ECSA

ENGINEERING COUNCIL OF SOUTH AFRICA

An Effective Regulator Assuring Engineering Excellence

Sub Discipline Specific Training Guide for Candidate Engineering Management Practitioner

R-05-EMAN-SC

REVISION 1: 06 August 2025

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DEFINITIONS

Accredited qualification: A qualification awarded on successful completion of an accredited programme.

Alternative Route: is the registration option for Engineering Management Specialists who have completed benchmark qualification or recognised equivalent educational requirements for registration as either a Professional Engineer or a Professional Engineering Technologist but are not registered with the Engineering Council of South Africa.

Assessor: A professionally registered person who carries out the Experience Appraisal assessment.

Benchmark Route: The normal process to attain registration that consists of the completion of an accredited, recognised or evaluated equivalent qualification and a well-structured and effectively executed programme of Training and Experience for the category of registration.

Candidate: A person who has covered the content of the relevant body of knowledge in the field, however, is learning the application of this knowledge to practical applications.

Competency area: The performance area where all the outcomes can be demonstrated at the level prescribed in a specific technology in an integrated manner.

Competency Assessment: A summative assessment of an individual's competency against the prescribed standard that is based on evidence from the individual's work, reports by qualified observers and other tests that may include a Professional Review.

Competency indicators: The typifying guide to evidence indicating competence and is not normative.

Competency Standard: Statement of competence required for a defined purpose.

Continuing Professional Development: The systematic, accountable maintenance, improvement and broadening of knowledge and skills, and the development of the personal qualities necessary to execute professional and technical duties throughout an engineering practitioner's career after professional registration.

Commitment: The expressed resolve of employers and mentors to afford every possible opportunity and ongoing support and guidance to engineering candidates during their periods of training and professional development as an indication of their alignment with and substantive support for the ideals of the profession.

Engineering discipline: A generally recognised major subdivision of engineering such as the traditional disciplines of Chemical, Civil or Electrical Engineering.

Engineering Management: is defined as an art and science of planning, organising, allocating resources, and directing and controlling activities that have a technological component.

Engineering problem: A problematic situation that is amenable to analysis and solution using engineering sciences and methods.

Engineering science: A body of knowledge, based on the natural sciences and using mathematical formulation where necessary, that extends knowledge and develops models and methods to support its application, solve problems and provide the knowledge base for engineering specialisations.

Experience appraisal: A documentary assessment of the applicant's evidence of competence.

Generic baseline competency: The competency for a professional category is defined in terms of outcomes, including the expected level of performance that can be demonstrated in a range of occupational contexts.

Ill-posed problem: Problems whose requirements are not fully defined or may be defined erroneously by the requesting party.

Initial Professional Development: Systematic participation in the activities typical of Continuing Professional Development but carried out prior to professional registration.

Integrated performance: An overall satisfactory outcome of an activity requires several outcomes to be satisfactorily attained, for example a design will require analysis, synthesis, analysis of impacts, checking of regulatory conformance and judgement in decisions.

Knowledge area*:* An important subject area that forms part of the overall knowledge base needed for a certain competency.

Level descriptor: A measure of performance demands at which outcomes must be demonstrated.

Management of engineering works or activities: The coordinated activities required to:

(a) direct and control everything that is constructed or results from construction or manufacturing operations;
(b) operate engineering works safely and in the manner intended;
(c) return engineering works, plant and equipment to an acceptable condition by the renewal, replacement or mending of worn, damaged or decayed parts;
(d) direct and control engineering processes, systems, commissioning, operation and decommissioning of equipment;
(e) maintain engineering works or equipment in a state in which it can perform its required function;

Mentor: Preferably ECSA registered person who guides the competency development of a candidate in an appropriate category and may be a person willing to spend the time and expertise to guide the development of another person

Moderator: A professionally registered person who carries out the moderation of the Experience Appraisal and Professional Review assessments.

Outcome: A statement of the performance that a person must demonstrate to be judged competent at the specified category level.

Over-determined problem: A problem whose requirements are defined in excessive detail, making the required solution impossible to attain in all aspects.

Practice area: A distinctive area of knowledge and expertise developed by an engineering practitioner through the path of education, training and experience followed by competent and responsible application in practice.

Prescribed standards: The Competency Standards (outcomes) for the category and the discipline-specific requirements (if any) that must be satisfied by an applicant for registration.

Professional Review: An integrative assessment of the applicant's competence, including professional attributes specified in the standard and subdiscipline-specific requirements for the

category and the sub discipline via a comprehensive review of the applicant's evidence and an interview.

Range statement: The required extent of or limitations on expected performance stated in terms of situations and circumstances in which outcomes are to be demonstrated in a particular competency area.

Refusal: When an application for registration as a Specified Category Practitioner is refused.

Reviewer: A professionally registered person who carries out the Professional Review assessment.

Specified Category: A category of registration for persons who must be licensed through the Engineering Profession Act or a combination of the Engineering Profession Act and external legislation as having specific engineering competencies at NQF 5 related to an identified need to protect the public safety, health and interest or the environment, in relation to an engineering activity.

Standards: Statements of outcomes to be demonstrated and the levels of performance and content baseline requirements in the context of engineering educational programmes. See document Competency Standard R-02-SC.

Sub discipline: A generally recognised practice area or major subdivision within an engineering discipline.

Substantial equivalence: (Applied to educational programmes). Two programmes while not meeting a single set of criteria are both acceptable for preparing their respective graduates to enter Training and Experience towards professional registration.

Supervisor: A person who oversees and controls engineering work performed by an applicant.

Sustainable development: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Engineering should look not only to decrease impacts but also to restore and regenerate through design.

Undertaking: The expressed resolve of employers and mentors to fulfil their commitment to the best of their abilities.

ABBREVIATIONS

ASEM	American Society of Engineering Management
C&U	Commitment and Undertaking
CPD	Continuing Professional Development
CRC	Central Registration Committee
EA	Experience Appraisal
ECSA	Engineering Council of South Africa
EM	Engineering Management
EMBoK	Engineering Management Body of Knowledge
EPA	Engineering Profession Act, 46 of 2000
IPD	Initial Professional Development
NQF	National Qualifications Framework
OHS	Occupational Health and Safety
PR	Professional Review
SC	Specified Category
TER	Training/Experience Report
TES	Training/Experience Summary
VA	Voluntary association

BACKGROUND

The illustration below defines the documents that comprise the Engineering Council of South Africa (ECSA) system for registration in specified categories. The illustration also locates the current document.

