Electrical engineering professionals' continuing professional development needs within one South African company

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Thesis presented in partial fulfilment of the requirements of Masters in Philosophy in Lifelong Learning presented to the Centre for Higher and Adult Education at the Stellenbosch University

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March 2015

Declaration

By submitting this thesis electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the sole author thereof (save to the extent explicitly otherwise stated), that reproduction and publication thereof by Stellenbosch University will not infringe any third party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

J.H Muller 30 January 2015

Abstract

The aim of the study performed in 2014 was to identify what the Continuing Professional Development (CPD) needs are of a selected group of electrical engineering professionals from one company in South Africa. The interpretivist research paradigm formed the basis for the "Interactive Qualitative Analysis" methodology used in the study. Due to limitations research was focused on only one constituency, a selected group of electrical engineering professionals in one organisation, which is close to, but have very little power over the specific phenomenon of CPD. Research activities included conducting focus group and individual interviews with participants to gain a better understanding of identified problem through the analysis and interpretation of the collected data. The phenomenon of CPD was found to lie within the spectrum of lifelong learning. Due to increasingly fast changing technological and work environments, practicing professionals take part in professional development, if it is compulsory or not, in order to stay competitive in the global arena. Research has shown that compulsory CPD for registered engineering professionals may further their professional development. From the "Possible Implications for CPD Provision for Engineering Professionals" document several issues and concerns were identified, which influence engineering professionals' perception of the professional body. The CPD system and CPD provision facilitated by the Engineering Council of South Africa (ECSA) may be one of the key reasons why many practicing engineers choose not to register professionally. Through this study the perceived and proposed CPD needs for the selected group of electrical engineering professionals have been identified, but to identify the actual needs of practicing engineering professionals in South Africa, a more detailed study will need to be done that should include all the constituencies that practice within the engineering environment or have any influence on the CPD phenomenon. The study also identified aspects that could help to improve the CPD system and the available CPD initiatives, and enhance the leadership from the professional body. This may positively influence the perception of practicing engineering professionals. Such positive perceptions could result in more practicing engineering professionals registering with ECSA and maintaining their professional registration.

Opsomming

Die doel van die studie uitgevoer in 2014 was om die Voortgesette Professionele Ontwikkeling (VPO) behoeftes van ‘n geselekteerde groep elektriese ingenieurs van een maatskappy in Suid-Afrika te bepaal. Die interpretatiewe navorsingsparadigma het die “Interaktiewe Kwalitatiewe Analise” metodologie wat gebruik is in die studie onderlê. Binne die studie beperkinge is gefokus op slegs een konstituensie, ‘n geselekteerde groep professionele elektriese ingenieurs binne een organisasie, wie digby die spesifieke fenomeen van VPO funksioneer, maar baie beperkte mag daaroor het. Navorsingsaktiwiteite het fokusgroeponderhoude en individuele onderhoude met deelnemers ingesluit om ‘n beter begrip van die geïdentifiseerde probleem te verkry deur analise en interpretasie van die ingesamelde data. Die fenomeen van VPO lê binne die spektrum van lewenslange leer. As gevolg van ‘n toenemend snel veranderende tegnologiese en werksomgewing, neem professionele praktisyns deel aan professionele ontwikkeling, of dit verpligtend is of nie, en bly sodoende kompeterend in die globale arena. Maar navorsing het ook bewys dat verpligte VPO vir geregistreerde ingenieurspraktisyns hul professionele ontwikkeling tot voordeel kan strek. Vanuit die “*Possible Implications for CPD Provision for Engineering Professionals*” dokument is verskeie kwessies en knelpunte geïdentifiseer wat professionele ingenieurs se persepsies van die professionele liggaam mag beïnvloed. Die VPO sisteem en VPO verskaffing wat deur die Suid-Afrikaanse Raad vir Ingenieurswese (SARI) gefasiliteer word, mag een van die kernredes wees waarom vele ingenieurspraktisyns kies om nie professioneel te registreer nie. Die perseptuele en voorgestelde VPO behoeftes van ‘n geselekteerde groep professionele elektriese ingenieurspraktisyns is geïdentifiseer in hierdie studie, maar om die werklike behoeftes van professionele ingenieurspraktisyns in die breër Suid-Afrikaanse konteks te bepaal is ‘n meer gedetailleerde studie nodig wat al die konstituensies insluit wat praktiseer binne die ingenieursomgewing of die VPO fenomeen in dié konteks beïnvloed. Die studie het ook aspekte identifiseer wat kan help om die huidige VPO sisteem en insiatiewe te verbeter, en die leierskap van die professionele liggaam tot voordeel kan strek. Dit mag ‘n positiewe invloed hê op die persepsies van professionele ingenieurspraktisyns. Diesulke positiewe persepsies kan lei tot meer professionele ingenieurspraktisyns wat registreer by SARI en hul professionele registrasie byhou.

Acknowledgements

I would like to firstly extend my gratitude to my managers and colleagues for giving me the opportunity and support to complete my research within my work environment, and hope my study will benefit Eskom and specifically the effective development of practicing engineering professionals going forward. Then I want to thank my research supervisor Dr Liezel Frick for all her support, motivation and time, without which I would not have been able to complete my dissertation. Thirdly, I need to thank my wife, daughter and son for their continuous support and understanding during the long days and nights working on the research. And lastly I want to thank God for giving me the health, talent and patience to be able to conclude the study.

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List of acronyms and abbreviations

ACT	Axial Code Table
ART	Affinity relationship table
CPD	Continuing professional development
CPE	Continuous Professional Education
EC	Engineering Council (UK)
ECSA	Engineering Council of South Africa
ECTS	European credit transfer and accumulation system
EPA	Engineering Profession Act
IEE	Institute of Electrical Engineers
IET	Institute of Engineering and Technology
IIE	Institution of Incorporated Engineers
IRD	Interrelationship Diagram
IPD	Initial Professional Development
IQA	Interactive Qualitative Analysis
SAIEE	South African Institute for Electrical Engineers
SID	System Influence Diagram

1. Orientation to the study

1.1 Introduction

The importance of continuing professional development (CPD) has grown from an optional activity to the point where it has become a vital way for professionals to keep up to date in their chosen careers (Guest, 2006). CPD is becoming the key component of lifelong learning in the move to a knowledge-based global society, and it includes formal, non-formal and informal learning that contributes not only to professional, but also personal development. When looking at South Africa with more than 180 000 engineering professionals as identified in a Department of Labour study in 2005 (Du Toit & Roodt, 2008, p. 7), there is an opportunity to identify what the real needs of these professionals in their specific environments are, and determine if the current CPD system is satisfying these needs. For this study only one of the engineering fields of practice was selected, which was the field electrical engineering. As with other international countries, CPD in South Africa has become mandatory for such engineering professionals. The Engineering Council of South Africa (ECSA) has implemented a CPD system that requires all registered engineers to accumulate a certain amount of points over a period of five years in order to keep their professional registration status. The continuous development of professional engineering practitioners is closely related to the implemented CPD system and the respective requirements for that engineering profession.

But CPD for engineering professionals is not without issues. Evetts (1998, p.443) discusses the practical difficulties in the supply, demand and cost of CPD initiatives for engineers in the UK and Europe. She argues that the rapid pace of technological advancement requires engineering professionals to continuously undertake CPD as part of their lifelong learning. Although the role of CPD for engineering professionals is undisputed, ensuring that European industries stay competitive in the global market, the CPD needs of engineering professionals was not being adequately met at the time of the study. Later Farr and Brazil (2009) explored the changing nature of engineering in a global environment and indicated that there is a new era for engineers that is characterised by outsourcing and increased global competition. Engineers need to be capable of leading multidisciplinary teams, and combine technical ingenuity with business acumen (Farr & Brazil, 2009, p. 3). Farr and Brazil evaluated three publications that they believe are forming the foundation and framework for modern engineering education, and within these publications they found strong

guidance on what types of skills engineers need to able to practice in the global arena. The important areas of development they highlighted include team skills, active learning, communication, leadership, and a system perspective (Farr & Brazil, 2009, p. 1).

Electrical engineers in the South African context are not immune to these global influences on their continued professional learning, especially given the complexity and the ever-changing nature of their profession. Electrical engineering professionals in South Africa can be responsible for any of the engineering functions of design, construction, testing, maintenance and improvement of electrical infrastructure. Within any major electrical project, engineering professionals will be required to ensure compliance with engineering standards and specifications, occupational and safety standards, and electrical regulations. In order to become a practicing professional in the field of electrical engineering, a person would need to have completed either a four year Electrical B.Eng or B.Sc degree, Higher National Diploma or Diploma, and should have completed an intensive training programme within the electrical industry. Within this training period exposure and practical experience in electrical system design, system modelling, project management, procurement, safety, standards and specifications, and problem solving are some of the requirements that have been set by ECSA to be able to register as an electrical engineering professional.

Initial professional development is not enough to maintain professional competence in the field of electrical engineering. To maintain professional registration a practicing engineering professional will be required by ECSA to re-register every five years and then provide proof of CPD credits accumulated over the period (ECSA, 2013, p. 10). Professionals need to obtain a minimum of five CPD credits a year in the categories of development, work-based, and individual learning. Engineers are allowed to accumulate up to four credits in the compulsory development category that includes all formal training. Two credits can be accumulated for the work-based category, one credit for each 400 hours of engineering related work. In the third category of individual activities, a professional is allowed to accumulate a maximum of three CPD credits per annum for activities such as lecturing, mentoring, supervising students, post-graduate studies, writing and presenting conference papers.

When taking into consideration the categories mentioned above, the CPD courses and activities available to electrical engineering professionals and the methods of delivery and validation, it does seem as if there is a limited choice currently available in the market. Most courses and activities are

delivered by conventional classroom or lecture-based methods at a seemingly increasing cost to the professional. Looking at the advancement in delivery of online CPD courses and activities in the field of health (CPD Direct, ©2010), education and finance (AOSIS eCPD, 2010) internationally, as well as the increasing availability of *OpenCourseWare* for engineering, ethics, project management and other fields of practice, from basic to advanced level, there could be an opportunity to change the way CPD courses are delivered, while increasing choice of subjects, relevancy and complexity.

ECSA has set clear objectives of the CPD system in their policy document and stated what types of development activities in the different categories for which a professional engineering professional would be able to claim points (ECSA, 2013, p. 3). Many of these activities are offered by a range of service providers within and from outside the engineering industry. However, it is unclear if the CPD requirements for engineers has taken into account the specific individual development needs and if it offers sufficient choices to the practicing engineering professionals and if these CPD activities are at the required level and effective in developing engineering professionals to level required to practice internationally on par with their international peers.

In the last available research report published in 2008 by the Department of Labour, there were 183 074 individuals employed as engineering professionals in 2005. Of this total, 40 144 were persons with degrees, 49 180 persons held National Diplomas, and 93750 persons had NQF level 4 and lower qualifications. All of these engineering professionals were employed as Engineers, Technologists and Technicians (Du Toit & Roodt 2008, p. 7). Chilwane (2011) cited the CEO of ECSA, Oswald Franks, who said that according to ECSA's database of registered persons, the number of registered engineering professionals has increased from 27 042 in 2005, to 36 069 in 2011. Thus in 2005 only 14.7% of practicing engineering professionals was registered with ECSA or only 30% of suitably qualified (Degree and National Diploma) professionals were registered. In the article Franks indicated a 33% growth in registration with ECSA from 2005 to 2011, but due to the fact that that there is no factual information on the growth in number of practicing engineering professionals, it is thus not really possible to gauge what the percentage of registered persons is in relation to the current amount of practicing engineering professionals. Most likely less than 20% of practicing engineering professionals are registered with ECSA and possibly less than 40% of suitability qualified engineering professionals are registered with this professional body. The reason why not more

engineering professionals gets professionally registered with ECSA, offered an additional research question besides the CPD needs which was the focus of this study.

1.2 Research Statement

It seems that engineering professionals in South Africa may not have any real influence on what CPD courses or activities are currently provided or have any choice in the delivery method, accessibility and portability of credits. This study identified the needs of a selected group of electrical engineering professionals in terms of their CPD requirements that may enable them to practice in the global arena. Despite the small scale of the study, the results may contribute to informing professional institutes on what electrical engineering professionals' needs are with regards to CPD within the South African context. Thus there may be an opportunity to influence the way the current CPD system is managed and the choice of CPD offerings available in the market.

1.2.1 Research Aim

The main aim of this study was to identify the needs of a selected group of electrical engineering professionals from one company with regards to the current CPD system, which would give them the necessary knowledge and skills to be able to compete successfully with their international counterparts.

1.2.2 Research Question

The main research question that this study hopes to answer can be seen as:

> ***What are the continuing professional development needs of electrical engineering professionals in South Africa?***

The sub-questions that support the main research question are:

- What is the knowledge, skills and competencies electrical engineering professionals need to be able to compete successfully with international counterparts?
- What are the perceptions of electrical engineering professionals with regards to the current CPD system?

- What are the perceptions of engineering professionals with regards to the choice of CPD offerings available in the market at the time of the study?

1.3 Key Terms and Definitions

In order for the reader to get a better understanding of the key terms that is contained within the research, some of the key terminology will be explained in more detail in the following paragraphs. The key terms in this study include continuing professional development, continuing professional education and lifelong learning.

1.3.1 Continuing Professional Development

Continuing Professional Development (CPD) is known within most professions, but according to Friedman and Phillips (2004, p. 361) the concept is ambiguous and there is some confusion with regards to the definition and its purpose within academic literature and even with the professionals themselves. According to Friedman and Phillips, professionals see CPD training as a way to stay up to date in their profession and used to build a career. Within professional associations CPD is often seen as:

> *…part of lifelong learning; a means of gaining career security; a means of personal development; a means of assuring the public that individual professionals are up-to-date; a method whereby professional associations can verify competence; and a way of providing employers with a competent and adaptable workforce* (Friedman & Phillips, 2004, p. 361).

In addition, Frick stated that CPD can be seen as a broad concept that includes education and learning which professionals will engage in as they mature from novices to experts (Frick, 2007, p. 6). This definition is also closely linked to what the Engineering Council of South Africa (ECSA) defines CPD as:

> *[t]he systematic maintenance, improvement and broadening of knowledge and skills, and the development of personal qualities necessary for the execution of professional and technical duties throughout a person's engineering career* (ECSA, 2013, p. 4).

As continuing professional development is currently the most commonly used term in literature and practice, it will be the preferred term used in this study. However, there is also a body of literature

that makes reference to the term continuous professional education (CPE) that necessitates some consideration as well.

1.3.2 Continuous Professional Education

Queeney (2000, p. 375) indicated that continuous professional education refers to the education of professional practitioners that follows a preparatory curriculum which extends their education, regardless of which profession they are in. Queeney argues that CPE should ideally keep practitioners abreast of new knowledge while enhancing their knowledge as they mature in their profession and should help with advancement and promotion and even be effective to support changing to different professions. When looking at CPE, the important parts of the concept include continuous, professional and education. When taking into account that most professionals can be seen as graduates, it must be assumed that the education referring to in CPE should be postgraduate or some form of formal education whose aim is to educate, inform and enhance the knowledge of practicing professionals. McDonald cites the definition below given by Griffith (1985) stating it to be the simplest and most usable definition of CPE:

> *…a subspecialty of continuing education that focuses on programming for persons who have earned their professional qualifications in some field and who have subsequently sought additional educational experiences to remind them of what they once knew and have forgotten, to acquaint them with knowledge that has developed since they earned their qualification, and to help them solve personal and professional problems of various kinds* (McDonald, 2001, p. 33).

The conceptualization of CPE is therefore closely aligned to the notion of CPD, and literature related to both aspects will be used in this study, even though CPD will be the preferred term used consistently throughout the study.

