Tables I and II.

ECSA designed standards for some of the 13 LPs that form part of the HEQSF. ECSA has, however, not developed competency standards for the Level 8 Postgraduate diploma, Level 9 Professional Masters, and L10 Professional Doctoral degrees. The HEQSF has significant implications for educational providers. Changes to Work-integrated Learning (WIL) are also described in the HEQSF (2013, p. 11).

A number of South African universities have designed their new HEQSF-aligned PQMs and are in the process of obtaining approval. It may still take a while until the HEQSF-aligned PQMs will be implemented. Currently, the requirements for registration with the ECSA for various types of candidacy programmes are as described in Table II. In the case of the technician, certificated engineer, and engineer a single LP is required to meet the academic requirements for professional registration. In the case of the technologist this pathway is longer in terms of the number of LPs that must be completed - it consist of at least two LPs, namely a National Diploma and BTech. See Table II.

In the past the UoTs offered cooperative education, meaning that the educational institution and industry cooperated to provide a joint educational programme, which might have included work-integrated learning (WIL). This practice has been largely continued by UoTs and comprehensive universities (CUs) that offer vocational programmes.

Table I

The HEQSF qualifications menu

Undergraduate		Postgraduate	
Qualification	**Level**	**Qualification**	**Level**
Higher certificate	5	Postgraduate diploma Bachelor honours degree	8 8
Advanced certificate Diploma (240 credits) Diploma (360 credits)	6 6 6		
Advanced diploma Bachelor's degree	7 7	Master's degree (Professional) Master's degree	9 9
(Professional) Bachelor's degree	8	Doctoral degree (Professional) Doctoral degree	10 10

Table II

Pre-HEQSF pathways towards professional registration

Category of professional registration	Pre-HEQSF academic requirements for professional registration in the various categories
Technician	National Diploma
Certificated Engineer	Recognised certificate of competency (COC) for example the COC Mine Manager (Mine Health and Safety) (Metalliferous)
Technologist	National Diploma + B Tech (Eng), or M Tech (Eng) and pre-requisite LPs
Engineer	B Eng/BSc (Eng)

Source: ECSA (http://www.ecsa.ac.za)

CUs like UJ and Unisa may in future for example, decide to include both traditional academic and vocation-based programmes in their PQMs.

The HEQSF is one of three sub-frameworks. The others are the framework for General and Further Education Sub-framework (GFETSF) and the framework for Occupational Qualifications (QCTO [sa], p. 3). The HEQSF provides for three progression routes, namely vocational, professional, and general academic. These are listed in Table III and are related to some extent to the 'types' of universities found in South Africa. According to the HEQSF (2013, p. 9), undergraduate certificates and diplomas are usually found within the vocational route, while the professional Bachelor, Master's, and Doctorate degrees are characteristic of the professional route. The general academic learning route focuses primarily on theoretical knowledge and research at higher levels.

It is important to note that the HEQSF specifies certain minimum requirements for qualifications. The minimum number of credits may, however, be exceeded by universities. For example, the HEQSF specifies that the Higher Certificate should consist of at least 120 credits. ECSA's minimum requirement is, however, 140 and multiples of 140 credits. See Table IV (HEQSF, 2013, pp. 21, 22, 25, 28, 30; Van Niekerk, 2013: slide 11). It is not currently clear whether (public) universities will receive subsidy for those credits that exceed the minimum number as specified by the HEQSF.

Four articulated (NQF L5-10) pathways under the HEQSF

Figure 1 illustrates four main L5-L10 higher educational pathways, with the National Senior Certificate (NSC) or its equivalent as the admission requirement and the Doctorate as the exit level (Actually, there are more than four such pathways if the differences at Master's and Doctoral level are also considered.) Please note that Figure 1 relates to engineering, since it uses some of ECSA's names for the various HEQSF qualifications.