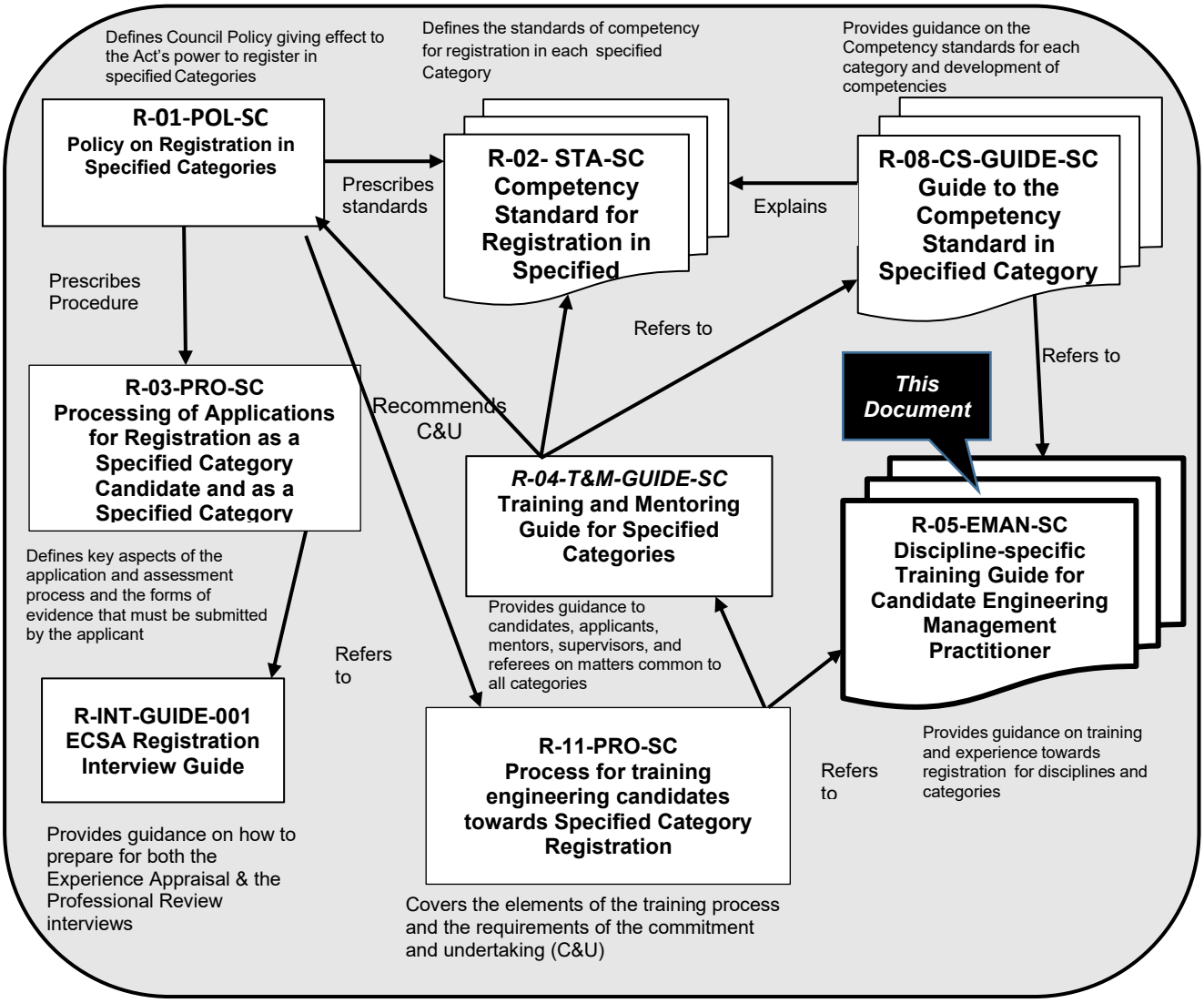

Figure 1: Documents defining the ECSA Registration System

1. PURPOSE OF THIS DOCUMENT

All persons applying for registration in the Specified Category of Engineering Management are expected to demonstrate the competencies specified in the *Competency Standard for Registration in a Specified Category* (document **R-02-STA-SC)** through work performed at the

prescribed level of responsibility, irrespective of the type of industry they practise in. In addition, the sub discipline-specific requirements set out in Section 5 below must be met.

This training requirements document supplements the *Training and Mentoring Guide* for Specified Categories (document **R-04-T&M-GUIDE-SC**), the *Guide to the Competency Standards for Registration in Specified Category* document *(**R-08-CS-GUIDE-SC**) and the Process for Training Engineering Candidates towards Specified Category Registration (document **R-11-PRO-SC**).*

In document **R-04-T&M-GUIDE-SC**, attention is drawn to the following sections:

- Duration of training and length of time working at the level required for registration
- Principles of planning, training and experience
- Progression of the training programme
- Documenting training and experience
- Demonstrating responsibility.

The document (**E-17-PRO-SC**) *Criteria and Process for the Recognition of Educational Qualifications for Specified Categories*, which is applicable to Alternative Route applicants, provides both a high-level and an outcome-by-outcome understanding of the Competency Standards as an essential basis for this sub discipline-specific training requirements document. The document (**R-11-PRO-SC**) elaborates on the elements of the training process and the requirements of the Commitment and Undertaking (C&U).

These requirements and the documents **R-04-T&M-GUIDE-SC**, **R-08-CS-GUIDE-SC** and **R-11-PRO-SC** are subordinate to the Policy for Registration in Specified Categories (document **R-01-POL-SC**), the document **R-02-STA-SC** and the Processing of Applications for Registration as a Specified Category Candidate and as a Specified Category Practitioner (document **R-03-PRO-SC**).

2. AUDIENCE

These requirements are directed towards Candidates and their Supervisors and Mentors in the sub discipline of Engineering Management Practitioners. The requirements are intended

to support a programme of training for Engineering Managers to gain experience incorporating good practice elements.

Table 1 contains the different categories in the Engineering team of registered practitioners. The requirements are also directed towards the members of the Engineering team, which consists of registered practitioners who accept full responsibility for their areas of work and adhere to the ECSA Code of Conduct, and the Engineering Professions Act, 46 of 2000 (EPA).

Table 1: Categories of Registration, knowledge, and areas of responsibility

Category	Authority	Underpinning Knowledge	Area of Responsibility
Professional Engineer (EPA Section 18(1)(a)(i)	Educated, trained, and experienced to carry out complex defined engineering work.	Graduate Attributes acquired in education at NQF 8 level (560 credits)	Complex interaction between professions and disciplines. Justify work outside codes, standards, and procedures.
Professional Certificated Engineer (EPA Section 18(1)(a)(iii))	Educated, trained, and experienced to carry out broadly defined engineering work	Graduate Attributes acquired in education at NQF 7 level (420 credits) and Government Certificate of Competency	Interaction with other professions and disciplines. Authorisation required to work outside codes, standards, and procedures after conducting research and investigation. Legal, Health and Safety responsibility (all safety regulatory documents).
Professional Engineering Technologist (EPA Section 18(1)(a)(ii))	Educated, trained, and experienced to carry out broadly defined engineering work	Graduate Attributes acquired in education at NQF 7 level (420 credits)	Interaction with other professions and disciplines. Authorisation required to work outside codes, standards, and procedures after conducting research and investigation.
Professional Engineering Technician (EPA Section 18(1)(a)(iv))	Educated, trained, and experienced to carry out well-defined engineering work	Graduate Attributes acquired in education at NQF 6 level (280 to 360 credits)	Mostly working within a single discipline. Strict adherence to codes, standards, and procedures. Repetitive work.