1.3.3 Lifelong Learning

Collin *et al.* (2012, p.155, citing Evers *et al.* 2011 and Maurer, 2002) state that for

> *…effective participation of employees in contemporary, knowledge base society it implies increased importance for voluntary learning and development by employees*.

Collin *et al.* (2012, p. 155) continues to explain that the need for lifelong learning has been recognized by entities such as the European Union that promotes continued lifelong learning for the

development of knowledge and skills of employees. The Organisation for Economic Co-operation and Development (OECD, 2000, p. 103) defines lifelong learning as:

> *All organised systematic education and training activities in which people take part in order to obtain knowledge and/or learn new skills for a current or a future job, to increase earning and to improve job and/or career opportunities in current or other fields*.

Collin *et al.* (2012) argue that lifelong learning or CPD are the means by which people maintain the knowledge and skills needed in their professional practices. From this it can be assumed that lifelong learning includes all learning activities that all working people take part in, and that it will include CPD, whose focus is more on practicing professionals.

1.4 Ethical Considerations

Institutional permission was obtained from the relevant manager of the business unit to perform the research within the business unit where this study took place. Ethical clearance was obtained from Stellenbosch University. Next an invitation for participation in this research was sent out to electrical engineering professionals within the institution where the study was conducted, and only those who volunteered were included in the study. To ensure that all the ethical considerations were covered for this study the following were explained in detail to the focus group and individual participants in the study:

- Purpose of the study;
- Research procedures;
- Potential risks and discomforts;
- Potential benefits of study;
- That there will be no payment for participation;
- Assurance of confidentiality of participants;
- Participation and free choice to withdraw from the research;
- Rights of research participants.

Each participant was then requested to complete and sign the consent form if they still agree to participate in this research study. The consent form used is the “Consent to Participate in Research” form as per annexure A. Within the consent form it was explained to participants that any

recordings used will be kept confidential and that the transcripts will be numbered using an alphabetical order. Both the recordings and transcripts were kept in a locked folder and were only accessible by myself as the researcher. The recordings were destroyed after transcription by deletion from recording device and computer applications.

I, the researcher, am also an employee within the institution and working as an engineering professional and to maintain objectivity, chose to use a methodology of research for this study that would help to avoid researcher bias and that is based on scientific principals.

1.5 Research Methodology and Design

The most appropriate research methodology found for this study of CPD needs for electrical engineering professionals, based on the researcher's engineering background and preference that it should be scientifically based, was "Interactive Qualitative Analysis" (IQA). IQA was considered effective to establish the general laws, relationships and connections that could apply to all engineering professionals with regards to CPD. IQA is a systems-based qualitative methodology and uses an interpretive approach, and in this study was used to identify the different constituencies of the CPD phenomenon. Before the study was initiated a high level research design was developed, that took into consideration all the IQA activities of the focus and individual interviews, and the analysis and interpretation of the data as can be seen in chapter 3 section 3.2, with the research flow graphically depicted in figure 3-1.

Thereafter interviews were conducted with the focus group and individual face-to-face interviews with selected participants. From focus groups interviews themes or "affinities" were identified with the systemic relationships between the themes or affinities that represented the groups experience with the phenomenon of CPD. Then using IQA protocols and rules a system that represents a "mindmap" of the group's reality was drawn. Thereafter an interview protocol was designed from the defined "themes" or "affinities" and used in the individual interviews to identify individual experiences and realities through interview quotes and statements. Again IQA protocols and rules were used to identify the individual systemic relationships between the themes or affinities, which was then used to develop a combined individual "mindmap". The two different midmaps was then compared and analysed in order to generate a high level system containing only the main derived

system influences. These main system influences was then analysed, discussed and interpreted to identify the view and experiences of research participants and the academic view with regards to the main derived system influences within the context of CPD for electrical engineering professionals

1.6 Overview of the Research Layout

In order to give the reader an understanding of the research designed used for this study a high level overview of the research layout of this research report is following.

Chapter 1 – Orientation to the Study

In chapter one there is an introduction to the phenomenon of CPD after which the aim and research questions are described. Related key terminology is discussed, followed by giving an overview of the research layout of the study, the possible contribution of the study and the ethical considerations.

Chapter 2 – Literature Review

Chapter two explores literature related to CPD in order to get a better understanding of what CPD is, why it is needed, how CPD relates to lifelong learning and what is the context of CPD in South Africa. From this discussion it is possible to consider the design, effectiveness of implementation and possible advantages and disadvantages of current CPD schemes. The chapter also provides an overview of the professional body, the objectives the body are trying to meet with the implementation of the current CPD scheme, and the requirements set for CPD for engineering professionals.

Chapter 3 – Research Design

In chapter three the research design and chosen methodology used for this research are discussed and explained in more detail in order to establish a better understanding of the processes and activities that was followed to complete this research.

Chapter 4 – Results and Discussion

In chapter four the results of the data generated by both the focus group and the individual interviews are provided and discussed.

Chapter 5 – Conclusion and Possible Implications

Chapter five contains the conclusions drawn from the research and possible implications for theory, policy, practice, and future research.

Chapter one introduced the phenomenon of CPD to the reader and then set out the research question as, *"What are the continuing professional development needs of electrical engineering professionals in South Africa?*" The chapter then continued to give an overview of key terms and definitions, the research layout of the document, the contribution this study could make and ethical considerations taken for this study. The next chapter will cover the review of the literature relevant to this research study in order to get a better understanding of what CPD is, why it is needed, and what is the context of CPD in South Africa.

2. Literature review

2.1 Introduction

In order to better understand what the CPD needs are for electrical engineering professionals, it is important to know what CPD is and how CPD is academically defined. In the following sections available literature relevant to CPD was reviewed to identify why CPD is needed by practicing engineering professionals. The literature review also evaluates current world trends and thoughts with regards to CPD and then puts CPD into context within the engineering environment in South Africa.

2.2 Defining CPD for the Twenty-first Century

The functioning of the post-modern society is mostly based on work-related activities. Besides other social structures such as home, education, religion or family, Carnivale (1985, as cited by Mott, 2000, p. 23), argued that professionals are increasingly finding satisfaction in their professions, that then becomes part of their identity. Continued professional competence demands workplace learning, which takes the form of continuing professional education (Mott, 2000, p. 23). Harris supports Mott by his argument that in “today's knowledge intensive world, sustainable competitive advantage can be gained through the ability to learn faster than the competition” (Harris, 2008, p. 218). He further highlighted that the knowledge gained by undergraduates when completing their degrees will only have an average lifetime of approximately four years and it needs to be updated. He continues to state that those firms that engage with CPD are likely to thrive, depending on their ability to effectively engage with knowledge transfer (Harris, 2008, p. 218). Hase and Kenyon argued that there is recognition that globalisation is creating a different work environment where people are required to be more than just competent, but that they need to be able to deal with dynamic and complex environments:

> *…by possessing an ‘all round’ capacity centred on the characteristics of: high self-efficacy, knowing how to learn, creativity, the ability to use competencies in novel as well as familiar situations, possessing appropriate values and working well with others* (Hase & Kenyon, 2003, p. 25).

Boud and Hager (2012) proposed extending the debate on CPD, to why it is needed and how it should be conceptualised. They argue that in the past engineers did CPD to satisfy their needs but that CPD now has become a codified set of activities that must be done in order to practice in the engineering profession. Boud and Hager then state that because it is easier to just monitor attendance, "formal CPD within professional organisations that mandate it has often become synonymous with participation in courses or seminars" (Boud & Hager, 2012, p. 17). Accumulation of hours by attendance then resulted in moving the focus of CPD away from the outcome to the input or the activity. They cite Webster-Wright (2009), who from research suggested that many professional development practices still focus on delivering content and not on enhancing learning. Boud and Hager then suggest that formal CPD should be reconceptualised in order to shift the focus away from the acquisition of points or hours, to the notion of practice (Boud & Hager, 2012, p. 18). They then also evaluate and discuss different metaphors to describe learning such as acquiring learning and transferring learning, and then warn against the limitations of these metaphors in the context of professional development.

Boud and Hager continue their argument that development implies that professionals continually develop their capacities, "but always in part at least, in response to happenings in their particular professional environment" (Boud & Hager, 2012, p. 20). They further propose that learning is part of normal work or any other social activities, and that by addressing the daily problems and challenges a professional learns by practicing in his work environment. Learning mostly takes place by practicing within the work setting, interacting with peers and others and building up and drawing from experiences gained. Only a small part of learning is done through formalised learning activities (Boud & Hager, 2012, p. 20). The same authors state that "the notion of practice can provide a holistic way of thinking that integrates what people do, where they do it, with whom and for what purpose" (Boud & Hager, 2012, p. 20). In concluding their work, Boud and Hager indicated that if we want to reconceptualise CPD for the Twenty-first Century there is a need to locate it in the practice of professionals. Just participating in activities provided by educators and trainers outside the work environment is no longer realistic due to the way they are currently being used in CPD. They argue that this distracts from what should be the focus of CPD, which is the situated learning of professionals and that:

> *CPD requires far greater opportunities to engage in practices that extend the repertoire of practitioners and that the focus needs to move from an analysis of individual*

> *knowledge skills and competencies to an analysis of environments and what the practices in them generate in terms of extending practice scope* (Boud & Hager, 2012, p. 27-28).

This new emphasis is required to re-locate CPD to the practice of professionals that will enhance the learning possibilities at work.

In defining CPD in the context of the engineering professional within the Twenty-first Century, it is important to look at all the facets of CPD. Collin *et al.* (2012, p. 156) indicated that CPD or lifelong learning is any means by which a person can maintain their professional knowledge and skills, and it can take on various forms, such as learning from formal educational courses or by gaining experience through work practice. Collin *et al.* continue to explain that professional development was traditionally based on more formal education and training within classrooms. Citing Baldwin and Ford (1988, in Collin *et al.* 2012) indicated that problems have been identified with transferring the skills learned in the classroom to the workplace, although according to Smith *et al.* (2006, in Collin *et al.*, 2012) this form of training and development remains important for organisations. In reaction to the problem of knowledge transfer, the amount of learning activities have increased over time and now includes informal workplace activities. Cheetham and Chivers (2001, in Collin et al., 2012, p. 156) listed a number of learning theories that guide the:

> *…understanding of informal professional learning, including behaviourism, cognitive approaches, mixed approaches (a combination of behaviourist and cognitive principles), constructivism, discovery learning and theories of adult development*.

They further indicated that informal professional learning also opens up a whole new avenue of research. Collin *et al.* (2012, p. 160) report that CPD is mostly seen as formal training and education within the work environment that is focused on promoting professional expertise. They then argued that more research is needed to determine and understand the multifaceted nature of CPD (Collin *et al.*, 2012, p. 160).

Billet *et al.* (2008) as cited by Collin *et al.* (2012, p. 160) argue that defining CPD broadly is more than just organising of training and education that professionals need to develop professional skills and competencies. There is also a need to identify how these professionals' practice within their communities of practice (Collin *et al*, 2012, p. 161). Collin *et al.* gives the definition of CPD as, "learning that takes place within workplaces and organisations", but then caution to say that this

leaves a gap as most research is based on the health and teaching practices and this may not be accurate for other professions (Collin *et al.*, 2012, p. 161). To better define CPD, there may be a need to refer back to the work of Boud and Hager (2012). They argued that in order to truly reflect the professional development there is a need to move away from the metaphors of skills acquisition or transfer to more correct meaning of participation, construction and becoming. In addition, the notion of practice, as also proposed by Boud and Hager (2012), becomes a crucial aspect that needs to be considered. Taken the above mentioned into consideration, it may be possible to re-define CPD as:

> *All continued activities of learning, such as formal, non-formal and informal learning relevant to the profession and the work environment, which are then applied through active practice within the professionals' place of work and improved by participation in the specific professions' community of practice, that would support the continuous evolution of the professional to a higher state of competence within the profession, ensuring the effective execution of professional duties.*

The changing work environment and the increased need for understanding of international business and project principles have added a new dynamic to CPD requirements for practicing professionals. Patil and Codner shared the results from a survey in their paper showing "that engineering graduates from university courses lack important skills, such as communication, decision-making, problem solving, leadership, emotional intelligence and social ethics" (Patil & Codner, 2007, p. 646). They cite Wellington *et al.* (2002) who stated that most students do not have the ability to work with people from diverse backgrounds (Patil & Codner, 2007, p. 646). Patil and Codner continue to argue that important key issues required to develop global engineering professionals are global mobility, multicultural workplace environment, internationalisation of engineering education and increasing numbers of engineering graduates. They highlight that engineering graduates have to be able to make use of advanced technologies in future workplaces and then cite Patel (2005) that therefore there is a need to include:

> *…assessment criteria of so called Global Competencies along with the Hard and Soft Competencies in the accreditation framework of engineering programmes, especially since engineering graduates need to work within multicultural and multinational workplace environments* (Patil & Codner, 2007, p. 646).

Figure 2-1: Global competencies for engineering graduates (adapted from Patil & Codner, 2007, p. 647)

The global competencies that Patil and Codner identified that an engineering graduate would need to function effectively in the global arena can be seen in figure 2-1 above. The figure shows a whole range of knowledge and skills a practicing professional will need, including the 'hard' competencies.

2.3 CPD and Engineering Professionals

Guest provides a global perspective of lifelong learning for engineers. He explains that in the not too distant past engineering professionals' competency was judged based on their skills, knowledge, understanding and competence which they gained at the start of their careers and that CPD was seen as an optional extra. Guest argues that this no longer holds true, as we move to knowledge-based global society; CPD has gradually become a vital requirement to keep up to date with one's chosen career. Such learning needs to be continuous and will include formal, non-formal and informal learning and that is not only related to employment (Guest, 2006, p. 273). This view is supported by Jones (2003, p. 170), who explains the advancement of the engineering field and points out that engineering has become a broad and increasingly diverse field in the 21st Century. He gives an overview on how the field of engineering changed from the Renaissance times when there were few people who were exclusively engineers, through the 19th Century when electrical engineering became a recognised discipline, to the digital age with engineers specialising in the complexities of analogue design. Jones stressed that with increasing specialisation by the end of the

Twentieth Century, maintaining current knowledge in just a small area of specialisation has become a challenge (Jones, 2003, p. 170).

Jenson (2007), argued that in order to secure the prosperity of modern society the facilitation of knowledge creation and sharing has become one of the most important factors (Jenson, 2007, p. 489). She supports the view of Jones, indicating that within the knowledge society there are rapid shifts in knowledge and institutional environments which pose an overall challenge to professionals, who are required to "keep up with dramatically changing networks to engage in continuous learning and re-learning" (Jenson, 2007, p. 489). Jenson indicates that in recent time several solutions have surfaced to try and explain new dimensions in expert learning practice as classical learning theories no longer seem to suffice, as they ignore roles that excitement, passion and desire play in the learning process (Jenson, 2007, p. 490). In her research she has found that all professional groups have adapted to fit in to the knowledge society by continuously working on addressing their need to renew their knowledge base (Jenson, 2007, p. 494).

With the advancement of technology it must be assumed that engineering professionals are keeping abreast with these technological advances and will make use of these technologies on a daily basis to communicate, network, socialise and do research relevant to their profession. In addition, most young engineering students are brought up with information readily available on request. In contrast, the provision of CPD for engineers in South Africa mostly uses conventional provision methods such as classroom or institutionalised training. Globally, there is a move by professional organisations to better utilise new computer technologies to offer training, qualifications and CPD on demand to professionals. Grierson (2000, p. 191), evaluated the value that new computer technologies had for delivering CPD, and argues that this will allow for better accessibility and flexibility and could reduce the cost of CPD for professionals. Taken into consideration that in South Africa (and even more so in the greater African continent) the access to CPD for engineering professionals is restricted, professional bodies in South Africa could better manage the CPD system, reduce cost and increase availability of CPD by making use of the new computer and social media technologies available today. In a study by Allan and Lewis (2006) they investigated the new direction of virtual learning communities (VLCs) and explored the way in which VLCs can support lifelong learning. From their findings they suggest that membership in such a community promoted individual lifelong learning both within and beyond the organisation (Allan &

Lewis, 2006, p. 846). Merriam *et al.* (2007, p 17) support the notion that technology has increased the flexibility of adults to learn through the use of interactive teleconferences from home or workplace computers. Today technology offers adults new media-rich learning experiences through self-directed learning (McWhorter, 2013, p. 268).