If the sole purpose is to develop a student from NSC to Doctoral level (and not for a specific ECSA registration catergory), then pathway 1 is a substitute for pathways 2, 3, and 4. Similarly, pathway 2 is a substitute for pathways 1, 3, and 4, and so on (for developing a student with a NSC right up to Doctoral level). Note that each qualification in a specific pathway complements the others in the same pathway. This means that all the qualifications, except for the Doctorate, are prerequisites for (subsequent) others in the same pathway. The removal of any one of the qualifications in a specific pathway will result in articulation deficiency. The view that some programmes or pathways may be substitutes for others points to the fact that they may compete for the same students, assuming that such students meet the admission requirements of the different programmes.

Table III

Vocational (V), professional (P), and general (G) academic routes provided for in the HEQSF (ECSA qualification standards exist for those in italics)

NQF level	Type of qualification and route according to the HEQSF	V	P	G
5	Higher Certificate – 'primarily vocational' (HEQSF, 2013: 21)	X		
6	Advanced Certificate – 'primarily vocational' (HEQSF, 2013: 21); 'particular career or professional context' (HEQSF, 2013: 23)	X		
6	Diploma (minimum, 240 credits) and Diploma (minimum, 360 credits) – 'primarily has a vocational orientation, which includes professional, vocational, or industry specific knowledge' (HEQSF, 2013: 24)	X		
7	Advanced Diploma – 'vocational or professional preparation or specialisation' (HEQSF, 2013: 26)	X	X	
7	(General) Bachelor's degree – minimum 360 credits (HEQSF, 2013: 26)			X
8	Professional Bachelor's degree – minimum 480 credits (HEQSF, 2013: 26)		X	
8	Bachelor Honours degree – 'broad and generic areas of study, disciplines or professions' (HEQSF, 2013: 30)		X	X
8	Postgraduate Diploma (HEQSF, 2013: 31)		X	X
9	Master's degree (HEQSF, 2013: 32) (Professional) Master's degree (HEQSF, 2013: 33)		X	X
10	Doctoral degree (HEQSF, 2013: 36) (Professional) Doctoral degree (HEQSF, 2013: 38)		X	X

Note that the HEQSF provides for two variants of the diploma, one consisting of 240 credits and another consisting of 360 credits (HEQSF, 2013, p. 24).

The concept of articulation is an important factor that should guide PQM decision-making. The *White Paper for Post-school Education and Training* stresses that articulation must be provided between various qualifications, that students should not experience any 'dead ends', and that people should be able to improve their qualifications without unnecessary repetition/duplication (DHET, 2013: viii).

LPs approved by the ECSA

The introduction of the HEQF set into motion a chain of events. The ECSA approved a number of generic HEQF/HEQSF-aligned competency standards for LPs that form part of the pathways for professional registration as an engineer, technologist, technician, certificated engineer, and the category of candidate with the Engineering Council of South Africa (ECSA). The Engineering Standards Generating Body (ESGB) is a committee of ECSA that develops and recommends relevant competency standards (qualification) for engineering practitioners for approval by to ECSA (Van Niekerk, 2013: slide 8).

ECSA pathways obviously have an influence on a faculty or school of engineering's PQM and the individual departments and/or sections that make up this faculty or school. In a number of cases, the ECSA introduced additional requirements (in addition to those required by the HEQSF) for those qualifications that form pathways to the various categories of professional registration. ECSA's professional development model towards registration is a two-stage process. Obtaining a relevant, engineering-accredited qualification is the first stage. Stage 2, (professional development of engineering practitioners) consists of a candidacy programme. The various forms of professional registration (and their pathways) with the ECSA are shown in Figure 2 prescribing learning outcomes.