Category	Authority	Underpinning Knowledge	Area of Responsibility
Specified Category Practitioner (EPA Section 18(1)(c))	Educated, trained, and experienced to carry out specifically defined engineering work	Graduate Attributes acquired in education at NQF 5 level (140 credits)	Working within a single discipline in a specific field. May be legally responsible for work.

Specified categories registration are created for persons who must be registered through the Engineering Profession Act or a combination of the Engineering Profession Act and external legislation as having specific engineering competencies normally at NQF 5 or better, related to an identified need to protect the public safety, health and interest of the environment, in relation to an engineering activity. These requirements apply to persons who:

- have completed the educational requirements for registration as either a Professional Engineer, a Professional Engineering Technologist, Professional Engineering Technician and are registered with the ECSA as such;
- have completed recognised equivalent educational requirements for registration as either a Professional Engineer, Professional Engineering Technologist, Professional Engineering Technician but are not registered with the ECSA (Alternative Route Applicants);
- are registered as a Candidate Specified Category for Engineering Management; and
- intend to adhere to the ECSA Code of Conduct, prohibiting the undertaking of engineering work for which the registered person is not qualified, trained, or experienced.

3. PERSONS NOT REGISTERED AS CANDIDATES OR NOT BEING TRAINED UNDER A C&U

All applicants for registration must present the same evidence of competence and be assessed against the same standards and requirements, irrespective of the development path followed. Application for registration as a Specified Category Engineering Manager is permitted without being registered as a Candidate or without training under a C&U / Training Academy. Mentorship and adequate supervision are, however, key factors in effective development to the level required for registration. A C&U / Training Academy indicates that the company is committed to mentorship and supervision.

If the Candidate has no C&U or Training Academy, the trainee should establish the level of mentorship and supervision that the employer is able to provide. In the absence of an internal Mentor, the services of an external Mentor should be secured. The recognised Voluntary Association (VA) for the sub-discipline should be consulted for assistance in locating an external Mentor. It is ideal that a Mentor should be in place at all stages of the development process.

These requirements are written for the recently registered Professionals and Candidates who are training and gaining experience towards Engineering Management registration. Mature applicants for Engineering Management registration may apply the requirements retrospectively to identify gaps in their development.

Applicants who have not enjoyed mentorship are advised to request an experienced Mentor (internal or external) to act as an application adviser while they prepare their application for Engineering Management registration.

4. TRAINING OBJECTIVES

To achieve ECSA Engineering Management registration, the training programme designed by the employer should achieve the following:

- Expose the applicant to Experience and Training, enabling the individual to apply engineering management theory (as referred to in Section 5) acquired during educational development to practical workplace situations for the prescribed period.
- Incorporate an increasing level of responsibility to enable the applicant to submit evidence in the Training and Experience reports (TERs) of achieving the duration and the Level of Responsibility as detailed in Section 7.2. of this document.
- Develop the engineering competency of the applicant to cover the sub discipline specific requirements referred to in Section 5 of this document (compulsory sub discipline-specific requirements to be met during the candidacy).

5. ENGINEERING MANAGEMENT IN PRACTICE

The case can be made for the requirement and utmost importance of the content of the field of Engineering Management. A critical link, which is presently missing from organisational

structures, is most often filled by dynamic individuals who take it upon themselves to improve their expertise in the knowledge silos of technical engineering, management and business sciences. The dynamic nature of these individuals allow them to draw presently vague parallels between these two facets of the organisation and become effective in their positions. This divide is crossed in the positions of Project Manager, Programme Manager, Engineering Manager, Operations Manager or Chief Operations Officer, among others.

Though these positions may present opportunities to register as professionals in the individual capacities (i.e., Project Management Professional; Programme Management Professional,), the organisation still requires a means to evaluate a trusted and accountable person who can progress through the organisation (move from entry positions through to senior positions). Therefore, an individual with the knowledge and skillset of covering the Engineering Management Body of Knowledge (EMBoK) who develops him or herself to remain relevant in the field, should progress through the organisation's structure.

The EMBoK, in **Figure 2**, includes the following knowledge areas, but is not limited to them:

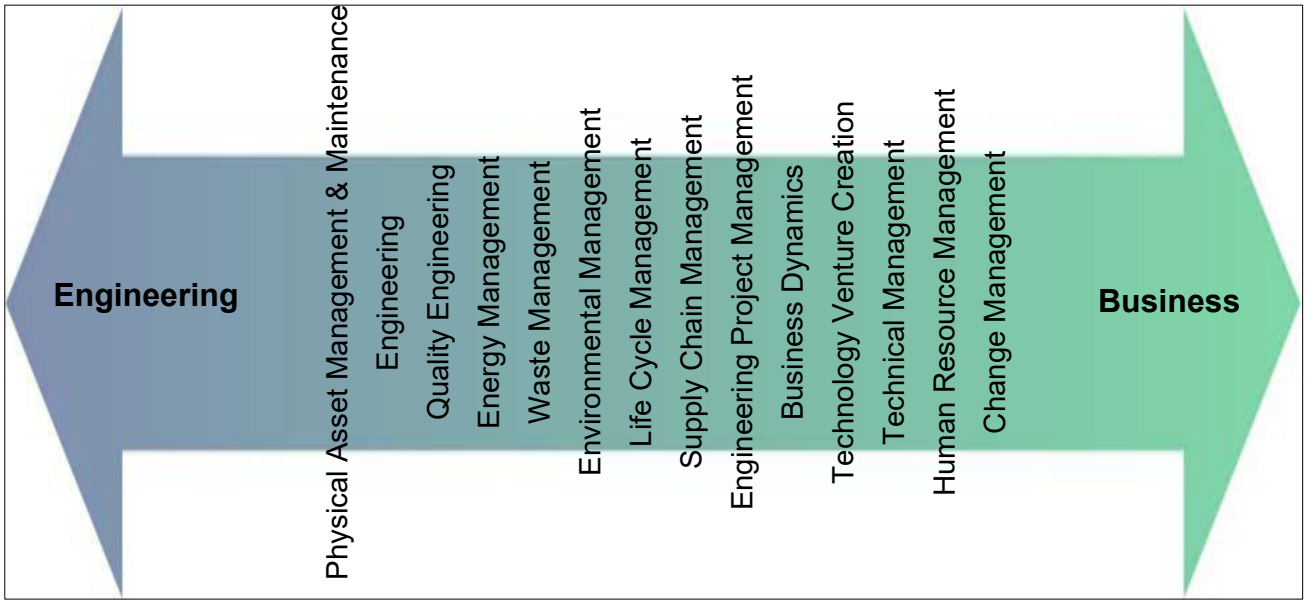

Figure 2: Knowledge areas in engineering management

Present economic and operational circumstances in South African organisations further support the need to evaluate the proven quality of an individual employed in these technical management positions. Examples of organisations and economic sectors that require these professionals include all State-Owned Enterprises, including Eskom, Transnet, Denel and South African Airways, as well as the Mining Industries, Construction and Manufacturing.