2.4 Global Trends within CPD

Collin *et al.* (2012, p.155) claim that for effective participation of workers in a contemporary, knowledge-based society, implies increased importance of voluntary learning and development by employees. The need for lifelong learning has been recognised by entities such as the European Union, which are promoting continued lifelong learning for the development of knowledge and skills of employees (Collin *et al.*, 2012, p.155). The Organisation for Economic Co-operation and Development (OECD, 2000) defines CPD as:

> *All organised systematic education and training activities in which people take part in order to obtain knowledge and/or learn new skills for a current or a future job, to increase earning and to improve job and/or career opportunities in current or other fields.*

CPD as a component of lifelong learning is the means by which people maintain the knowledge and skills needed in their professional practices. Professionals use CPD to update their professional knowledge. These professionals include doctors, lawyers or teachers – and engineers – who are usually part of a professional body and that certification or registration would be required to practice in some of these professions. Generally these bodies would regulate the profession and manage membership in order to practice; CPD for members is often compulsory (Collin *et al.*, 2012, p.156).

Galloway (1998) explores the changing scene for the professional engineers by analysing one of the professional institution's approaches to CPD within the United Kingdom (UK). Her research included in-depth interviews with representatives of professional bodies, professionals themselves and training providers. The results of this study indicated that engineering professionals have always conducted CPD in an informal manner. One of her research participants from the Engineering Council indicated that CPD has become obligatory for engineering professionals and will soon

become mandatory in order to be able to practice as a professional engineer. An interesting phenomenon Galloway highlight is that she sees market control and marketability as inseparable. To support this, Galloway cited Macdonald's (1995) idea that an occupational group collectively could through their specialist knowledge claim acceptance to a monopoly in the markets that can be associated with that specific expertise:

> *The occupation and its organisation attempts to close access to the occupation, to its knowledge, to its education, training and credentials, and to make its markets in service jobs; only 'eligibles' will be admitted…. Exclusion is aimed not only at the attainment and maintenance of the monopoly, but also at the usurpation of the existing jurisdiction of others and at the upward social mobility of the whole group* (Galloway, 1998, p. 232).

Galloway continues by citing the mission of the Institute of Electrical Engineers (IEE) in UK as (Galloway, 1998, p. 233):

- Promoting the advancement of electrical and manufacturing engineering and to exchange of information and ideas.
- Providing a broad range of services to members, to assist them in developing their careers by improving their capabilities as engineers and to play their full part in contributing to society.
- Raising the standing and visibility of the profession and maintaining a high standard of professional conduct.

Galloway then explains that the IEE also operates as the qualifying and regulating body for Electrical Engineering Professionals, is positioned as both a technical authority and learned society and also publishes engineering content. IEE as the qualifying body admits only those suitably qualified and experienced professionals to corporate membership as charted engineering professionals. The body further accredits and regulates both engineering courses at higher institutions and graduate training schemes of companies. Galloway highlighted that the body is active in the professional community by having more than 1 000 meetings, 100 conferences and colloquia annually. In addition, the body actively markets engineering through school visits and offering an information service for educational courses (Galloway, 1998, p. 233). This is further supported by Greenwood et al. (2002, citing Scott, 1994, 1995) who argued that the purpose of professional bodies is to:

> *…represent an intermediate level between organiszation and society and is instrumental to processes by which socially constructed expectations and practices become disseminated and reproduced"* (Greenwood *et al*, 2002, p. 58).

They continue to highlight that there are few research studies in this field and so there is little known of how and why institutionalized practices within in this environment change. The important point here is that:

> *…the Professional Association's role is crucial in theorizing change, endorsing local innovations and shaping diffusion after organizational failings has been conceptualized and linked to possible solutions* (Greenwood et al, 2002, p. 58).

From the above, it is possible to get some insight of what the role a professional body should entail. And that it is crucial that besides regulating the profession, the Institute should offer additional services to the professionals to raise the standing and visibility of that profession.

Dodridge (2002) touches on international recognition of engineering programmes and indicates that comparing the standard of the programmes is difficult in a single country, more so comparing it internationally. Dodridge refers to the Bologna Declaration signed by 29 countries in 1999, which aim was to promote mobility through universal or standardised tools such as European credit transfer and accumulation system (ECTS) that allows for studies done in signatory countries that are understood and accepted by others that are part of the process. Currently, there are 47 participating countries who have adopted the prescribed degrees which include the Bachelors, Masters and Ph.D. degrees. Many of the countries needed to make substantial changes to their higher education system by reviewing curricula in order to meet the requirements as set out by the Bologna Process (EUA, 1999). This process ensures there is an accepted standard of qualifications for all participating countries that would facilitate the mobility of engineers. Dodridge (2002, p. 308) next listed the three levels of designations engineering professionals can register for in UK, which are:

- Chartered Engineer (CEng)
- Incorporated Engineer (IEng)
- Technician Engineer (EngTech)

The institutions mentioned above also accredit educational programmes and professional training to ensure it meets the Council's criteria. Dodridge (2002, p. 308) gave the following three stages that an engineer needs to follow to register as a professional engineer at Chartered or Incorporated level:

- The educational base: an accredited degree programme or equivalent.
- Initial professional development (IPD), which is designed to improve the acquisition and development of skills, specialist knowledge and competence needed to practise in a particular area of engineering and preferably undertaken by means of an accredited programme.
- Professional review in which the competence achieved in IPD is demonstrated and assessed through evaluation of the candidate's written report and an in-depth interview by two suitably qualified professional engineers. The review also requires the candidate to demonstrate a commitment to continuing professional development (CPD) and to a code of conduct and codes of practice.

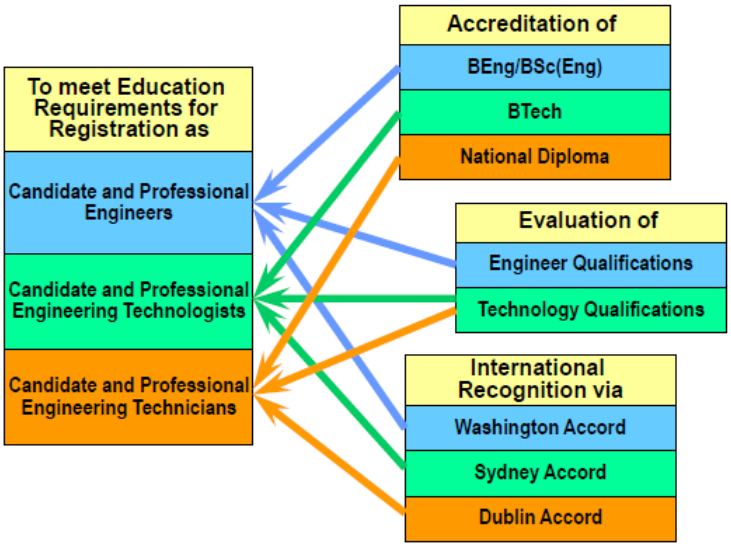

Figure 2-2: International Recognition of South African Engineering Qualifications (Campbell. 2010)

When considering international recognition of South African engineers, ECSA is a signatory to three accords that facilitate the international recognition of registered engineering professionals. The three accords are the Washington Accord, the Sidney Accord and the Dublin Accord (IEA, 2014), with each accord ensuring the recognition of engineering qualifications as per order of engineers,

technologists and technicians (Campbell, 2010). The accords can be seen graphically depicted in figure 2-2 above.

2.5 CPD within the Context of Engineering in South Africa

In South Africa the Engineering Council of South Africa is the statutory body established in terms of the Engineering Profession Act 46 of 2000 (EPA). The primary role of this council is to regulate the engineering profession. Regulation is done by promoting the appropriate level of education and training, registration of competent engineering professionals and governing their professional conduct to facilitate recognition of their professional competence locally and abroad (ECSA, 2012). ECSA is accountable to serve and protect the safety and health of public and achieve this:

> *…by establishing and maintaining minimum standards of practice, knowledge and skills of registered engineering persons in the country as well as to establish and maintain standards of professional ethics among them* (ECSA, 2013).

According to the Engineering Profession Act, 2000, section 18(1) ECSA was empowered to register persons in the following categories (ECSA, 2001):

(a) Professional, which is divided into:

- Professional Engineer;
- Professional Engineering Technologist;
- Professional Certificated Engineer; or
- Professional Engineering Technician.

(b) Candidate, which is divided into:

- Candidate Engineer;
- Candidate Engineering Technologist;
- Candidate Certificated Engineer; or
- Candidate Engineering Technician.

The list above gives the different levels of practicing professionals within South Africa and ECSA have defined and set the CPD registration and CPD requirements of each. ECSA as the regulating body also set out the duties of registered engineering professionals for renewal of their registration.

According to ECSA, section 22(1) of the Engineering Profession Act, it is the duty of a professionally registered person to apply for renewal of their registration and that the Council is responsible to

determine conditions of that renewal. Then section 13(k) of the Act covers the conditions related to education and training which makes provision for CPD. ECSA in its CPD policy indicated that CPD gives the Council a mechanism that can be used to comply with both the registration and CPD requirements (ECSA, 2013, p. 3). ECSA further indicates that it is not their role to police the career of every registered professional, but it is their goal to establish a culture of CPD for South African Engineering Professionals. ECSA then continues to point out that to meet the requirements of their agreements with other international bodies such as the Engineers Mobility Forum and the Engineering Technologists Mobility Forum, which facilitate the mobility of registered professionals, they must ensure registered professionals maintain and improve their competence through a system of CPD in order to sustain their international registration. Thus ECSA instituted a CPD system that was linked to registration renewal of professionally registered engineers on 1 January 2007. According to ECSA the objectives of the CPD system are the following (ECSA, 2013, p. 3):

- to ensure, through the creation of a culture of CPD, that all registered persons maintain their competence throughout their period of registration;
- to meet the requirements of the Act;
- to be the acceptable means for renewal of registration;
- to meet the requirements for recognition of ECSA's assessment process to comply to international agreements; and
- to ensure that those South African registered professionals meet the requirements for their continued international registration.

ECSA defines CPD as given under section 1.3.1. The categories of CPD activities are given in section nine of the CPD policy. Registered professionals must obtain CPD credits in at least two of three categories, with a minimum of five credits from category one in a five-year cycle. The maximum credits that can be accumulated per category annually can be seen in the table 2-1 below (ECSA, 2013, p. 7). The administration of the CPD system is also the obligation of ECSA according to the Engineering Profession Act, but the provision of CPD activities is outsourced by ECSA to recognized voluntary associations and accredited tertiary institutions according to specific criteria and guidelines.

Table 2-1: Maximum Credits per Categories of CPD Activity

Category	Type	Credits	Hours
1	Developmental activities: ○ Conferences ○ Congresses ○ Large group workshops ○ Lectures ○ Seminars ○ Refresher courses ○ Colloquiums	4	40 (10 hrs/credit)
2	Work-based activities: • Engineering work • Mentoring of candidate practitioners	 2 1	 600 (300 hrs/credit) 50 (50 hrs/credit)
3	Individual activities: • Membership of a ECSA recognised voluntary association • Other activities (examples): ○ Part-time lecturing to undergraduate and postgraduate students ○ Supervision of students undertaking postgraduate studies ○ Oral examinations of final year and postgraduate students ○ Evaluation of M dissertations and PhD theses by external examiners ○ Evaluation of final year students by external examiners ○ Publication of research in peer reviewed journals ○ Publication of technical articles ○ Papers presented at conferences or congresses ○ Participation in statutory, professional, institutional, technical or non-technical committees or task groups	 1 3	 Not linked to hours 30 (10 hrs/credit)

Lester describes a better and improved CPD approach, influenced by Kolb (1984), Honey and Mumford (1986) and Schön (1987), where the importance of the learning process and the results of learning are put above that of quantitative inputs. In this approach professional members are required to identify their needs, “draw up a development plan and review their learning, with many bodies providing a pro-forma for recording the complete process” (Lester, 1999, p. 3). Lester calls this the “learning cycle approach” and indicates that it is in use with professional bodies such as the Royal Institution of Chartered Surveyors (RICS), the Museums Association, and Institute of Personnel and Development (IPD) (Lester, 1999, p. 4). This is strongly supported by Boud and Hager,

who suggested that formal CPD should be reconceptualised in order to shift the focus of CPD away from the acquisition of points or hours to the notion of practice (Boud & Hager, 2012, p. 18). To improve and make CPD more effective it is suggested that there is a need to locate CPD within the practice of professionals. And that just participating in activities provided by educators and trainers outside the work environment is no longer effective (Boud & Hager, 2012, p. 27-28).

2.6 Conclusion

The environment and technology are changing at an increased pace and CPD has become vital for engineering professionals to maintain and improve their knowledge and competencies in order to keep up with changes in their chosen career. Recent research has shown that the CPD delivered to engineering professionals focuses on delivering of content and not on enhancing learning as it is easier to monitor attendance than knowledge transfer.

In South Africa, ECSA is the statutory body whose primary role through legislation is to regulate the engineering profession as they are accountable to serve and protect the safety and health of public. Regulation is done by promoting the appropriate level of education and training, registration of competent engineering professionals and governing their professional conduct to facilitate recognition of their professional competence locally and abroad (ECSA, 2012). ECSA has implemented and used CPD as the mechanism to regulate engineering professionals through compliance to both registration and CPD requirements (ECSA, 2013, p. 3). ECSA is also responsible for administrating the CPD system, but outsource the provision of CPD activities to recognised voluntary associations and accredited tertiary institutions according to specific criteria and guidelines. ECSA as the professional regulating body for engineering professionals is responsible for ensuring the competence of professionals, and by implementing compulsory CPD have set the requirements for those registered engineering professionals to maintain their professional registration. It is a concern that less than 20% of practicing engineering professionals and possibly less than 40% of suitability qualified (diploma or degree) engineering professionals are registered with ECSA. These statistics give an indication that there is not an effective enforcement of registration requirements, professionals do not see any benefit to registering for or to comply with CPD requirements, and there may not be adequate professional registration categories to cater for all practicing engineering professionals. It is therefore necessary to look at the CPD needs of such engineering professionals.

The research design and methods used to identify the needs of electrical engineering professionals will be explained in detail in the next chapter. Through the use of the chosen methodology it was possible to meet the objectives as set out in chapter one.

3. Research Design

3.1 Introduction

The investigator that performed this research is also part of the engineering professional fraternity that was studied, and preffered a research methodology that would help to avoid bias and is more scientificly based. The most appropriate research methodology found that satisfied the researchers requirements for this study of the social phenomenon of CPD within the engineering environment was “Interactive Qualitative Analysis” (IQA). The IQA was considered effective by the researcher to establish the general laws, relationships and connections that could apply to all engineering professionals with regards to CPD. It was also observed that very little previous scholarly work on engineering CPD incorporated the actual responses from research participants in the major component of the data analysis. IQA use participents interview responses that can be effectively utilised to make this study more credible and trustworthy.

IQA is a systems-based qualitative methodology grounded in systems theory (Northcutt & McCoy 2004, p. 16). IQA uses an interpretive approach by means of identifying different constituencies of a particular phenomenon and then conducting focus group interviews and individual face-to-face interviews with participants. The respective interviews are used to gain a better understanding of an identified problem through the analysis and interpretation of the data collected. The two relevant criteria that are used for selecting constituencies to take part in IQA research are:

- the degree of power that a constituency has over the phenomenon to be investigated, and
- the distance from the phenomenon (Northcutt & McCoy, 2004, p. 16).