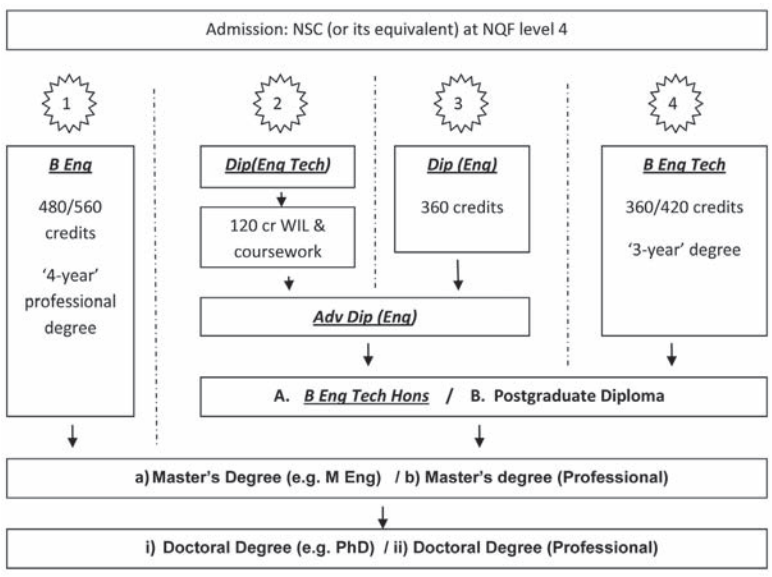

Figure 1—From National Senior Certificate (NSC) to PhD - four articulated pathways under the HEQSF (ECSA qualification standards exist for those in italics and underlined)

Table IV

Differences between the HEQSF's and ECSA's requirements for selected qualifications

Qualification	HEQSF's minimum specified NQF credits	ECSA's minimum required NQF credits
Higher Certificate	120	140 – HCert(___Eng)
Advanced Certificate	120	140 – AdvCert(___Eng)
Diploma	240 360	280 - Dip (Eng Tech) 360 – Dip (Eng)
Advanced Diploma	120	140 – AdvDip(Eng)
B degree B degree (Professional)	360 480	420 – BEng Tech 560 – BEng
Bachelor Honours	120	140 – BEng Tech(Hons)

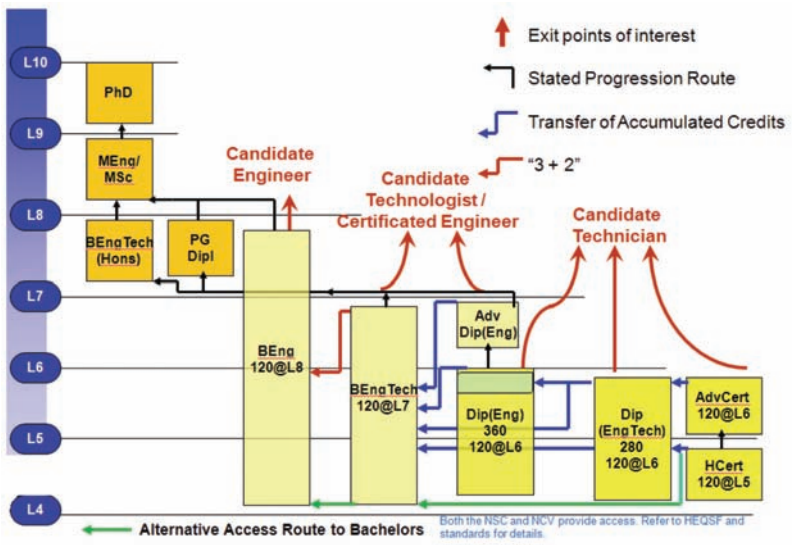

Figure 2—Pathways towards professional registration with the ECSA (Van Niekerk, 2013: slide 12)

It is important to note that ECSA's pathways are not comprehensive NQF L5-10 pathways. (Currently, the B Eng degree at NQF Level 8 is the highest qualification that ECSA acknowledge for professional registration. This does not, however, prevent ECSA from adding further pathways for professional registration in the future.) It may be useful for engineering departments to incorporate one or more of ECSA's pathways into one or more NQF L5-10 pathways in order to prepare students not only for professional registration, but also to provide them with a route via which they can become involved in research (if research outputs are important for a specific department).