Notwithstanding the requirements for these professionals, the question regarding the limitations of ECSA's mandate to register these professionals can be reflected upon. It could be stated that the above spread of topics through the EMBoK constitutes a requirement for a hybrid form of registration – that is, a collaborated or endorsed registration in which ECSA works together with another professional body to evaluate and register different Candidates. However, there is no such professional body for business professionals. These registrations are limited to the different bodies for Chartered Accountants (SAICA, IRBA, ICSA, ACCA, CIMA, SAIPA, SAIBA, ICB, IACSA and IISA), South African Institute of Tax Professionals, South African Board for People Practices and Southern African Marketing Research Association, among others.

5.1 Competencies of an Engineering Management Practitioner

Among the important attributes and skills required, skills with a social component (referred to as "soft skills" below) such as communication, teamwork, leadership, motivation and general management are important to engineering professional's success. These areas are often not specifically focused on in undergraduate engineering curricula. Currently, engineering professionals learn leadership and management skills while in the workplace; employers prefer engineering professionals with "strong" soft skills. Even when looking for promotion and senior management positions, engineering professionals with strong soft skills are preferred. Engineering professionals may often be overlooked for senior management positions which can be attributed to lack of education in communication, leadership and management skills.

Graduate programmes in Engineering Management should maintain a balance between quantitative and qualitative concepts. According to the American Society of Engineering Management (ASEM) certification standards, the curriculum requirements include a balance between qualitative and quantitative courses with at least one third of the curriculum being

management. The body of knowledge for Engineering Management Practitioners include three areas: lifecycle issues, core processes and enabling processes, which are the core disciplines. The lifecycle issues include topics such as new product development, value chain management, production and technology marketing. Core processes include strategic management, project/programme management, systems engineering, knowledge management and change management. The third area is the core discipline, which include organisational and workplace design, economics of engineering, quantitative methods and models, quality management and developing Engineering Management practitioners.

Through the natural career-path progression of Engineering graduates, Engineering practitioners pass through the phases of apprentice, professional, mentor and finally the sponsor phase. During these phases, Engineering professionals face several difficulties when they assume management responsibilities within their organisations. Their undergraduate education seldom prepares them to deal with the complexities and challenges of managing people.

Since engineering professionals are the most qualified to work in and manage technical engineering organisations at various levels, technical engineering competencies are a requirement for engineering managers to effectively communicate technical engineering issues with staff and stakeholders, both inside and outside the organisation. They must be able to develop efficient, effective and robust organisational systems. Their function requires the ability to assess risk and use innovative technical knowledge and skills as well as interpersonal and conceptual skills. Mastering technical knowledge by itself is therefore insufficient to assure the Engineering Manager's success, who would also require expertise in, for example, decision-making tools and system optimisation techniques to efficiently utilise organisation resources, including information technology.

Engineering management practitioners are best suited to manage either a technical function such as production and design or a general management function such as marketing management in a technical engineering organisation. The expertise to combine functions such as these requires the development of necessary core competencies according to El-Baz *et al*., (2007) which includes a balance of the core competencies for Engineering Managers that may

be divided into four broad categories as outlined in **Figure 3** below**:** technical competencies, financial competencies, managerial competencies and leadership competencies.

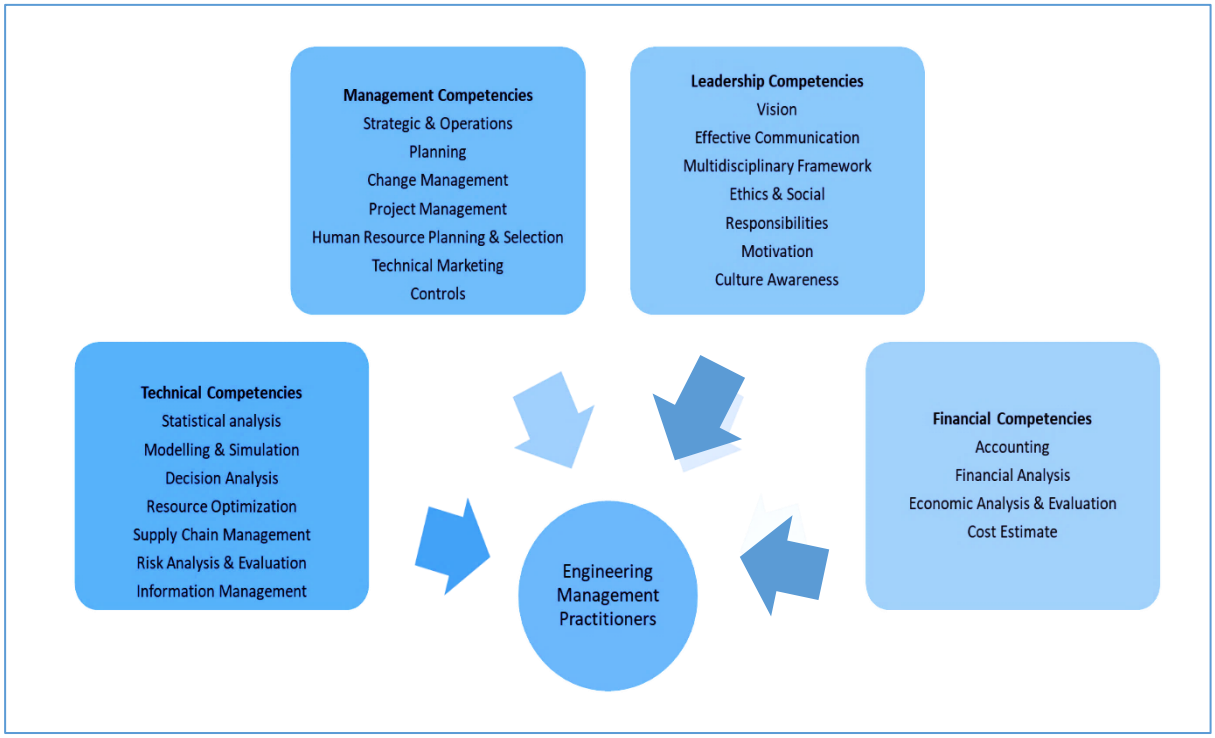

Figure 3: Core competencies for engineering management practitioners

Demonstrating technical competence must be accompanied by competencies in the management function of planning, which includes strategic, operational and tactical planning. According to Shah & Nowocin (2015), competencies in other management functions such as organising, staffing and controlling are necessary for Engineering Management Practitioners to be able to direct organisational resources in a focused manner to serve and contribute to the organisation's mission and vision.