Focus groups are used to identify the similarities, “themes” or “affinities” of a system or systems that represent the groups experience with the phenomenon. In the next step the group identifies the relationships between the identified affinities. From the IQA systems theory, a set of protocols or rules is used to draw a system that represents a “mindmap” of the group’s reality. Thereafter an interview protocol is designed from the defined affinities to help further explore the meaning of the affinities and their systemic relationships. A comprehensive system diagram is then developed from interviews to explain the phenomenon (Northcutt & McCoy, 2004, p. 44-45). In the final report the affinities and their relationships are described; comparisons are made of the systems developed

and individual interview responses and then it is possible to make predictions based on the properties of the systems.

Taking into consideration that the research for this master's study through coursework only requires a mini-dissertation, the research design based on IQA did not include all the proposed elements, such as comparing different constituencies. The following sections explain the research design used for this study in more detail.

3.2 IQA Research Flow

The research flow in IQA has certain distinctive phases, which are research design, focus group interview, individual interviews, and reporting. In research design a series of tools are used to articulate the problems of interest, to identify the constituencies that have an interest in the phenomenon and to state the research question implied by the problem statement (Northcutt & McCoy, 2004, p. 44). After the research design is completed, a focus group is used in order to identify the puzzle pieces (themes or affinities) and then how these pieces fit together through relationships or influences on each other within the system or systems, which then represent the participants' perceptions of the phenomenon – their CPD needs in this case. Using the protocols and rules as given by the IQA systems theory, a system can then be drawn that should represent the reality as perceived by the participants in the form of a mindmap. An interview protocol is developed through analyses of the system and its components that is then used in individual interviews to explore the meaning and systemic relationships of identified themes/affinities. From the results it is then possible to develop a comprehensive system diagram that can then be used in the final report to describe the affinities, and their relationships with each other based on the properties of the phenomenon.

For this research, the first step of the research design requires the investigator to develop an IQA research flow diagram covering the four phases of the proposed research. Following the guidelines as given by Northcutt and McCoy (2004, p. 45), the IQA research flow diagram for this study was developed as can be seen in Figure 3.1 below. From the flow diagram it can be seen that the first important part of the study was the focus group, where the focus group participants did axial coding to determine the affinities or themes of the phenomenon.

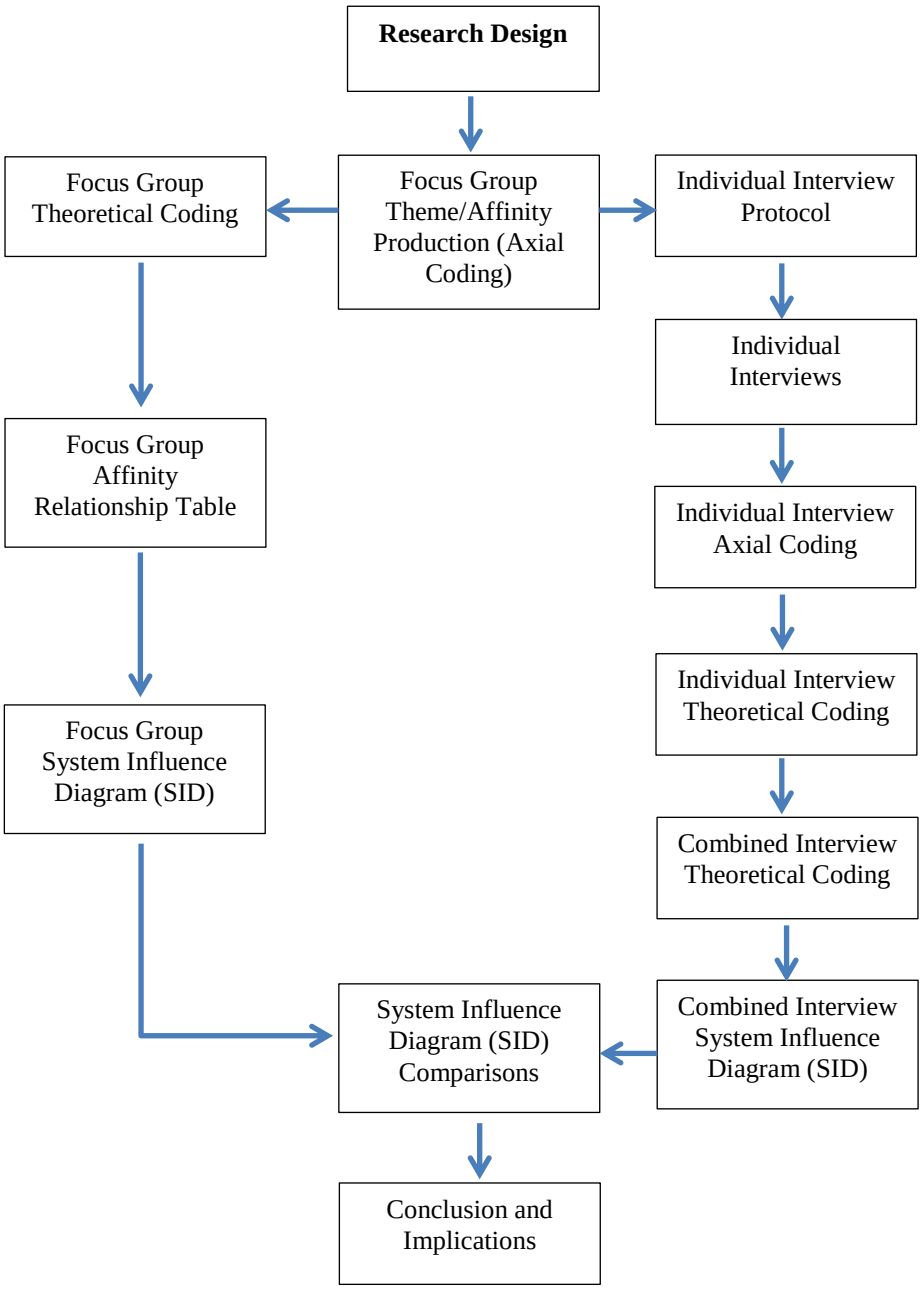

Figure 3-1: Overview of IQA Research Flow

After the focus group interview was completed, the IQA research flow diagram shows that research was then split up into two separate processes. The left side of Figure 3-1 shows the theoretical coding; compiling the group affinity relationship table (ART) and developing a focus group system influence diagram (SID). The right side of the flow diagram shows that from the information obtained from the focus group an individual interview protocol that was developed, which was then used in the individual interviews. The individual interviews included two parts; one part contained open-ended questions to identify how individuals perceived each affinity or theme, and in the second they were asked to complete an affinity relationship table (ART). Information gathered through the open-ended questions was then axially coded and the respective affinity relationship tables were used as input to the theoretical coding which was then combined to produce a Combined Interview System Influence Diagram (SID). On completion of the two research processes, the two completed SIDs, the one from the focus group and the other from the combined individual interview diagrams were compared to each other.

After the research flow diagram had been completed, the investigator initiated the research, starting with the identification of the constituency, developing the input to the focus group study and identification of the research participants. The research design and activities that were used in the focus group interview will be discussed in more detail in the following section.

3.3 Focus Group Interviews

The IQA research starts with a group of people, who share the same experience, are part of the same organisation, perform the same work, live in the same area or have the same or similar background. This it is required for any researcher that wants to use IQA to identify similarities between participants. A focus group is made up of individuals with different perceptions, opinions and experiences of the same phenomena being studied. The research process that was followed to select and conduct focus group interviews for this study follows.

3.3.1 Constituency Selection

Evaluating the phenomenon of CPD for electrical engineering professionals, the following possible constituencies were identified:

- ECSA registered engineering professionals;
- South African Institute of Electrical Engineers (SAIEE) registered professionals not registered with ECSA;
- Unregistered engineering graduates;
- Governmental Departments (minister of Public Works and the Council for Built Environment);
- Professional Bodies and Associations (ECSA, SAIEE);
- International Professional Bodies (Engineers' Mobility Forum); and
- Employers.

As previously mentioned, this is only a 50% thesis for a master's degree through course work programme, and thus it was decided that this study would only include one of the constituencies from the above-mentioned list, which was the ECSA registered engineering professionals. Due to access and availability it was decided to only focus on the group of registered electrical engineering professionals at the investigator's place of work. When evaluating this selected group against the two selection criteria of distance from and power over phenomenon, it is possible to see that ECSA registered engineering professionals have little power over the CPD system. Yet, these engineering professionals are required to operate within this system and thus are very close to it.

An invitation was sent out to 20 of the ECSA registered electrical engineering professionals. Of those invited, 15 potential participants initially accepted the invitation to participate in the research. The demographics of the participants whom initially accepted as per Table 3-1 below.

Table 3-1: Initial Participants Demographics

Race	Sex	Profession	Number
Black	Male	Engineer	4
White	Male	Engineer	3
White	Female	Engineer	4
Coloured	Male	Engineer	1
Indian	Male	Technologist	1
Black	Female	Technologist	1
Black	Male	Technologist	1

3.3.2 Focus Group Setup

The focus group for this research was arranged, and the date set with the participants and the research supervisor. There were several apologies on the day of the arranged focus group and only 7 participants arrived for a group session. Most of the apologies were due to work responsibilities and it was decided to continue with the focus group as planned. An additional engineer not registered with ECSA indicated that he would like to take part in the focus group and after discussion with research supervisor was allowed to join. Participants were welcomed and given an overview of the planned research and a short overview of the IQA methodology. The demographics of the participants who attended the focus group are indicated in Table 3-2 below.

Table 3-2: Focus Group Participants Demographics

Race	Sex	Profession	Number
Black	Male	Engineer (ECSA)	3
Black	Male	Engineer (not registered)	1
White	Male	Engineer (ECSA)	2
White	Female	Engineer (ECSA)	1
Coloured	Male	Engineer (ECSA)	1

3.3.3 Process for Identification of System Factors by Focus Group

Next the research objective of identifying what the CPD needs of electrical engineering professionals are was introduced to the focus group. The following discussion points were then shared and discussed with the group to initiate discussion and thoughts on the topic:

- What are the professional development needs of electrical engineering professionals?
- How well is the current CPD system suited for continuing professional development?
- If you were to compete with international engineering professionals, what are your thoughts on the following:
    - How do you see yourself compared to your international counterparts?
    - What skills and competencies do you feel you would need to be able to successfully compete with your international counterparts?
    - With the current support available to you, will you be able to equip yourself to become internationally competitive as an engineering professional?

Next participants were asked to reflect and share their experience with regard to the following:

- How do you feel about yourself as an engineering professional?
- Do you think you have the required skills and competencies to be competitive on an international level?
- Tell me if the current CPD system for professional engineers supports you effectively to become internationally competitive?
- Explain how you would improve the current CPD system to effectively support the development of engineering professionals?

Then the question of "***Tell me about CPD for engineering professionals?***" was put to the group. Everyone was allowed to discuss and brainstorm their respective experiences and thoughts, after which participants were asked to think of words, phrases, mental pictures, experiences or memories that came to them during this exercise. Next, cards and black marker pens were issued to the participants, and they were asked to individually write down one thought or experience per card provided. Participants were assured that their responses are confidential and that the identity of each author would remain anonymous. All the words or phrases captured on the cards can be seen in Table 4-1 in Chapter 4, arranged alphabetically.

Then participants were asked to stick their cards onto a wall inside the venue and when done the group was requested to read silently through the cards, trying to make meaning of each. After participants had indicated they have completed this task the content of each card was read aloud to the group with the facilitator asking if it makes sense and if participants understood the meaning captured on the card. If any word or phrase was unclear to the group, the group was asked to assist in clarifying and give meaning to the content.

On completion, the group was requested to put the cards into columns with similar meanings without speaking or discussing the cards. They were given permission that if any individual felt a card did not belong under a theme the person could move the card to the theme where the person thought it belonged. The facilitator also explained that if the participant felt a card belonged to more than one group, and additional card could be written and added to the theme. On completion, the facilitator asked the group to write any other cards they thought were missing and add it to the relevant column.

Next the facilitator asked the group to carefully analyse and discuss each of the columns, the meaning of the information on the cards under each, and to deliberate between themselves in order to come up with a theme or affinity name for each of the columns. To remove any confusion participants, were only introduced to the term ‘theme’ and not ‘affinity’ and from this point on in this research the term theme will also refer to affinity, except where the IQA tool titles specifically has referenced affinity. Thereafter, participants were requested to evaluate and discuss each of the theme names and then decide if additional themes were required or if some of the columns could be combined. The themes that the group came up with from the cards can be seen in Table 4-2 in Chapter 4. These themes were numbered as they were arranged on the wall from left to right, from 1 to 10.

3.3.4 Identifying the Relationship between System Factors

When the group was content with the grouping of the cards and the theme names they were then each issued with a Focus Group Affinity Relationship Table (ART) as per Annexure B. The focus group members used the ART to help analyse the relationship between each of the themes. At this stage, one of the participants had to leave the group due to a work emergency. The focus group continued

with the seven remaining participants. The ART is a matrix that contains all possible relationships pairs of the ten themes identified above. Using the table they were then asked to indicate what they believed the relationship between all the different pairs of theme were. Each participant was asked to determine the relationship between all pairs of themes by indicating one of the following:

- A→B
- A←B
- A<>B (none)

It was explained to the group that A would represent a theme based on the number allocated to it and then B will be the other theme. They then needed to indicate if A would affect B, or if B would influence A, or if there was no influence between the two at all. Each participant in the group then continued to complete the Focus Group ART. With this exercise, the focus group members started with the theoretical coding process that is required to develop the Interrelationship Diagram (IRD), which would lead to the mindmap or Inter Relationship Diagram of the group's perceived reality of the phenomenon.

3.3.5 Developing the Group Composite Interrelationship Diagram (IRD)

Within the IQA research methodology several tools are provided that can be used to produce a group Interrelationship Diagram (IRD), which is needed to create a system map. The information obtained from the ART from each participant in the group was then imported into the template of the Pareto table for ten affinities. This template was sourced from the CD accompanying the book by Northcutt and McCoy (2004) called the "frequency on affinity pair relationship table." The information was then ordered as per theme number and each one's relationship to the other. To complete the analysis further manipulation of the data was required by importing it into the "Pareto Cumulative Frequency Table". In this table the theme frequency was sorted in descending order, with additional calculated values such as cumulative frequency, cumulative percent (relation), cumulative percent (frequency) and the power of each of these components. Then taking the cumulative percent (frequency) as a reference and identifying where this value reaches close to 80%, the cut-off was set at 80.3%. Table 4-4 shows the columns of both the theme number and frequency sorted (descending). The sorted table was then copied over to the Affinity Pair Relationship table and then sorted by ascending order in order to clearly show the relationships for

each numbered theme in relation to the other nine themes, depending if their influence was within the selected 80.3% cut-off band.

The affinity pair relationships in Table 4-4 were next examined for any conflicts. Where both affinity pairs relationships (ex. 4>5 and 4<5) are present, a question mark was placed in the conflict box. Because there were only 7 participants that took part it was easy to resolve conflicts as there was none with even votes and all the conflict relationships had a full vote, the relationship with the highest frequency was used. With all the conflicts resolved, the voted relationships were used to create a group composite Tabular Interrelationship Diagram (IRD), by recording the information from the Affinity Conflict table, into the Tabular IRD Table 4-5. Each relationship was captured twice – once with a left arrow and once with an up arrow. These arrows were then counted to find the value of *delta (Δ)* in order to complete the table. The rules for calculating the delta are as follows:

- Sum of the arrows going up (↑) or *Outs*.
- Sum of the arrows going left (←) or *Ins*.
- Subtract the Ins from the Outs.
- *delta* (Δ) = Out – In

On completion of populating the first Tabular IRD, the deltas (Δ) were then ordered in ascending order as can be seen in Table 4-6. The data in the table then provided the information that could be imported into the Tentative System Influence Diagram (SID) Assignment Table (Northcutt & McCoy, p. 173) seen in Table 4-7. The assignment table then clarified which of the themes were primary or secondary drivers, which were primary or secondary outcomes and what the pivot point of the system was.