'NQF L5-10' pathways as a decision-making tool

Departments have one of the following three options as far as the selection of NQF L5-10 pathways are concerned:

- To offer part of a NQF L5-10 pathway only. In this case, the four main 'NQF L5-10' LP are not useful as a tool. In a specific area of study a department may decide to offer one or two programmes on the ECSA framework (Figure 2) only. This may be done for a number of reasons (e.g. addressing a specific industry need). Another reason may be that such an area of study may not be earmarked for research activities. A decision has been made, for example, at Unisa's Department of Electrical and Mining Engineering, to offer a Higher Certificate and Advanced Certificate in Mine Surveying only. (Note that PLATO is the professional body for mine surveyors.) ECSA's competency standards do not cater for programmes in the area of mine surveying, since surveying is not primarily considered as an engineering field of study
- To offer one 'comprehensive' (NQF L5-10) pathway only. The depth of the field of study may, for example, justify offering one comprehensive pathway. Student numbers, economic viability, staff capacity, and other factors may create an environment in which it is advisable to offer one comprehensive pathway only. The *White Paper for Post-school Education and Training* expresses the need for a greater focus on research and innovation, the building of research

capacity, and the creation of more Master's and PhD learners (DHET, 2013: xiv, 33, 35). It is for these reasons that a full NQF level 5 to 10 pathway is proposed as the PQM for mining engineering at Unisa

- To offer multiple 'comprehensive' (NQF L5-10) pathways. This may be done if the appropriate conditions exist. This option is discussed in more detail below.

The following provides some information and guidelines on the usefulness, advantages, disadvantages, and applications of various NQF L5-10 pathways and combinations of pathways.

Offering pathway 1 (starting with the B Eng)

Pathway 1 consists of three LPs, namely the B Eng, Master's, and Doctoral degrees (see Figures 1 and 2). It therefore includes the (ECSA) pathway for developing a person with a NSC to the level where the academic requirements for registration as a candidate professional engineer are met.

Pathway 1 is offered by many engineering faculties at traditional academic universities. This pathway has basically not been affected by the HEQSF. Some of these universities may be research-intensive institutions that want to focus on the postgraduate level. One of the advantages of this pathway is that the B Eng degree is a well-established qualification that has been offered by a number of universities for a considerable period of time. Two (potential) disadvantages of this pathway are as follows:

- The admission requirements for the B Eng degree at most universities preclude many students from registering for this LP, e.g. symbols for Mathematics and Physical Science.
- Offering a B Eng degree by means of distance learning is problematic due to the fact that it is a 560-credit qualification and a student in full-time employment may take very long to complete this degree. Employed students will also have to spent time away from the workplace to attend laboratory sessions and non-work-based WIL if incorporated into such a programme.

Offering pathway 2 (starting with the Dip [Eng Tech])

Pathway 2 consists of five LPs, namely the 240-credit Dip (Eng Tech), Adv Dip (Eng), B Eng Tech Hons, M Eng, PhD, as well as a WIL component (HEQSF, 2013: 24). See Figures 1 and 2. This pathway includes a number of the vocational programmes listed in Table III. It is therefore an appropriate option for a department at a comprehensive university that wants to offer both vocational and academic programmes and that has a history of offering vocational programmes. Pathway 2 will allow such a department to keep its current student body (since a switch to pathway 1, for example, will result in higher admission requirements (for the B Eng degree) which only a much smaller percentage of its current student body is likely to meet). (This example points to the 'path-dependency' factor, which is not discussed in this paper.) One would expect more diversity in the staff profile of a department offering this pathway: some members will need to have gained industrial experience and done vocational programmes themselves, while some staff will, in addition, have to be recognized researchers with the ability to supervise research at Master's and Doctorate levels. One of its main strengths is that this pathway could prepare students for three of ECSA's four categories of professional registration, namely Certificated Engineer, Technologist, and Technician (Figure 2). It is therefore the single most flexible pathway in terms of ECSA's requirements for professional registration, and should be of great use to the general student population and, indeed, most industries.

One of the advantages of pathway 2, which is particularly relevant to distance learning, is its multiple exit levels combined with the fact that it includes some of the smallest programmes (in terms of credit value). This is very important, since a learner who is in full-time employment may take twice as long to complete a programme compared with a student at a class-based institution. More exit levels and shorter programmes in a pathway therefore reduce the risk of (1) non-completion on the part of the student, and (2) reduced government subsidy on the part of the university.