Developing financial competencies is no longer an option for Engineering Management Practitioners. Engineering Management Practitioners must not only be concerned with the accuracy of design but also with the fit-for-purpose, functionality and sustainability thereof, while simultaneously creating economic value for the organisation. They must assure that

designs exceed the needs and expectations of their customers as well as making money for the organisation.

5.2 Engineering Management in the public sector

The public sector is the portion of an economic system controlled by national, state or provincial, and local governments. In the South African Government and public sector, Engineering practitioners provide independent and objective advice to clients across the broad public sector at municipal, provincial and national government levels, including respective state-owned entities.

Public services in general include public goods and governmental services such as the military, law enforcement and infrastructure (public road, bridges, tunnels, water supply, sewers, electrical grids, telecommunication, etc.) as well as public transit and public education, along with health care and those working for the government itself, such as elected officials. The public sector might provide services that a non-taxpayer cannot be excluded from, for example, basic services such as street lighting and services that benefit all of society rather than just the individuals who use the service. There are also public enterprises or state-owned enterprises that are self-financing commercial enterprises under public ownership which provide various private goods and services for sale, and which usually operate on a commercial basis.

The primary role of Engineering is to develop and maintain the infrastructure within both public and private sector. Infrastructure is the fundamental facilities and systems serving a country, city or other area, including the services and facilities necessary for its economy to function. In general, it has also been defined as the physical components of interrelated systems providing commodities and services essential to enable, sustain or enhance societal living conditions.

There are two ways to view the infrastructure: hard or soft. Hard infrastructure refers to the physical networks necessary for a modern industry to function. This includes roads, bridges and railways. Soft infrastructure, on the other hand, refers to all the institutions that maintain the economic, health, social and cultural standards of a country. This includes educational programmes, official statistics, parks and recreational facilities, law enforcement agencies and emergency services. Both soft and hard are controlled and managed differently under various

workbooks and scopes, hence there is no generic organogram or portfolios for Engineering Management functions.

Generically, projects follow a certain project life cycle: initiating, planning, executing, monitoring and controlling. The nature of these projects may differ in degree and complexity, so it would make sense for personnel structures to include EMBoK such as: introduction to a framework for the Engineering Management discipline; leadership and organisation management; strategic planning; financial resource management; project management; operations and supply chain management; marketing and sales management engineering organisations; management of technology, research and development, system engineering and legal issues in engineering management; professional codes of conduct and ethics.

5.3 Engineering Management in the private sector

The consulting Engineering organisational structure in the private sector varies according to function, the size (number of employees) and engineering services offered. A typical consulting Engineering organisation has the structure as shown in **Figure 4**.

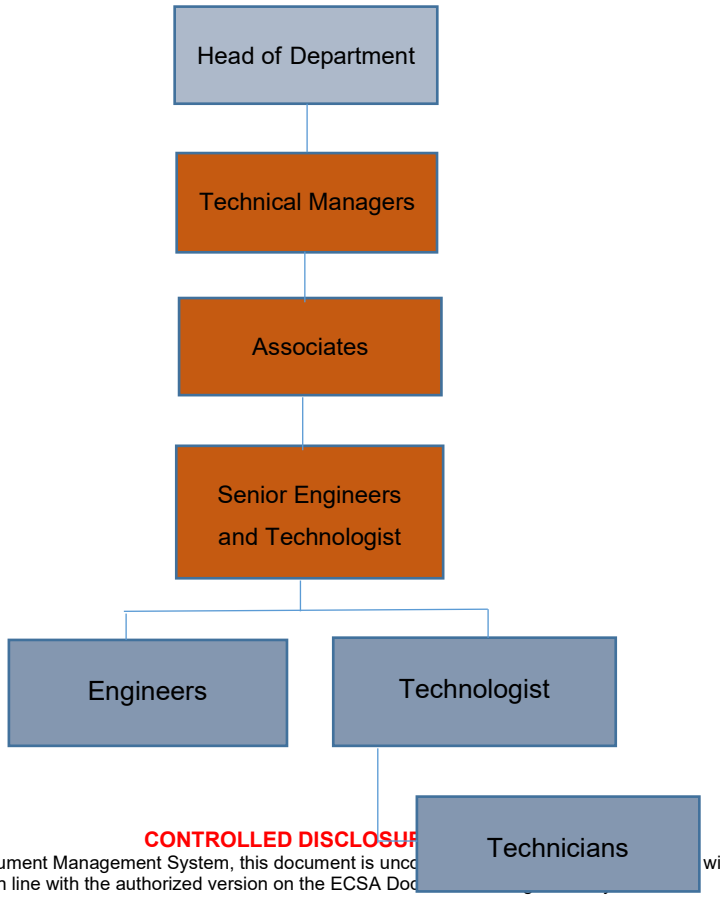

Figure 4: Typical consulting engineering organisation structure

Candidates that specialise in the EMBoK could fill the roles from Senior Engineers and Technologist up to Technical Managers as the personnel are likely to perform these functions without necessarily having the title of 'Engineering Manager'.

Candidates who want to function as a specialist in Engineering Management must have the base Engineering qualification from a university or university of technology. In addition to this, the Candidate needs to have met the following criteria:

- Further study in the form of attaining an honours or master's degree in Engineering Management; a range of short courses could also suffice but the content would need to be vetted in terms of its alignment to the above degree; and/or
- at least 3 years practising as an Engineering Manager or fulfilling Engineering Management role (recognition of prior learning);
- Candidates need to be agile in their interactions with an array of multidisciplinary teams;
- A good understanding of operations and/or project management.

The previous discussion indicates significant value in a registered person practising Engineering Management in an organisation for the benefit of the engineering professional, accountability, responsibility and thriving in excellence for recognition, development and sustainability of the organisation.

6. ORGANISING FRAMEWORK FOR OCCUPATIONS (OFO)

Engineering Management Practitioners may be employed in both private and public sectors. In the private sector, Engineering Management Practitioners would typically be involved in contracting, or in supplier or manufacturing/installation organisations. Engineering contractors are responsible for project implementation; activities include planning, construction, forensic investigation, and labour and resource management. Those working in supply or manufacturing companies could be involved in research and development and would be involved in production, supply and quality control.