3.3.6 Constructing the System Interrelationship Diagram (SID)

The information from the ordered data in the Tentative SID Assignment Table a System Influence Diagram (SID) was then drawn as can be seen in Figure 4-1. The first SID completed is called the cluttered SID which contains all of the influences of each of the themes on each other.

When looking at the cluttered SID (as shown in Figure 4-1) it becomes clear that the system is highly saturated and very difficult to interpret with the ten identified themes. In order to simplify the cluttered SID and to make the system relationships flow to stand out, all the redundant links were

then removed. Using the primary driver number three as a base to start from, direct links to themes deeper into the system were removed if there was a link with neighbouring themes that would also link to the primary driver. For example, theme three have a link to two in Figure 4-1, yet theme three also has a link to theme seven, which in turn has a link to theme two. This link from theme three to theme two was removed as theme three will still connect to theme two through theme seven. The order that was followed to remove redundant links was as per the order in the Tentative System Influence Diagram (SID) Assignment Table (see Table 4-7).

In the uncluttered SID, it was now possible to identify a model that could be more easily interpreted, although this does not make the cluttered SID redundant. Each one of the SIDs has their use, depending on what information the researcher wants to draw from the diagram. With the uncluttered SID it was now possible to develop a simple flow model of the system. This model could then be used to determine which of the themes would be the best to focus on in order to influence the outcomes. This simple flow diagram in Figure 4-7 was then developed from the uncluttered SID in Figure 4-6, which clearly show the interaction and flow of influences.

The system flow diagram was then used to give a visual representation of the drivers and outcomes of the entire system to the investigator. The SID makes it easier to analyse how modification within the system could change the nature of the system.

> *As a visual representation of the mindmap developed from the data, the SID is roughly analogous to a set of qualitative structured equations or as a path diagram; however, it is distinguished from traditional path diagrams in that recursion or feedback loops are allowed* (Northcutt & McCoy, 2004, p. 48).

3.4 Individual Interviews

The IQA individual interview was a blend of structured and open-ended interview methods which gave it both consistency and allowed for gathering some deeper detail. After the finalisation of the data that was generated by the focus group and due to severe time constraints, it was decided to define or write a statement describing each of the ten themes. These describing statements could then be used in the individual interviews. Interview questions were then developed based on the statements developed for each theme and combined to form the interview protocol. In the first part of the interview participants were asked to reflect on the meaning of each theme as given by

the statement and also if they agreed with the statement or wanted to amend it, and if they could share any personal experience related to the theme. In the second part of the interview, the individual participant was asked to use an affinity relationship table to examine how he or she perceived the connections between all possible pairs of themes or affinities.

3.4.1 Individual Interview Participants

From the list of 15 persons that initially indicated that they would like to take part in the study, seven registered engineering professional were selected for individual interviews. Three of the 7 participants were not part of the original focus group, and four participants of the original group that indicated they were available were selected. The demographics of the interview participants can be seen in Table 3-3 below.

Table 3-3: Individual Interview Participants Demographics

Race	Sex	Profession	Number
Black	Male	Engineer (ECSA)	2
White	Male	Engineer (ECSA)	1
White	Female	Engineer (ECSA)	2
Coloured	Male	Engineer (ECSA)	1
Indian	Male	Technologist (ECSA)	1

3.4.2 Interview Protocol

The interview protocol that was developed included the theme reference table with the cards under each theme. The protocol contained clear guidelines on how interview should be conducted and how questions should be asked as can be seen in Annexure C. The objective of the individual interview protocol was to:

- Allow each of the participants to give the deeper meaning of each theme according to their perception of how the theme related in the overall scheme of their reality of the phenomena, which would not have been possible in the focus group.

- Give an individual view of how they saw the themes influencing and relating to each other, which allows for individual mindmaps that can be used for debriefing sessions as interpretive aid to the investigator (Northcutt & McCoy, 2004, p. 48).

The theme reference table (Table 3-4) was then handed to each participant to refer to during the interview after an in-depth description was given to explain the research and how the individual interview will be conducted.

Table 3-4: Themes Reference table produced from data obtained from focus group

Participant Theme Reference Table	
Theme Number	
1	CPD is needed to give engineering professionals the opportunities to develop and to be kept abreast of technological advances.
2	Quality assurance of CPD initiatives and system are required to ensure the professional competence of engineering professionals are current and recognised by international professional bodies.
3	An engineering professional body needs to show real leadership in the development of world recognised engineering competencies, through participation, taking initiative, mentoring others and facilitating international recognition.
4	The model professional engineer needs to maintain strong technical competencies, while also gaining the required non-technical competencies and leadership needed in the engineering environment, to enable the ability to function effectively in any environment, while working with a diverse group of people.
5	To belong to a professional body means members also have a responsibility to participate and make sacrifices for the improvement and upliftment of the body and the profession which will result in members building a reputation of effective and competent engineering professionals and thereby achieving international recognition
6	Due to mostly bigger organizations supporting and requiring professional registration many engineering professionals will rather become managers, resulting in many engineering managers not being professionally registered.
7	The current CPD system implementation is very poor as there is no effective quality management system; many courses on offer for CPD are easy and do not truly develop members and initiatives are accepted without any evaluation.
8	An effective CPD system should have high quality courses on demand that are relevant and current to the engineering environment, support the economy and give constructive feedback on the development progress of members.
9	The current CPD system is seen by members as a money making scheme, that only big organisations can afford to support.
10	Members find the current CPD system frustrating as it is confusing to navigate, there is little real support, it is an administrative nightmare and most of the courses or training is not relevant, which results in many engineering professionals choosing not to register with the professional body.

Then the conversation continued, discussing each theme with participants and using probing questions to extract more information based on the affinities that were identified by the focus group. The objective of the individual interview was to gain a deeper insight into the individuals' perceptions of the themes in the system and their specific experience with regards to each theme. Below are some of the types of questions that were asked:

- Do you agree with the definition or statement of the theme?
- What does the theme mean to you?
- Tell me about your experience with the theme?
- What do you mean by that?
- So why is that important to you?
- You said that……. can you give me an example?

The interview transcripts were then coded both axially and theoretically as was done for the focus group information as explained in the sections below.

3.4.3 Individual Axial Code Table (ACT)

The Individual Interview Axial Code Table (ACT) was the main document to capture all the individuals' responses on the questions for each of the themes, which helped to explain what meaning each of the participants gave for the particular theme within the system. Key quotes or phrases were then identified and documented by the researcher for easy reference and retrieval. These quotes from individuals for each theme were then copied over into a Combined Interview ACT, indicating from which Individual ACT it originated from in order to compare quotes and what meaning each participant gave to a theme. An example of a Combined Interview ACT for theme three can be seen in Appendix D.

3.4.4 Simple Individual Interview Affinity Relationship Table (ART)

On completion of the individual interviews, each participant was given an individual ART to indicate which theme will influence which or if there will be no influence as was done during the focus group. Then the results of all participants were imported into a combined ART.

Next those minority relationships were identified within this system that accounted for the majority of the variation within the system once again using the "Pareto Cumulative Frequency Table." Then taking the Cumulative Percent (Frequency) as the reference and identifying where this value reaches close to 80%, the cut-off was set at 80.4%. Table 4-11 shows the columns of both the Theme Number and Frequency Sorted (Descending) that were copied over to a new table, and the Affinity Pair Relationship was sorted by ascending order.

The affinity pair relationships in Table 4-11 were next examined for any conflicts as with the focus group data and a question mark was placed in the conflict box. Again because there were only seven participants that took part it was mostly easy to resolve conflicts, except for two relationships that showed equal votes between pairs as can be seen in the Table 4-11 highlighted in yellow. Due to the direct conflict it was decided to omit these four relationships from the data imported into the Tubular IRD in Table 4-12. Again each relationship was captured twice – once with a left arrow and once with an up arrow as explained earlier in section 3.3.5. As previously explained, the delta values (Δ) were then ordered in ascending order as can be seen in Table 4-13. The ordered table then gave the information that could be imported into the Tentative System Influence Diagram (SID) Assignment Table as can be seen in Table 4-14. The assignment table again clarifies which of the themes are primary or secondary drivers, which are primary or secondary outcomes, and what the pivot point of the system is.

3.4.5 Composite System Influence Diagram (SID)

Next the information from the ordered data in the SID Assignment Table was used to draw a SID as can be seen in Figure 4-12. The completed SID was again a cluttered SID, which was highly saturated and again all the redundant links were removed to produce an uncluttered SID. Theme three (Leadership from professional body) was again the theme with the highest delta (Δ) and the base used to start from to remove direct links to other themes deeper into the system as was previously explained. The order that was followed to remove redundant links was as per the order in the combined individual Tentative SID Assignment Table (see Table 4-14). The combined individual uncluttered SID that was developed can be seen in Figure 4-13. From this uncluttered SID it was possible to develop a simple flow model of the combined individual system, as shown in Figure 4-14).

3.5 IQA Results and Interpretation

The results derived from using the IQA method of analysis delivered two system flow diagrams, one the Composite System Flow Diagram and the other the Combined Individual System Diagram. Each of these diagrams showed a similar flow on the driver side of the system and then observable differences on the outcome side. Each system on its own could be used effectively to analyse the reality as given by participants for "CPD Needs for Engineering Professionals." But, to be able to identify the main system drivers it was firstly necessary to compare the two system diagrams with each other as was done in section 4.4. Then to simplify the diagrams by combining possible sub-themes that then provided a simple flow diagram that could then be used for interpretation (see Figure 4-21). The high-level themes were then analysed and discussed to give the scholarly view of each, how participants perceive the theme and to explain how each could affect the high-level system if adjustments are to be made.

3.6 Conclusion

Using the IQA research methodology, which is a structured and rigorous process, the research participants defined, refined and verified sets of textual references that have an underlying common meaning or theme. The constituency – a selected group of electrical engineering professionals – then identified perceived relationships among these experiences that helped the researcher to produce a conceptual map (or mindmap). This map is a systemic representation of how the constituency understands the particular phenomenon. The focus group's mindmap was then checked through the individual interviews and compared to the Combined Individual System Diagram (combined individual mindmap). The results, analysis and interpretation of the research from both the focus group and the individual interviews will be covered in the next section.

4. Results and discussion

4.1 Introduction

In this chapter the results of the data generated by both the focus group and the individual interviews was captured, analysed and interpreted. The aim was to capture the facts as they were gathered during the research phase and presenting the results of the data after manipulation using the IQA tools such as the affinity relationship table (ART), interrelationship diagram (IRD) and system influence diagram (SID). From the results and analysis it was important to try and answer the question, “What are the continuing professional development needs of electrical engineering professionals in South Africa?” This was done by comparing and interpretation of the analysed data from both the focus group and the individual interviews as can be seen in the following sections in this chapter.

4.1.1 Interview Protocol 1 – Inductive and Axial Coding Results

In Table 4-1 the group realities with regards to the phenomenon of CPD for engineering professionals were identified, as was described in section 3.3.3, by the participants writing down their thoughts or experiences generated through discussion on the cards provided. As can be seen in Table 4-1 a diverse number of thoughts and experiences were generated by the exercise.

Table 4-1: Cards Generated by Focus Group

Adaptable skills	International recognition
Administration	International recognition
Any course can be used to claim CPD without adequate QA	It's a way of checking if engineers are keeping up with their profession
Assessment of the status of the profession	Lack support
Available courses not relevant	Lacking coordination
Balanced in technical and other non-technical competencies	Large organisations pay for membership
Big money making business	Meaningless
Brings confidence to the profession	Most available CPD courses easy, maybe too easy
Cash cow for providers	Mostly quantitative, need more quality
Caution to not pollute engineering component	Multi skilled
Confusion	Necessary but confusing
Contradictory (ECSA to ensure technical competence, now also including soft skill)	Need forward looking training
Cost too high for professionals outside large organisations	Need more constructive feedback
CPD and ECSA registration essential in organisations such as Eskom, yet absolute in other areas of practice	Need to make some sacrifices
CPD mostly not compulsory outside bigger companies	Networking
CPD system does help drive individual development	Not a national priority
CPD system to be improved	Not purely technical
Current and relevant	Offer opportunities for technological development
Discouraging	Participation in professional body essential
Diverse	Peer recognition
Easier for professional to follow management route as there are fewer requirements	Professional competence
ECSA does not do anything for me – CPD has bad association	Reputation
ECSA / SAIEE / CPD provision money making scheme	Room for improvement
Effective mentorship	Skeleton, no real structural substance, need more meat/substance
Engineering managers are not required to be registered as engineering professionals	Socialising
Facilitate international recognition	Strong leadership skills
Find current system useless	Supports economy
Flexible	Supports greater insight in power industry
Fragmented (x2)	System very frustrating
Good idea but awful implementation / Good concept poor execution	The evaluation process needs some improvement
Good intentions for CPD	Uncontrolled
Good mentor	Un-firm
If done correctly they are useful	Unstructured
Inconsistent	Walk the talk leadership
International professional status	Well rounded engineer

The cards were then grouped into categories of similarity by participants supported by the facilitator in order to identify the themes of the system, through the process of inductive coding. The ten themes identified by the participants given in table 4-2 below.

Table 4-2: Focus Group Themes

Theme Name	
1.	CPD opportunity for individual professional development
2.	Quality assurance
3.	Leadership from professional body
4.	Ideal identity of model engineer
5.	Professional recognition/perceived professional identity
6.	Lack of incentives and enforcement
7.	Inadequate quality management
8.	Desired end state
9.	Members' perceptions of ECSA/CPD – financial
10.	Members' perceptions of ECSA/CPD system – process to comply

The focus group participants guided by the facilitator then evaluated and re-evaluated the theme labels and the expressions contained in each category under the respective themes (Axial Coding). With themes two (Quality assurance) and seven (Inadequate quality management), and nine (Members' perceptions of ECSA/CPD – financial) and ten (Members' perceptions of ECSA/CPD system – process to comply) there was an extended debate if they are sub-themes of each other, but the group remained adamant that they should remain separate. Through the processes of axial coding, the themes and their respective categories of expressions were then finalised, and the group moved on to the next exercise of theoretical coding of the information generated.

4.1.2 Theoretical Coding – Frequency Relationship Table

From the Focus Group Affinity Relationship Table (ART) as per Annexure B, participants analysed and captured the relationship between each of the ten themes following the process as described in section 3.3.4. The focus group participants this used the process of theoretical coding to identify their individual views on how the themes relate and influence each other. The information from the respective ART tables was then imported by the researcher into the 'Pareto table for ten affinities'

template, which resulted in a total of 254 votes cast for 90 possible relationships, as can be seen from Table 4-3 below. The information was then ordered and manipulated using the Pareto principle to find the least number of themes that would have the largest influence on the system.