An important advantage (from a university's perspective) of pathway 2 is that WIL does not form a compulsory requirement for the 240-credit diploma, but follows after the diploma has been completed – this means that the 240 credit diploma is a prerequisite for the WIL component for learners aspiring to achieve access to the Advanced Diploma. In terms of the HEQSF, universities will be held responsible for placing students in industry for work-based, WIL (HEQSF, 2013: 11, 24). In 2011, 860 students were registered for the current National Diploma in Mining Engineering at Unisa. The number of students that complete the National Diploma successfully are fewer and more manageable as far as WIL placement is concerned. There are a number of reasons for this relatively low throughput rate, but two are worth mentioning:

1) Distance learning requires the student to be both highly disciplined and independent
2) The admission requirements for mining at Unisa are much lower compared with those of the University of Pretoria and the University of the Witwatersrand.

In pathway 2, an additional 120 credits to the 240-credit Diploma must be completed in order to obtain admission to the level 7 Advanced Diploma in Engineering. This is described in the HEQSF (2013: 25) as follows: 'Candidates who complete the 240-credit Diploma may enter an Advanced Diploma upon successful completion of a work-integrated learning component or a combination of work-integrated learning and coursework equivalent to 120 credits that is approved and accredited by an education provider and/or a professional body and a QC.' (See Figure 1.)

Offering pathway 3 (starting with the Dip [Eng])

Pathway 3 consists of five LPs, namely the 360-credit Diploma, Adv Dip (Eng), B Eng Tech Hons, M Eng, and PhD. See Figures 1 and 2. Like pathway 2, it includes a number of the vocational programmes, listed in Table III.

Pathway 3 may achieve the same basic objective as pathway 2, but includes WIL in the (360-credit) diploma. The

disadvantage of pathway 3 is that the lack of sufficient placement opportunities for the 360-credit diploma may prevent some students from graduating in the shortest time possible and thus influence a university's throughput rate and government subsidy. Pathway 3 – where the diploma includes a WIL component (as indicated in Figure 2) – is recommended only in cases where the university can guarantee WIL placement for students. (See 'Brief comment regarding WIL placement'.)

Offering pathway 4 (starting with the B Eng Tech)

Pathway 4 consists of four LPs, namely the B Eng Tech, B Eng Tech Hons, M Eng, and PhD. See Figures 1 and 2. Pathway 4 is an option for a UoT or CU that elects to implement the new B Eng Tech as an 'alternative' to the current B Tech degree/national diploma combination. (Traditional academic universities are not excluded from this pathway.) One advantage is that this could prepare students for two categories of ECSA professional registration (Table V). Another is that students obtain a 'degree' and not a 'diploma' at undergraduate level – this is important for some students. (In pathways 2 and 3 students will obtain a 'degree' for the first time only at postgraduate level – the honours degree.)

Offering pathways 1 and 2

The combination of these two pathways is an appropriate option for a fairly well-resourced department that has enough students to ensure the viability of both pathways. It combines the strengths of pathway 2 with the more ambitious and elitist pathway 1. This may be a good option for a large department at a comprehensive university. All four levels of professional registration with ECSA can be covered by means of this combination (Table V).

Offering other combinations of pathways

Other combinations of pathways are also possible (e.g. offering pathways 1, 2, 3, and 4). Offering all four pathways is recommended only for very large, extremely well-resourced departments with very high numbers of students.

General remark regarding the need for a diversity of educational pathways

Engineering departments in the country will have to collectively offer a diversity of LPs to ensure that suitable numbers of technicians, technologists, certificated engineers, and professional engineers are educated and trained to cater for the country's need for scarce skills i.e. range of engineering practitioners.