The public sector is responsible for service delivery and is usually the client, although in some departments, construction is also performed. Engineering Management Practitioners are required at all levels of the public sector, including national, provincial and local government level, state-owned enterprises and public utilities. Engineering Management Practitioners in the public sector are involved in overseeing implementation, operations and the maintenance of infrastructure. An extension of the public sector includes tertiary academic institutions and research organisations.

Depending on where the Candidate is employed, there may be situations where the in-house opportunities are insufficiently diverse to develop all the competencies required in all the groups noted in Section 5.1. For example, the opportunity for developing problem-solving competence (including design and developing solutions) and for managing Engineering activities (including implementing and constructing solutions) may not both be available to the Candidate. In such cases, employers are encouraged to appoint an external Mentor.

It is common practice that where an organisation is unable to provide training in certain areas, secondments are arranged with other organisations so that the Candidate is able to develop all the requirements (and competencies in the case of an Alternative Route applicant) for registration. These secondments are usually reciprocal in nature so both employers and their employees mutually benefit from the other party. Secondments between consultants and contractors and between the public and private sectors should be possible.

The OFO must add value to skills and competency development, planning and implementation of the sub discipline-specific training that aims to provide a clear and common understanding of the requirements and criteria that define the occupations and capture the skills and competencies in the form of occupations groups that organise the occupations into successive categories and hierarchical levels that should be based on similarity of experience, skills and knowledge.

The experience and competencies required for the Engineering Management Practitioners are as described in Section 5 above and in the training programme described in document **R-04-**

T&M-GUIDE-SC. The competency level is defined as a function of the complexity and range of tasks and duties to be performed and this is measured objectively by the following:

- The nature of the Engineering work performed the level of complexity and the degree of responsibility in relation to the experience.
- The level of formal education and classification of education for competent performance.

Problem-solving is the core of engineering. It is a logical thinking process that requires Engineering Management Practitioners to apply Engineering principles to diagnose specifically defined Engineering Management problems systematically. This process involves the analysis of Engineering systems and the integration of various elements in Engineering systems through the application of basic and Engineering sciences.

The problem-solving experience may be obtained in any of the work categories presented in the following sections.

6.1 Operations

Operations deals mainly with the maintenance, performance and functionality of Engineering systems and the monitoring of implemented and proven solutions to ensure smooth system operation as indicated in Engineering Management knowledge area in Section 5 above.

In addition, this category of work also involves continuous improvement initiatives for optimising the operational efficiencies. In performing the abovementioned work, Engineering Management practitioners use the knowledge and experience they have obtained in managing operations, which includes the ability to assess designs.

6.2 Research and development

This type of work may be performed in research and product development centres of business organisations or academic institutions. Engineering Management Candidates must participate in research and development work that is predominantly of a Systems Engineering nature. The work must include the application of the various aspects of different Engineering disciplines, including product or system testing under controlled experimental conditions.

7. DEVELOPING COMPETENCY – R-08-CS-GUIDE-SC

The ECSA document, titled *Engineering Management Feasibility Study*, provides an extensive study and review of the need for Engineering Management to be a discipline specified registration category; this is based on the dynamics of the modern organisation, and the ongoing recognition of the EMBoK and skillset to motivate and stimulate growth in this new facet of Engineering. To do this, ECSA ensures that regulatory structures keep pace with and adapt to developing requirements and movements in industry and the applied fields.

The need for Engineering Management to be discipline specified is required as organisations still require a way to evaluate a trusted and accountable person who can progress through the organisation with the required competency and professional recognition. Therefore, an individual with the knowledge and skillset of covering the EMBok who develops him or herself to remain relevant in the field should progress through the organisation's structure and ultimately practise as an Engineering Management Practitioner.

The implementation of this sub discipline-specific training guide is dependent on following the policy provision as set out in ECSA document **R-02-STA-SC**, whereby competency must be demonstrated within the specifically defined Engineering activities.

The level descriptors, which are for specifically defined Engineering activities, are characterised by several or all of the following:

- Scope of specific practice area is defined by specific techniques applied; change by adopting new specific techniques into current practice.
- Practice area is located within a wider, complex *context,* with specifically defined working relationships with other parties and disciplines.
- Work involves specific familiar *resources,* including people, money, equipment, materials and technologies.
- Require resolution of *interactions* manifested between specific technical factors with limited impact on wider issues.
- Are *constrained* by operational context, defined work package, time, finance, infrastructure, resources, facilities, standards and codes, and applicable laws.

- Have *risks* and *consequences* that are locally important but specifically defined.

Before ECSA internal assessment, Candidates/applicants must demonstrate that during their training period, they have mastered the competencies defined in document **R-08-CS-GUIDE-SC** to a satisfactory level and have attained the appropriate degree of responsibility for the different subcategories of the outcomes groups as described above. The degree of responsibility is set out to guide Candidates as they progress in their careers with the aim of the Candidate being able to perform at level E as described in the **Table 2** below.

After successful professional registration, Candidates are expected to maintain their professional registration by acquiring continuous professional development (CPD) points on a yearly basis, which are then vetted and verified by ECSA for the minimum requirements. It is important to note that CPD should be acquired in the specialisation for which the Candidate registers to keep the continuous learning relevant.

There is no ideal training programme structure that constitutes best practice or the ideal learning structure for Candidates; however, Candidates must place themselves with employers that can provide them with the needed training to be exposed to all 11 ECSA outcomes at the right degree of responsibility where possible. A regular reporting structure with suitable recording of evidence of achievement against the competency outcomes and responsibility needs to be in place. The training programme should be such that Candidates progress through the levels of work capability **R-04-T&M-GUIDE-SC** to ensure that by the end of the training period, they can exhibit Responsibility Level E and are able to perform individually and as a team member at the level of problem-solving and Engineering activity required for registration.

7.1 Contextual knowledge

Applicants are required to demonstrate the insight and ability to use and interface various aspects through verifiable performance of providing Engineered solutions to practical, specifically defined problems experienced in their operating work environment. In addition, applicants must develop the skills required to demonstrate the use of applicable Engineering knowledge in optimising the efficiency of operations. Applicants must demonstrate the ability

to manage a team, and to achieve these objectives and should have acquired at least 3 years minimum experience in Engineering Management.

Candidate Engineering Management Practitioners must be able to demonstrate that they have been actively involved in an Engineering environment and have participated in executing practical work to the extent that they have learnt sufficient detail regarding basic Engineering management procedures to be able to exercise judgement in the workplace, thereafter contextual knowledge.

Candidates are expected to be aware of the requirements of the Engineering profession. The recognised VA applicable to the Engineering Management Practitioner and its functions and services to members, for example, providing a broad range of contextual knowledge for the Candidate Engineering Manager through the full career path of the Registered Engineering Management Practitioner within the Specified Category.