Table 4-3: Pareto table – Frequency on Affinity Pair Order

	Affinity Pair Relationship	Frequency		Affinity Pair Relationship	Frequency
1	1 > 2		46	3 < 9	1
2	1 < 2	3	47	3 > 10	4
3	1 > 3		48	3 < 10	2
4	1 < 3	7	49	4 > 5	4
5	1 > 4	6	50	4 < 5	3
6	1 < 4	1	51	4 > 6	
7	1 > 5	3	52	4 < 6	4
8	1 < 5	3	53	4 > 7	1
9	1 > 6	2	54	4 < 7	3
10	1 < 6	3	55	4 > 8	4
11	1 > 7		56	4 < 8	2
12	1 < 7	6	57	4 > 9	
13	1 > 8	3	58	4 < 9	3
14	1 < 8	4	59	4 > 10	
15	1 > 9	1	60	4 < 10	3
16	1 < 9	4	61	5 > 6	1
17	1 > 10		62	5 < 6	4
18	1 < 10	5	63	5 > 7	
19	2 > 3	1	64	5 < 7	6
20	2 < 3	5	65	5 > 8	4
21	2 > 4	4	66	5 < 8	3
22	2 < 4	1	67	5 > 9	2
23	2 > 5	4	68	5 < 9	3
24	2 < 5	1	69	5 > 10	2
25	2 > 6	1	70	5 < 10	4
26	2 < 6	3	71	6 > 7	2
27	2 > 7		72	6 < 7	2
28	2 < 7	7	73	6 > 8	4

29	2 > 8	5	74	6 < 8	2
30	2 < 8	2	75	6 > 9	6
31	2 > 9	2	76	6 < 9	
32	2 < 9	1	77	6 > 10	6
33	2 > 10	2	78	6 < 10	
34	2 < 10	1	79	7 > 8	5
35	3 > 4	6	80	7 < 8	2
36	3 < 4	1	81	7 > 9	7
37	3 > 5	6	82	7 < 9	
38	3 < 5	1	83	7 > 10	7
39	3 > 6	3	84	7 < 10	
40	3 < 6	2	85	8 > 9	3
41	3 > 7	6	86	8 < 9	4
42	3 < 7		87	8 > 10	4
43	3 > 8	7	88	8 < 10	3
44	3 < 8	1	89	9 > 10	5
45	3 > 9	4	90	9 < 10	1
				Total Frequency	**254**

With this information now ordered per theme number, the data was importing into the “Pareto Cumulative Frequency Table.” With the theme frequency sorted in descending order, the Cumulative Percent (Frequency) was used as the reference to identify where the value reached close to 80%, and the cut-off was then set to 80.3%. The next Table 4-4 showed the columns of both the theme number and frequency sorted (descending) that was copied over to a new table. The Affinity Pair Relationship was then sorted by ascending order to clearly show the relationships for each numbered theme in relation to the other nine. It must be noted that during the theoretical coding part of the analysis done by the researcher, only the theme numbers was used to simplify the overall anaylisis process.

Table 4-4: Pareto table – Affinity Conflict Table

No	Affinity Pair Relationship	Frequency	Conflict?	No	Affinity Pair Relationship	Frequency	Conflict?
1	1 < 10	5		25	4 < 6	4	
2	1 < 3	7		26	4 < 7	3	
3	1 < 7	6		27	4 < 9	3	
4	1 < 8	4	?	28	4 > 8	4	
5	1 > 8	3	?	29	5 < 10	4	
6	1 < 9	4		30	5 < 6	4	
7	1 > 4	6		31	5 < 7	6	
8	1 > 5	3		32	5 < 8	3	?
9	2 < 3	5		33	5 > 8	4	?
10	2 < 6	3		34	5 < 9	3	
11	2 < 7	7		35	6 > 10	6	
12	2 > 4	4		36	6 > 8	4	
13	2 > 5	4		37	6 > 9	6	
14	2 > 8	5		38	7 > 10	7	
15	3 > 10	4		39	7 > 8	5	
16	3 > 4	6		40	7 > 9	7	
17	3 > 5	6		41	8 < 10	3	?
18	3 > 6	3		42	8 > 10	4	?
19	3 > 7	6		43	8 < 9	4	?
20	3 > 8	7		44	8 > 9	3	?
21	3 > 9	4		45	9 > 10	5	
22	4 < 10	3					
23	4 < 5	3	?				
24	4 > 5	4	?				

Table 4-4 also shows the results of the examination of conflicts between affinity pair relationships. Because there were only seven participants that took part in the focus group, conflicts were easily

resolved as there were none with even votes, the relationship with the highest frequency was selected to be used.

4.1.3 Theoretical Coding – Group Interrelationship Diagram (IRD)

With all the conflicts resolved, the voted relationships were used to populate a group Composite Tabular IRD as explained in section 3.3.5, and the results can be seen below in Table 4-5.

Table 4-5: Group Interrelationship Table

Tabular IRD													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**OUT**	**IN**	**Δ**
1			←	↑	↑		←	←	←	←	2	5	-3
2			←	↑	↑	←	←	↑			3	3	0
3	↑	↑		↑	↑	↑	↑	↑	↑	↑	9	0	9
4	←	←	←		↑	←	←	↑	←	←	2	7	-5
5	←	←	←	←		←	←	↑	←	←	1	8	-7
6		↑	←	↑	↑			↑	↑	↑	6	1	5
7	↑	↑	←	↑	↑			↑	↑	↑	7	1	6
8	↑	←	←	←	←	←	←		←	↑	2	7	-5
9	↑		←	↑	↑	←	←	↑		↑	5	3	2
10	↑		←	↑	↑	←	←	←	←		3	5	-2

The data as captured in the Table 4-5 above was then ordered in a descending order according to the delta (Δ) results as can be seen in Table 4-6 below.

Table 4-6: Sorted Group Interrelationship Table

Tabular IRD – Sorted in Descending Order of Δ													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**OUT**	**IN**	**Δ**
3	↑	↑		↑	↑	↑	↑	↑	↑	↑	9	0	9
7	↑	↑	←	↑	↑			↑	↑	↑	7	1	6
6		↑	←	↑	↑			↑	↑	↑	6	1	5
9	↑		←	↑	↑	←	←	↑		↑	5	3	2
2			←	↑	↑	←	←	↑			3	3	0
10	↑		←	↑	↑	←	←	←	←		3	5	-2
1			←	↑	↑		←	←	←	←	2	5	-3
4	←	←	←		↑	←	←	↑	←	←	2	7	-5
8	↑	←	←	←	←	←	←		←	↑	2	7	-5
5	←	←	←	←		←	←	↑	←	←	1	8	-7

4.1.4 Theoretical Coding – System Influence Diagram (SID)

The delta (Δ) values from table 4-6 was then used as markers for the particular themes in the system, by importing the ordered delta (Δ) theme numbers into the Tentative SID Assignment Table in Table 4-7 below. The assignment table allowed the themes to be marked as primary or secondary drivers or primary or secondary outcomes. The pivot point of the system could also be easily identified where the delta (Δ) is zero.

Table 4-7: Tentative System Influence Diagram (SID) Assignment Table

Tentative SID Assignments	
3	Primary driver
7	Secondary driver
6	Secondary driver
9	Secondary driver
2	Circular/pivot
10	Secondary outcome
1	Secondary outcome
4	Secondary outcome
8	Secondary outcome
5	Main secondary outcome

Next the information from the IRD results and the information from the Tentative SID Assignment Table, it was possible to draw an SID to visually representing the entire system and clearly showing the relevant influences and outcomes of the system. The activity produced a cluttered SID that can be seen in Figure 4-1 below, showing the results from analysed information obtained from the focus group. The SID can be seen as cluttered, and it is difficult to follow the influences of each respective theme in the system.

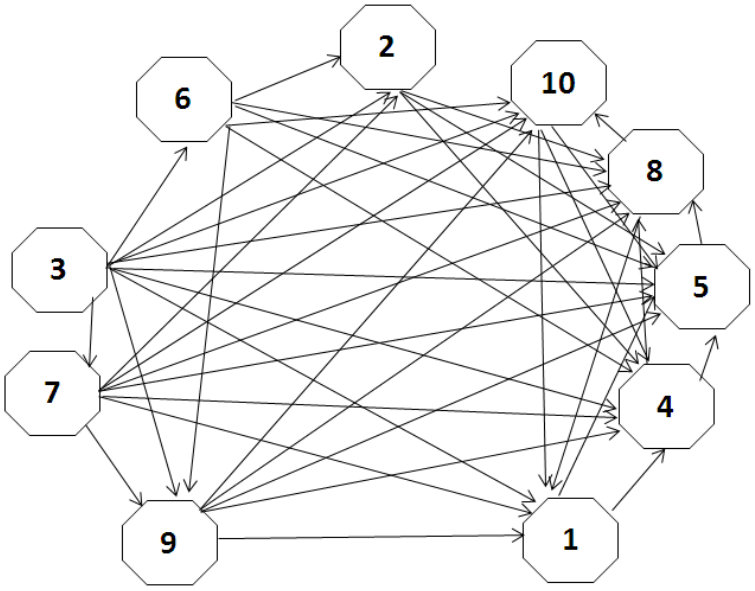

Figure 4-1: Cluttered System Influence Diagram (SID)

To better show the influences by the primary drivers, the pivot point and the main outcome, each one is shown separately below to clarify the interaction of the themes on the others within the Cluttered (SID).

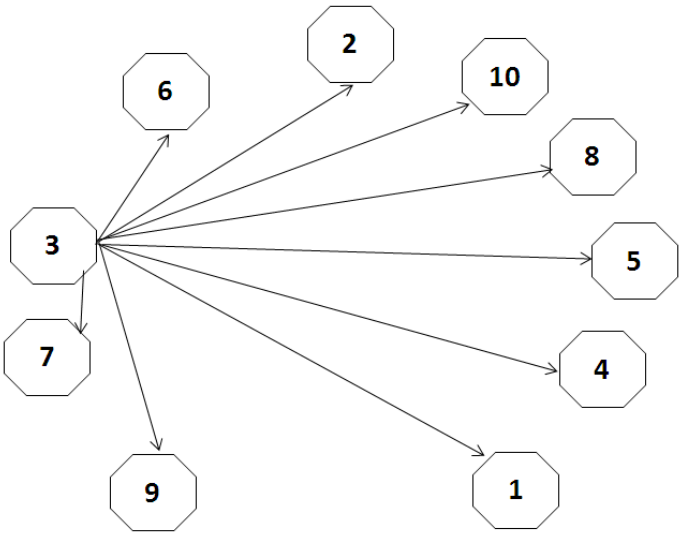

Figure 4-2: Main System Driver, Theme 3

In Figure 4-2 above it can be seen that theme three, the primary driver, *"Leadership from professional body"* has a direct influence to all other themes by receiving major votes by all of the participants in the focus group, indicating that theme 3 influences all of the other nine themes.

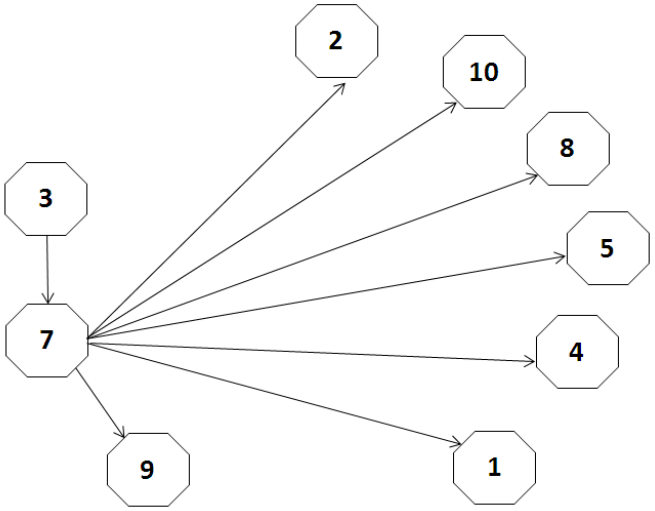

Figure 4-3: Primary Driver Theme 7

The next secondary driver identified by the number of votes that was given by the participants in the focus group is theme seven, *"Inadequate quality management"*. In Figure 4-3 it can be observed that theme seven directly influenced seven of the other nine themes and was only influenced by the primary driver theme three.

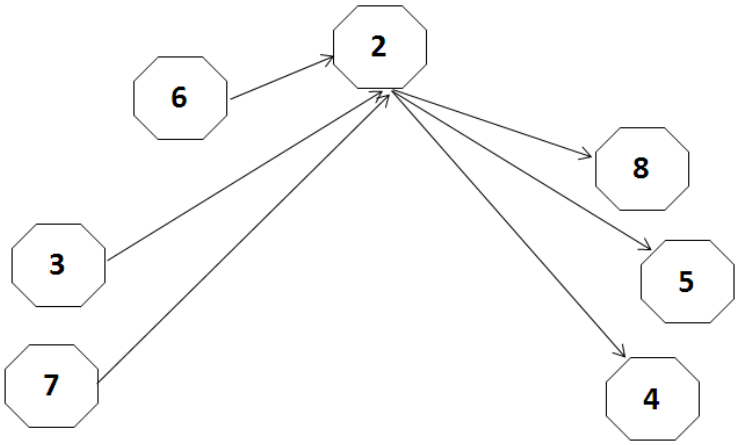

Figure 4-4: System Pivot Point, Theme 2

"Quality assurance", theme two in Figure 4-4, can be seen as the pivot point of the system as it had the same number of influences to and from the other affinities. Theme two was influenced by

themes three (Leadership from professional body), six (Lack of incentives and enforcement) and seven (Inadequate quality management) and in turn influenced themes four (Ideal identity of model engineer), five (Professional recognition/perceived professional identity) and eight (Desired end state).

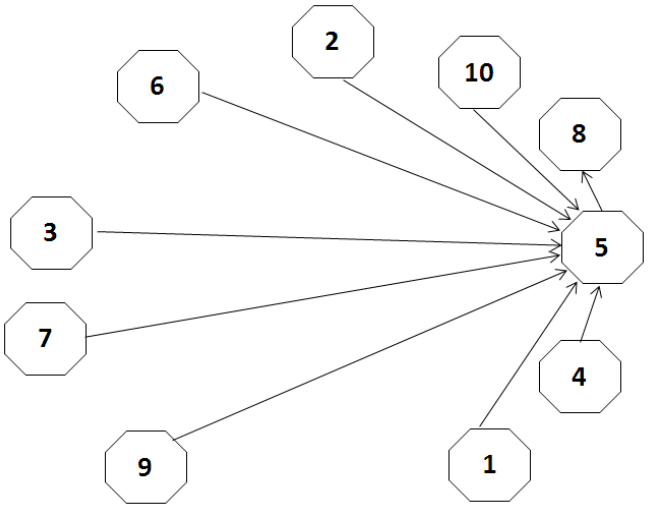

Figure 4-5: Main Secondary Outcome, Theme 5

Theme five, *"Professional recognition/perceived professional identity"* was selected as the main secondary outcome of the system, with eight of the nine influencing theme five (Professional recognition/perceived professional identity) and it only influenced theme eight (Desired end state) directly. According to Northcutt and McCoy (2004) the primary outcome should have only incoming influences and no outgoing influences. Therefore it will be assumed for this research that theme 5 (Professional recognition/perceived professional identity) is the main secondary outcome.

As discussed in section 3.3.5, Figure 4-1 is highly saturated and difficult to interpret. So to simplify the cluttered SID and to make the system relationships flow to stand out, all the redundant links were removed. Redundant links were removed as per the order in the Tentative SID Assignment Table, Table 4-7 until only the influences remained that can be seen in Figure 4-6, which resulted in the uncluttered SID.

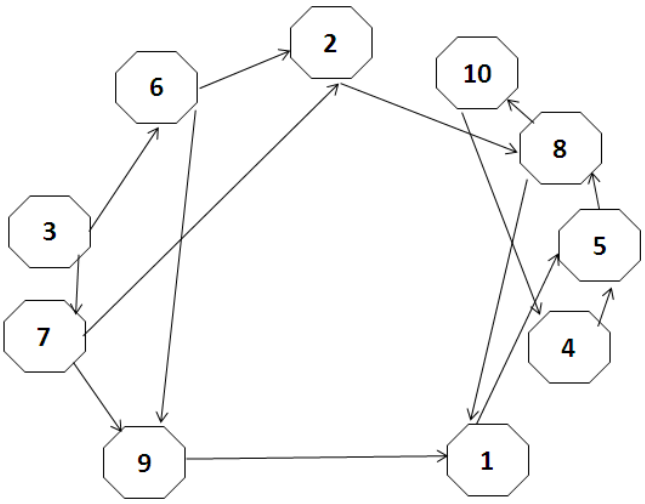

Figure 4-6: Uncluttered System Influence Diagram (SID)

The uncluttered SID was then more easily interpreted, and it was then easy to develop a simple flow model of the system. This simple flow diagram in Figure 4-7 below shows the interaction and flow of influences which can now be easily visualised and understood by a researcher and others.