Brief comment regarding WIL placement

The HEQSF (2013: 11) provides for at least five types of WIL: simulated learning, work-directed theoretical learning, problem-based learning, project-based learning, and workplace-based learning. One type of WIL which is currently being used is workplace-based learning. As far as this type of learning is concerned, the HEQSF (2013: 11) states that: 'Where the entire WIL component or any part of it takes the form of workplace-based learning, it is the responsibility of institutions that offer programmes requiring credits for such learning to place students into appropriate workplaces.' The implication of this requirement is different from current practice (at Unisa) where it is also the student's responsibility to try and find WIL placement, an internship, employment, or a bursary with a mining company. The WIL office at Unisa enables students to upload CVs to a database that is available to employers. Unisa currently provides students with an experiential learning guide and mentor's guide for WIL and relies on mines, mentors at mines, and heads of department to ensure that students are exposed to the various areas prescribed. The new HEQSF expect universities to guarantee workplace-based learning. For every learner enrolling on the respective programme, given the fact that universities do not own mines or other workplaces, industry's participation and support for WIL is crucial. It is, however, also important to note that the HEQSF provides for greater diversity of WIL activities. That said, it is extremely

Table V

Individual NQF L5-10 pathways and their relationship with pathways that lead to professional registration with the ECSA

NQF L5-10 pathway	Inclusion of the ECSA pathways for registration as professional ...			
	Engineer	Certificated Engineer	Technologist	Technician
1	Yes	No	No	No
2	No	Yes	Yes	Yes
3	No	Yes	Yes	Yes
4	No	Yes	Yes	No
1 and 2	Yes	Yes	Yes	Yes
... (Other combinations, e.g. 1, 2, and 3)	- Yes	- Yes	- Yes	- Yes

expensive for universities to provide facilities such as mock-up tunnels and stopes and pilot plants, and to develop a virtual reality capability and various forms of simulated learning.

If one assumes that industry may still prefer that the major part of WIL must be workplace-based learning, then this raises the question of how universities can guarantee workplace-based placement for students. This is because providing such placements involves scarce industry resources and not all employers in need of qualified persons may have the capacity to provide students with suitable workplace-based support. One option may be to limit student numbers to what industry is capable of committing to. But should universities follow the example of the various faculties of medicine and veterinary sciences, both of which have stringent pre-screening mechanisms? A university that applies such screening mechanisms needs to know how many students can be absorbed by industry and various other employer organizations. Following the example of the faculties of medicine means that engineering departments in universities will need to have suitable screening and selection mechanisms in place to determine which of the applicants will have the best chances of success in their future careers. Perhaps another solution is for mining companies to re-introduce the well-known and respected Learner Official programmes.

Pathway 2 has the potential to overcome the above problem (at least, to some extent). The 240-credit Dip (Eng Tech), which will include theoretical and laboratory modules but no compulsory work-placed based modules, can act as a 'screening mechanism' before successful (but unemployed) students are employed by industry. The Stage 2 structural and mentored professional development of engineering graduates could be designed in such a way as to incorporate WIL.

Conclusion and the way forward

Decision-makers in university departments have to consider many factors, requirements, and constraints when deciding on a PQM. In this paper, I have generalized and expanded ECSA's pathways for professional registration to suggest a proposed 'pathway tool' that will reduce the complexity (by one level) of this decision-making process. Instead of having to decide on the basis of a menu of thirteen qualifications and associated programmes, I propose that decision-making be done from a menu of four main articulated 'NQF L5-10' pathways that also include one or more of the ECSA's pathways leading to professional registration. The proposed 'NQF L5-10 pathways' tool is an attempt to move one step closer to the aim of achieving a structured decision-making approach for designing a PQM at departmental level. A holistic evaluation of the strengths and weaknesses of various 'NQF L5-10' pathways and combinations of such pathways are required when deciding on a PQM. The mining section at the Department of Electrical and Mining Engineering at Unisa proposes pathway 2 as its PQM for the discipline of Mining Engineering.

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Erratum

The affiliation for the author A. Heidary Moghadam published in the SAIMM *Journal* vol. 113, no. 12, pp. 941–945 entitled: '**A study on the effect of coke particle size on the thermal profile of the sinters produced in Esfahan Steel Company (ESCO)**', by A. Dabbagh*, A. Heidary Moghadam†, S. Naderi*, and M. Hamdi* was incorrectly listed by the author.
The correct affiliation of the author should be Metallurgy Department, Engineering Faculty, Islamic Azad University, Dezful Branch, Dezful, Iran