Candidates in Specified Category in Engineering Management must obtain experience in solving a variety of problems in their work environments. The solutions to these problems should involve the use of fundamental, prior learning as well as conceptual and practising Engineering knowledge. The problems that require a scientific and Engineering approach to their solutions may be encountered in any Engineering work environment that consists of integrated Engineering systems, equipment, machinery, operations, manufacturing, construction and infrastructure.

7.2 Outcomes for registration

In applying Engineering Management knowledge gained through prior learning and experiential training, the applicant must also demonstrate the technical Engineering and business science and economic benefits of engineered solutions at the appropriate level. In addition, applicants must show evidence of adequate training in these functions/skills through project work carried out to analyse specifically defined engineering problems, problem solving and synthesis of solutions.

While Engineering Management can be defined as the application of the generic management functions of planning, organising, leading and controlling together with Engineering knowledge in contexts that include the management of projects, construction, operations, maintenance, quality, risk, change and business. As Engineering practitioners, the level of Engineering Management a person is involved in or is sufficiently experienced to do is of necessity limited when applying for registration as a Specified Category Practitioner.

As the first criterion, Candidates should gain experience in one or more of the core competencies outlined above. Engineering Management is more than project management. Project management is in most cases supportive of Engineering activity, but it does not represent the level of demonstration of performance at the degree of responsibility required. It is useful to measure the progression of Candidates' competence by using the degree of responsibility, as shown in Table 2 below. The degree of responsibility shows the gradual increase in responsibility to which Candidate Specified Categories are exposed to during their professional training. The aim is to get the applicant or Candidate working at Responsibility Level E prior to registering for professional registration and carrying out the activities for each outcome outlined in the competency standard.

Table 2: Degree of responsibility and level of support

Level	Nature of work	Level of responsibility	Level of support
A: Being Exposed	Undergoes induction, observes processes, and work of competent practitioners.	No responsibility.	Mentor explains challenges and forms of solutions.
B: Assisting	Performs specific processes under close supervision.	Limited responsibility for work outputs	Supervisor/mentor coaches, gives feedback
C: Participating	Performs specific processes as directed with limited supervision.	Full responsibility for supervised work.	Supervisor progressively reduces support but monitors output.
D: Contributing	Performs specific work with detailed approval of work outputs.	Full responsibility to supervisor for immediate quality of work.	Articulates own reasoning and compares it with that of supervisor.
E: Performing	Work in team without	Level of responsibility to	Assumes problem

Level	Nature of work	Level of responsibility	Level of support
	supervision, recommends work outputs, responsible but not accountable.	supervisor is appropriate to that of a registered person, supervisor is accountable for applicant's decision.	solving without support; very limited guidance.

Engineering activities should be selected to ensure the Candidate reaches the required level of competency and responsibility. The Candidates should demonstrate that during the training period, they have mastered the competencies defined in document **R-02-STA-SC** to a satisfactory level. The 11 outcomes are grouped into five outcome groups. It is therefore expected that the Candidate or the applicant should ensure that the outcomes outlined in the five outcome groups below meet the responsibility level for application as a Professional Engineering Management Practitioner within specified category:

Group A: Engineering Management problem solving

1. Define, investigate, and analyse *specifically defined* Engineering management problems.
2. Design or develop or plan solutions to *specifically defined* Engineering management problems.
3. Comprehend and apply knowledge embodied in widely accepted Engineering principles, practices, procedures, processes, systems, or methodologies specific to the jurisdiction in which the Candidate practises.

Group B: Managing Engineering management Activities

1. Manage part or all of one or more *specifically defined* Engineering management activities.
2. Communicate clearly with others in the course of the Candidate's *specifically defined* Engineering management activities.

Group C: Impact of Engineering Management Activity

1. Recognise and address the reasonably foreseeable social, cultural and environmental effects of specifically defined Engineering management activities.

2. Meet all legal and regulatory requirements and protect the health and safety of persons in the course of the Candidate's specifically defined Engineering management activities.

Group D: Exercising sound judgement, take responsibility and act ethically

1. Conduct Engineering management activities ethically.
2. Exercise sound judgement in the course of specifically defined Engineering management activities
3. Be responsible for making decisions regarding part or all the specifically defined. Engineering management activities.

Group E: Continuing professional development

1. Undertake professional development that is sufficient to maintain and extend the Candidate's competency,

The following steps should be taken by Candidate Engineering Managers at each level descriptor in the specified category for eligibility of registration within the specified category:

Step 1 – Identify whether the activity is an Engineering management problem.

- Does solving the problem require coherent and detailed engineering knowledge underpinning the applicable technology area?

Step 2 – Identify whether the problem has the knowledge area of Engineering Management, as outlined in Section 5 above and partly in the document **R-08-CS-GUIDE-SC**.

- The problem is ill-posed, is under- or over-specified and requires identification and refinement into the technology area.
- The problem encompasses systems within complex Engineering systems.
- The problem is classified as falling within typical Engineering requirements and is solved in well accepted and innovative ways.

Step 3 – Identify whether the nature of the Engineering management activity has elements of the four core competencies (technical, financial, managerial and leadership) within Engineering Management, as outlined in Figure 3, Section 5.1 above.

Step 4 – Identify whether the nature of the work satisfies the 11 outcomes according to the competency standard (**R-02-STA-SC)**.

Step 5 – Identify the degree of responsibility and whether it satisfies the degree of responsibility E (performing).

7.3 Statutory and other industry-related requirements

The typical activities of Engineering Management Practitioner outlined in the sections above have a direct public liability. The legislation listed in document **R-08-CS-GUIDE-SC** also applies to Engineering Management Practitioners. However, this does not include all the industry-specific legislation and regulations that form part of contextual knowledge required of Engineering Managers. Candidates or applicants are expected to have a working knowledge of, among others, the following regulations and Acts and how they affect their working environment:

- Engineering Profession Act, 46 of 2000, including the ECSA Code of Conduct
- Council of Built Environment Act, 43 of 2000
- Occupational Health and Safety Act, 85 of 1993 as amended, and the associated regulations.
- Mine Health and Safety Act, 29 of 1996, as amended
- South African National Standards
- National Environmental Management Act, 107 of 1998
- Labour Relations Act, 66 of 1995
- The Public Financial Management Act, 1 of 1999
- Municipal Finance Management Act, 56 of 2003
- Standard form of Contracts and Regulation; FIDIC or JBCC or NEC or GCC
- King Code of Ethics.

All Specified Category practitioners who are registered should comply with the provisions of these Acts and any external legislation related to an identified need to protect the safety, health and interest or the environment, in relation to engineering activity.