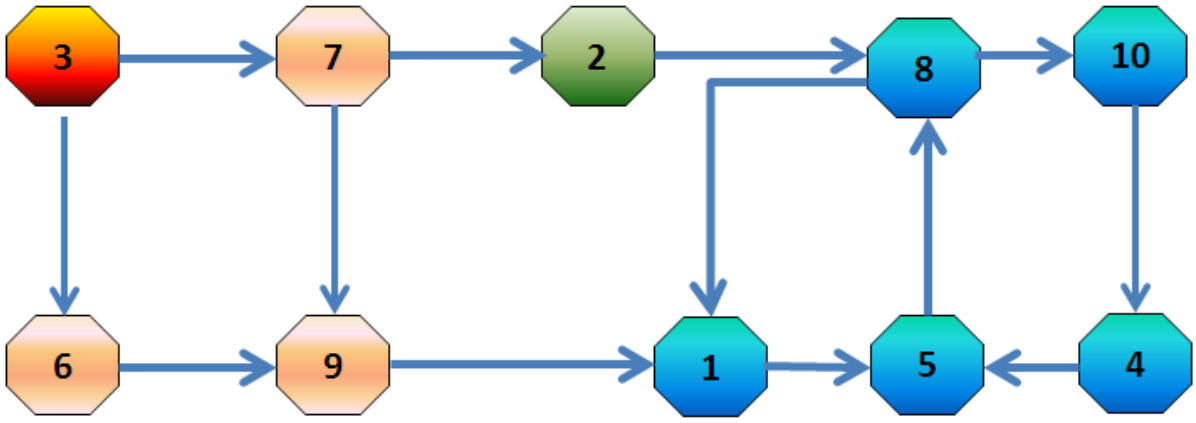

Figure 4-7: Group System Model Flow Diagram

There are two feedback loops in Figure 4-7 that become clearly evident with regards to all the outcomes, which will be discussed and analysed in more detail later in section 4.5.

4.2 Placement of Themes in the System

It can be seen in figure 4-7 that the themes are arranged from the left to right according to the *delta (Δ)* values within the system flow diagram. The figure 4-8 shows that the main primary driver theme three, *"Leadership from professional body"* directly influenced theme seven, *"Inadequate quality management"* and theme six, *"Lack of incentives and enforcement."*

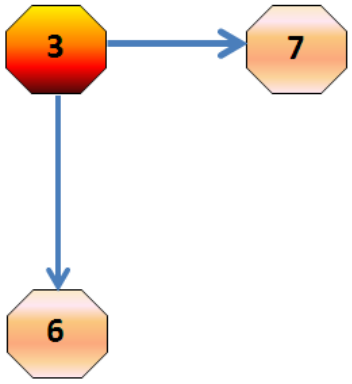

Figure 4-8: Theme 3 System influence

Themes seven, *"Inadequate quality management"* strongly influenced the system pivot point theme two, *"Quality assurance"* and secondary driver theme nine, *"Members' perceptions of ECSA/CPD – financial"* as can be seen in figure 4-9.

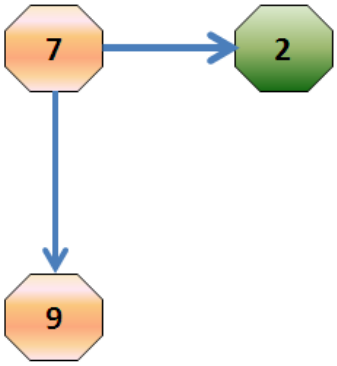

Figure 4-9: Themes 7 system influences

In figure 4-10 it is possible to see that the pivot point theme two, *"Quality assurance"* and the secondary driver theme nine, *"Members' perceptions of ECSA/CPD – financial"*, influenced the

secondary outcome theme eight, *"Desired end state"* and theme one, *"CPD opportunity for individual professional development"* respectively. Themes two *"Quality assurance"* and nine *"Members' perceptions of ECSA/CPD – financial"* also fed into the first feedback loop of themes eight *"Desired end state",* one *"CPD opportunity for individual professional development"* and five *"Professional recognition/perceived professional identity"*.

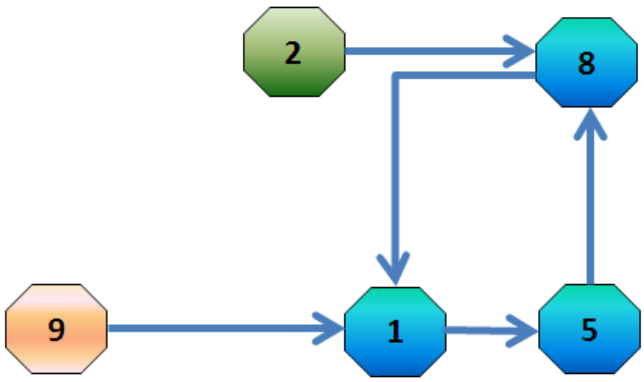

Figure 4-10: Themes 2 and 9 system influences on first feedback loop

Lastly, within the system a second feedback loop can be observed as shown in figure 4-11, running from theme eight, "*Desired end state*", to secondary outcome ten, "*Members' perceptions of ECSA/CPD system – process to comply*", to secondary outcome 4, "*Ideal identity of model engineer*", to main secondary outcome 5, "*Professional recognition/perceived professional identity*".

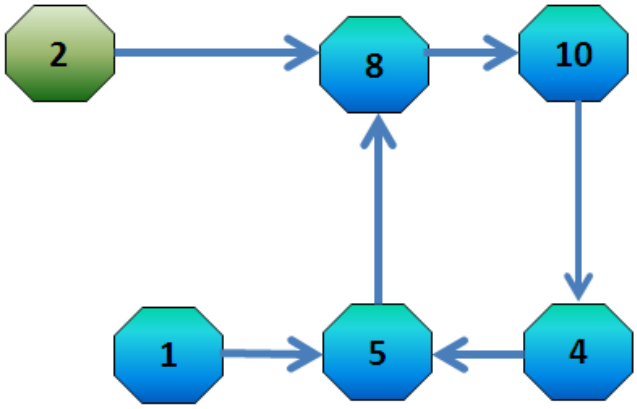

Figure 4-11: System influence of second feedback loop

The loop then fed back to theme eight, "*Desired end state*" again. The second feedback loop was influenced by both theme two, "*Quality assurance*", the pivot point and theme one, "*CPD opportunity for individual professional development*" a secondary driver.

4.3 Individual Interview Analysis

4.3.1 Simple Individual Interview Affinity Relationship Table

On completion of the individual interviews, the quotes or phrases identified from individual interview participants were then copied over into a Combined Interview ACT. An example of combined ACT for theme three (Leadership from professional body) can be seen in appendix D. The combined ACT was used to compare quotes and individual meaning that each person gave to a theme. The ACT was used later on in the research to explain individual realities in the context of the identified main system influences.

4.3.2 Simple Individual Interview Affinity Relationship Table

During the individual interviews participants were given an individual affinity ART to indicate which theme would influence which from their own perspective, as was explained in chapter 3. The results from all participants were imported into a combined ART. The seven participants selected for individual interviews, casted a total of 260 votes for 91 possible relationships.

The minority relationships within this system were then identified that accounted for the majority of the variation within this system once again using the "Pareto Cumulative Frequency Table." Then taking the Cumulative Percent (Frequency) as the reference and identifying where this value reaches close to 80%, the cut-off was set at 80.4%. The next table, table 4-8, showed the columns of both the theme number and frequency sorted (Descending) that was then copied over and again sorted in ascending order.

Table 4-8: Pareto table – Combined Affinity Conflict Table

No	Affinity Pair Relationship	Frequency	Conflict?	No	Affinity Pair Relationship	Frequency	Conflict?
1	1 < 2	6		23	3 > 8	7	
2	1 < 3	7		24	3 > 9	7	
3	1 > 4	4		25	3 > 10	7	
4	1 < 5	3	?	26	4 > 5	6	
5	1 > 5	3	?	27	4 < 6	3	
6	1 < 6	5		28	4 < 7	3	
7	1 < 7	5		29	4 < 8	6	
8	1 > 8	4	?	30	5 < 6	5	
9	1 < 8	3	?	31	5 < 7	6	
10	1 < 9	5		32	5 < 8	6	
11	1 < 10	3		33	5 > 9	4	
12	2 < 3	6		34	5 > 10	3	
13	2 > 4	4		35	6 < 8	3	?
14	2 > 5	6		36	6 > 8	4	?
15	2 < 7	5		37	6 > 9	6	
16	2 > 8	6		38	6 > 10	4	
17	2 > 9	4		39	7 > 8	6	
18	2 > 10	4		40	7 > 9	6	
19	3 > 4	7		41	7 > 10	5	
20	3 > 5	7		42	8 < 9	3	?
21	3 > 6	7		43	8 > 9	3	?
22	3 > 7	7		44	8 > 10	4	

The affinity pair relationships in table 4-8 were also examined for conflicts. Once again due to only seven participants it was mostly easy to resolve conflicts by selecting the relationship with the highest frequency. Two relationships showed equal votes between pairs as can be seen highlighted in the table above. The direct conflicts were omitted from the data imported into the tubular IRD in table 4-9 below.

4.3.3 Individual Interview Protocol 2 – Theoretical Coding

Table 4-9: Combined Individual Interrelationship Table

Tabular IRD													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**OUT**	**IN**	**Δ**
1		←	←	↑		←	←	↑	←	←	2	6	-4
2	↑		←	↑	↑		←	↑	↑	↑	6	2	4
3	↑	↑		↑	↑	↑	↑	↑	↑	↑	9	0	9
4	←	←	←		↑	←	←	←			1	6	-5
5		←	←	←		←	←	←	↑	↑	2	6	-4
6	↑		←	↑	↑			↑	↑	↑	6	1	5
7	↑	↑	←	↑	↑			↑	↑	↑	7	1	6
8	←	←	←	↑	↑	←	←			↑	3	5	-2
9	↑	←	←		←	←	←				2	5	-3
10	↑	←	←		←	←	←	←			1	6	-5

Next the IRD table the *deltas* (Δ) were again sorted in a descending order as can be seen in table 4-10.

Table 4-10: Sorted Combined Individual Interrelationship Table

Tabular IRD – Sorted in Descending Order of Δ													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**OUT**	**IN**	**Δ**
3	↑	↑		↑	↑	↑	↑	↑	↑	↑	9	0	9
7	↑	↑	←	↑	↑			↑	↑	↑	7	1	6
6	↑		←	↑	↑			↑	↑	↑	6	1	5
2	↑		←	↑	↑		←	↑	↑	↑	6	2	4
8	←	←	←	↑	↑	←	←		←	↑	3	5	-2
9	↑	←	←		←	←	←	↑			2	5	-3
1		←	←	↑		←	←	↑	←	←	2	6	-4
5		←	←	←		←	←	←	↑	↑	2	6	-4
4	←	←	←		↑	←	←	←			1	6	-5
10	↑	←	←		←	←	←	←			1	6	-5

4.3.4 Theoretical Coding - System Influence Diagram (SID)

From the table 4-10 the *delta (Δ)* values were used as markers of the specific themes in the system. By importing the *delta (Δ)* values into the Tentative SID Assignment Table in table 4-11 below, it was possible to again identify which themes were primary or secondary drivers, which were primary or secondary outcomes and if there was a pivot point in the system. Theme three (Leadership from professional body) remained the primary driver, and again there was no clear primary outcome.

Table 4-11: Tentative System Influence Diagram (SID) Assignment Table for Individual Interviews.

Tentative SID Assignments	
3	Primary Driver
7	Secondary Driver
6	Secondary Driver
2	Secondary Driver
8	Pivot/Secondary Outcome
9	Secondary Outcome
1	Secondary Outcome
5	Secondary Outcome
4	Secondary Outcome
10	Secondary Outcome

Next taking the information from the IRD results and the information identified in the Tentative SID Assignment Table, a Combined Individual SID was drawn to visually representing the combined individual system. Again a cluttered diagram system influence diagram was created. The combined individual cluttered SID can be seen in figure 4-12 below.

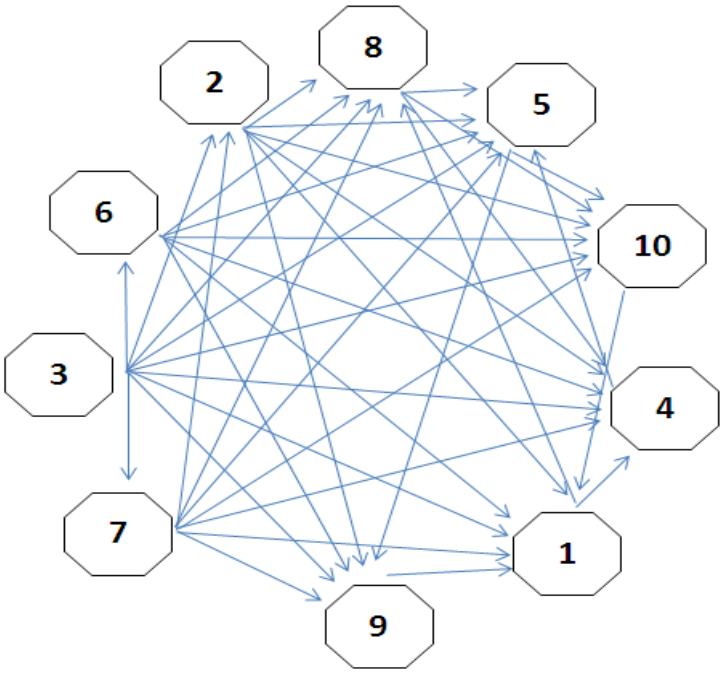

Figure 4-12: Combined Individual Cluttered System Influence Diagram (SID)

Again starting with the primary driver theme three (Leadership from professional body), direct links to themes deeper into the system were removed following the same method as was used previously for the focus group data. The order that was followed to remove redundant links was as per the order in the Tentative System Influence Diagram (SID) Assignment Table (table 4-11).

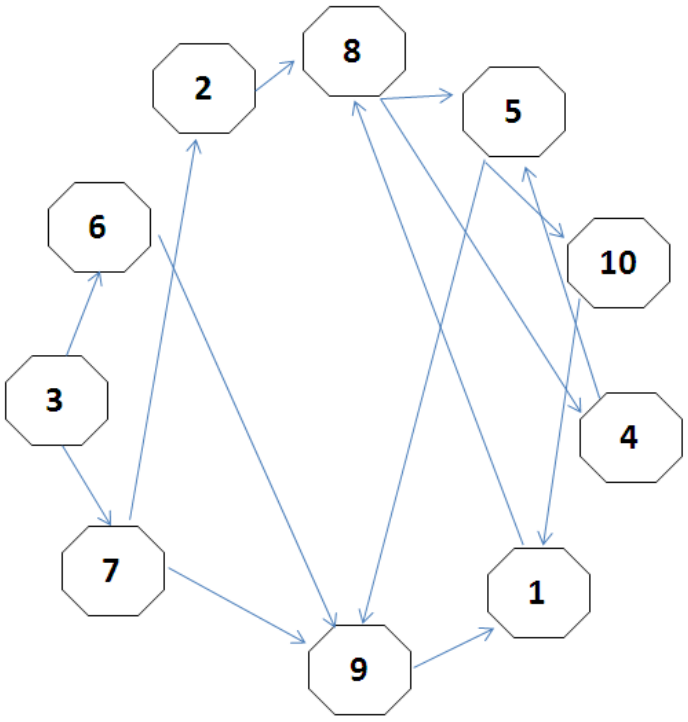

Figure 4-13: Combined Individual Uncluttered System Influence Diagram (SID)

Looking at the uncluttered SID above, it was again possible to develop a simple flow diagram of the combined individual system, which could be used to compare to the flow diagram developed from the focus group data.