To demonstrate competency in regulatory aspects, the applicant should:

- identify the applicable legal, regulatory and health and safety requirements for the engineering activity
- identify the risk and apply defined, widely accepted risk management strategies
- select safe and sustainable materials, components, processes and systems
- communicate with parties involved in the legal and regulatory aspects of the work.
- maintain ethical standards.

7.4 Recommended formal learning

The benchmark qualification to be satisfied by Candidates aspiring to register as Engineering Practitioners under Specified Category should at least have NQF 5 or better, related to an identified need to protect the public safety, health and interest of the environment, in relation to an engineering activity.

Evidence of acquired knowledge of Engineering Management as a graduate attribute as outlined in the “E” series qualification standards for the Bachelor of Science in Engineering and the Engineering Technology qualifications acquired during undergraduate phase is ideal to satisfy the education requirement and may provide eligibility for registration as Candidate Engineering Management practitioners. Registration only comes into effect 3 years later, after the applicant has demonstrated competent performance against the prescribed standard **(R-02-STA-SC)**.

Applicants for Specified Category Practitioner in engineering management registration who have completed higher education programmes beyond the level required for registration in the category may offer appropriate aspects of the advanced programme as part of the evidence of competence subject to meeting the competency of the prescribed standard.

As part of the documentation required to apply for registration, the Candidate needs to provide evidence of initial professional development (IPD) by supplying a list of structured learning activities for continued education that were completed during the training period.

The VAs offers an annual conference and specialist group meetings through which Candidates may pursue CPD. The VA's also provides a listing of possible validated CPD activities for which CPD points are awarded.

It is suggested that Candidates work with their Mentors or supervisors to select appropriate projects for gaining exposure to the eventual responsibility for the knowledge areas listed in Section 5 above and the appropriate IPD.

Once registered, a person is obliged to subscribe to the ECSA Code of Conduct as well as any ECSA-approved code of practice. The registered person is also subject to continuing education and training (CPD) requirements as described in document **ECPD-01-STD**.

8. PROGRAMME STRUCTURE AND SEQUENCING

8.1 Best practice

There is no ideal training programme structure or unique sequencing that constitutes best practice. The training programme for each Candidate Engineering Management Practitioner depends on the work opportunities available at the time for the employer to assign to the Candidate.

It is suggested that Candidate Engineering Management Practitioners work with their Mentors to select appropriate training to gain exposure and eventually to select and understand the design, installation, commissioning, maintenance and/or inspection of the selected Engineering systems.

The training programme should be such that the Candidate Engineering Management Practitioner progresses through the levels of work capability described in document **R-04-T&M-GUIDE-SC** so that by the end of the training period, the Candidate can perform individually and as a team member, meeting the discipline-specific requirements (and the Engineering outcomes for Alternative Route applicants) at the level required for registration and exhibiting the Degree of Responsibility E.

The nature of work and the Degrees of Responsibility defined in document **R-04-T&M-GUIDE-SC** are indicated above in Table 2. The Mentor and the Candidate Engineering Management Practitioners must identify the level of responsibility an activity is compliant with and demonstrate the various requirements and if applicable, the outcomes. Evidence of the Candidate's activities is recorded on the appropriate system to meet the requirements (e.g., TERs and Training/Experience Summary (TES)).

8.2 Realities

Generally, irrespective of the system types, it is unlikely that the training period will be 3 years, the minimum time ECSA requires. Typically, it will be longer and determined, among others, by the availability of functions in the actual work situation. Each Candidate will effectively undertake a unique programme where the various activities carried out at the discipline-specific level are then linked to the generic competency requirements of **R-08-CS-GUIDE-SC** and the compulsory sub discipline-specific requirements to be met during the Candidacy. Also, several Engineering Management knowledge areas and one element of each of the four core competencies for Engineering Management Practitioners need to be satisfied.

8.3 Consideration for generalists, specialists, researchers, and academics

Document **R-08-CS-GUIDE-SC** adequately describes what is expected of persons whose formative development has not followed a conventional path, for example academics, researchers, specialists and those who have not followed a Candidate training programme. The overriding consideration is that, irrespective of the route followed, the applicant must provide evidence of competence against the prescribed standard **R-02-STA-SC**.

8.4 Moving into or changing the Candidacy programme

This guide assumes that the Candidate enters a programme after graduation and continues with the programme until ready to apply for registration. It also assumes that the Candidate is supervised and mentored by persons who meet the requirements in document **R-04-T&M-GUIDE-SC**. In case of a person changing from one candidacy programme to another or moving into a candidacy programme from a less structured environment, it is essential that the following steps be completed:

- The Candidate must complete the TES and TERs for the previous programme or unstructured experience. In the latter case, it is important to reconstruct the experience as accurately as possible. The TERs must be signed off by the relevant supervisor.
- On entering a new programme, the mentor and supervisor should review the Candidate's development in the light of the experience and opportunities and the requirements of the new programme, and plan at least the next phase of the Candidate's programme.

During Candidacy, Alternative Route Candidates (refer to second paragraph in Section 2: Audience) must ensure that they are conversant with the practical knowledge set out in form ER-SC (part of the Application for Registration form) and submit evidence in the form of an Engineering Report (ER-SC).

REVISION HISTORY

Revision number	Revision date	Revision details	Approved by
Rev. 0 Draft A	2 July 2021	First draft from the working Group	RPS BU
Rev. 0 Draft B	1 September 2021	Recommendation for broader consultation	RPSC
Rev. 0 Draft C	28 October 2021	Consideration of collated inputs from broader consultation	Working Group, RPS BU
Rev. 0 Draft D	24 January 2022	Review and Recommendation for Approval	Executive RPS: EL Nxumalo
Rev. 0	09 February 2022	Approval	RPSC
Rev. 1 Draft A	28 March 2025	The document has been updated to ensure alignment with the Policy and Standards Framework on ECSA Policies. The document according to the four-year review cycle. There are no material changes, as there has been no activity in this category regarding registration.	RIDR Business Unit
Rev. 1 Draft B	16 May 2025	Reviewed and checked	Acting Executive: RSIR
Rev. 1	06 Aug 2025	Approval	RPSC

The Discipline-specific Training Guide for:

Engineering Management Practitioners

Revision 1 dated 06 August 2025 and consisting of 35 pages has been reviewed for adequacy by the Business Unit Assistant Manager and is approved by the Acting Executive: Regulatory Services & International Relations **(RSIR)**.

08 October 2025

Business Unit Assistant Manager — Date

08 October 2025

Acting Executive: **RSIR** — Date

This definitive version of this policy is available on our website.

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2. Shah, H., & Nowocin, W. (2015). Yesterday, Today and Future of the Engineering Management Body of Knowledge. *Frontiers of Engineering Management*, *2*(1), 60. https://doi.org/10.15302/j-fem-2015009