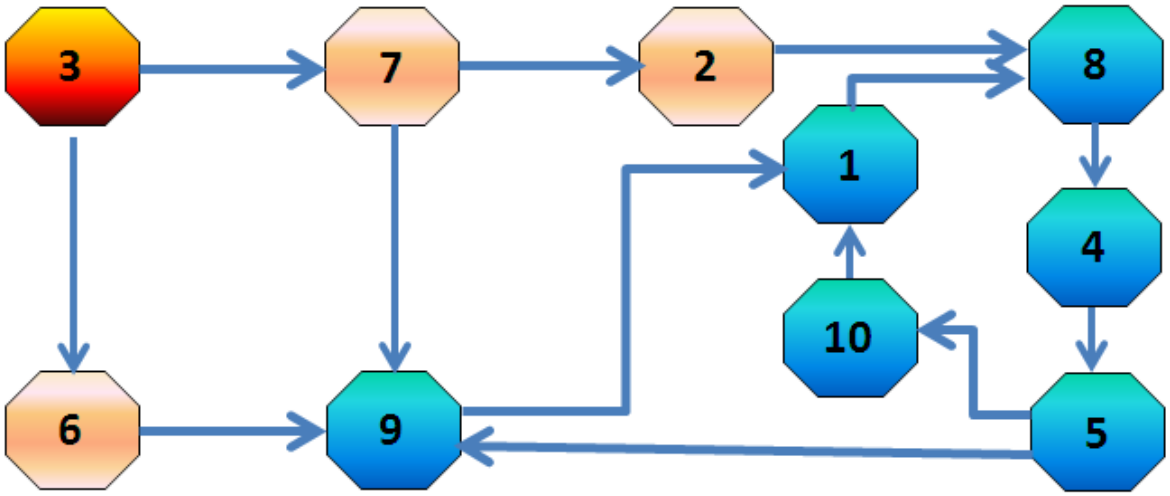

Figure 4-14: Combined Individual System Model Flow Diagram

The flow diagram above, developed from the uncluttered SID, clearly shows the interaction and flow of influences, as was given by individuals during their interviews. Within this flow diagram a feedback loop within a feedback loop can be seen and it is a combination of all the secondary outcomes of the system.

4.4 Structural Comparison of System Maps

Next a systematic comparison was done between the two system maps from the same constituency, the one developed from data from the focus group and the other developed from the combined individual responses from interviews. Below in figures 4-15 and 4-16 the two system flow diagrams can be seen with all the theme titles included for easy comparison and reference.

Figure 4-15: Focus Group Theme System Flow Diagram

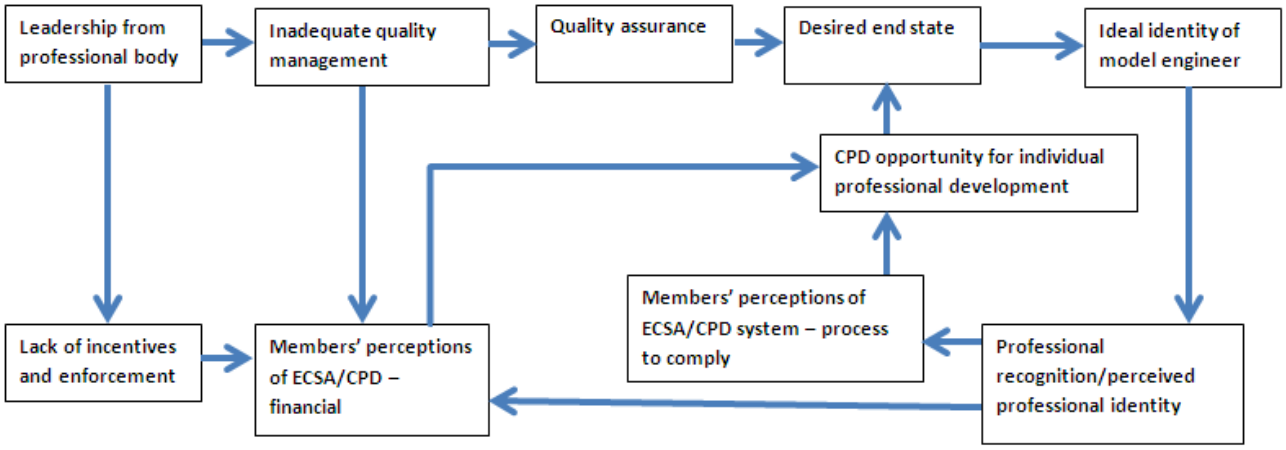

Figure 4-16: Combined Individual Theme System Flow Diagram

In both of the system diagrams the left part of the system is almost identical with *"Leadership from professional body"* remaining the primary driver for both systems. From this it can be deducted that

the participants perceive that *"Leadership from professional body"* will influence the quality management of the CPD system and how the professional registration would be enforced or incentivised in practice. Then in both systems participants perceived that *"Inadequate quality management"* would influence the *"Quality assurance"* of the system. The first main difference from the group system map and the combined individual map is that theme two, *"Quality assurance"* is the pivot point in the group map and only a secondary outcome in the combined individual map.

The theme *"Lack of incentives and enforcement"* and theme seven, *"Inadequate quality management"* influence theme nine, *"Members' perceptions of ECSA/CPD – financial"* in both of the system maps, which firstly creates an interesting discussion point. According to both, the focus group and the individuals, the way that the requirement for registration of engineering professionals is implemented, and due to the fact that available CPD is not adequately developing engineers, may directly influence their perception of the value that the CPD system offers engineering professionals and the cost to comply with the CPD requirements. Another interesting point to note is that in the group map, theme nine "*Members' perceptions of ECSA/CPD – financial*" was a secondary driver, yet in the combined individual map it was a secondary outcome.

From this point on the two maps begin to show some differences with regards to how the secondary outcomes seemingly influence each other. In each of the two maps there are clear feedback loops that can be seen, yet the sequence and direction of the influences are different. Due to the differences it becomes necessary to zoom into the feedback loops of both systems and find some correlation.

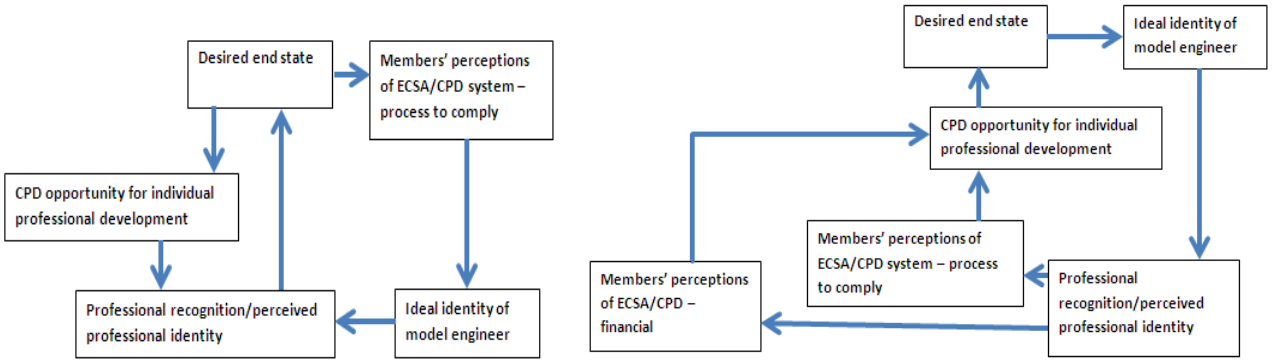

Figure 4-17: Systems Feedback Loops Comparison

In the figure 4-17 the feedback loops from the group map are on the left, and the feedback loops from the combined individual map are on the right. The only additional secondary outcome that becomes part of the combined individual map is theme nine, *"Members' perceptions of ECSA/CPD – financial."* There may be three of the themes that could be combined, and that may be assumed to be a subset of each other in each of the maps. They are theme five, *"Professional recognition/perceived professional identity,"* theme four, *"Ideal identity of a model engineer"* and theme eight, *"Desired end state".* If these themes are combined to form a new theme with the name *"Recognised professional identity"* and this is substituted within both systems, the feedback loops could be collapsed even more, creating a higher level perspective as can be seen in Figure 4-18.

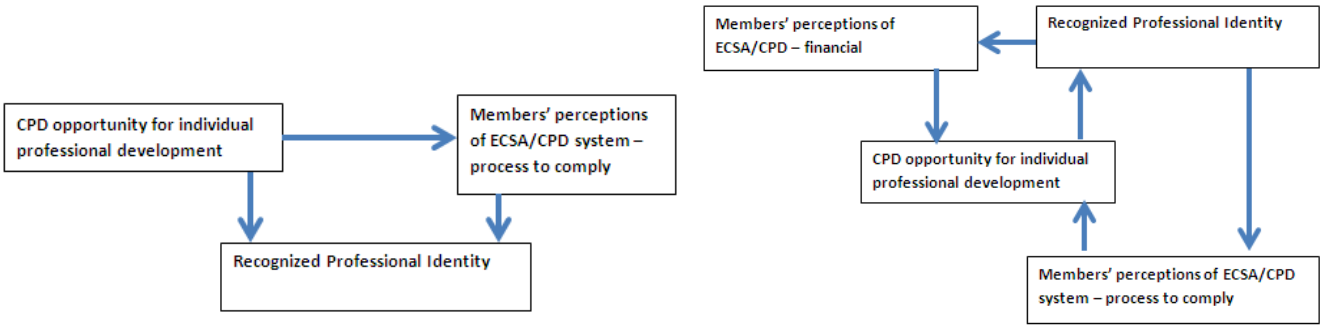

Figure 4-18: Adjusted Feedback Loops Comparison

After adjusting the feedback loops of the two systems, the feedback loops have collapsed for both systems. The group map on the left no longer had a feedback loop as can be seen on figure 4-18. The feedback loops from the combined individual map on the right still show two feedback loops. But when looking at the two themes named, *"Members' perceptions of ECSA/CPD – financial"* and *"Members' perceptions of ECSA/CPD system – process to comply",* it would be possible to form another new theme as both of them have a similar connotation. So if a new theme with the name *"Members perception of CPD"* is created and used to substitute both themes nine and ten in the feedback loop map on the right, then the combined individual system map will only be left with one clear feedback loop as shown in the map on the right in figure 4-19 below.

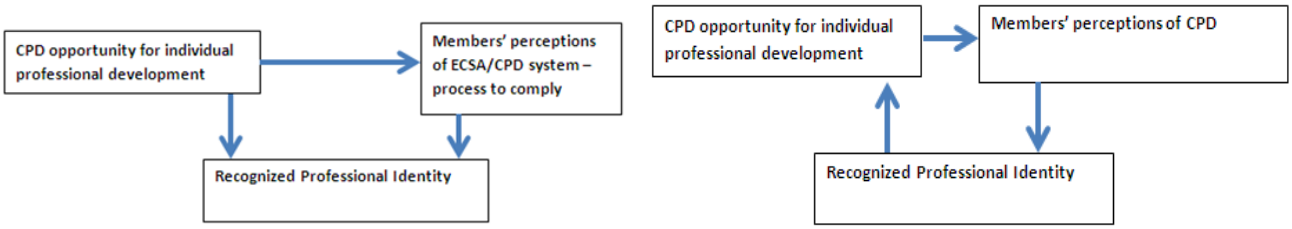

Figure 4-19: Additional Adjusted Feedback Loops Comparison

Now a simplified view of the secondary outcomes for both of the systems can be seen above, which then can be used to adjust the original system maps. The maps below are that of the group system map and combined individual map, adjusted with the collapsed feedback loops.

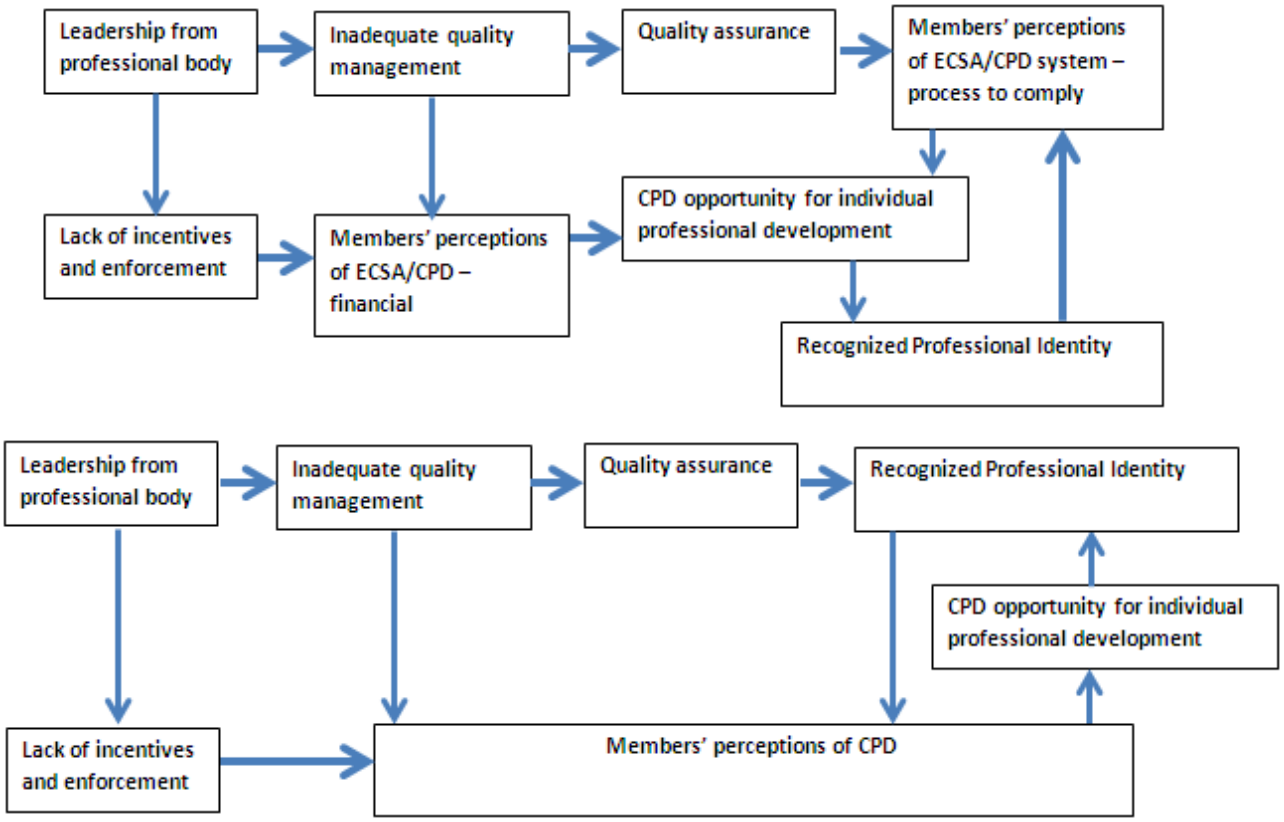

Figure 4-20: Modified Focus Group and Combined Individual Theme System Flow Diagrams

Now when looking closer at both the system maps above it is possible to see some of the main relationships within each system starting to become more evident. In essence if the relationships of each of the maps are followed throughout each system there is no real difference as the path of influence should have the same effect, if a change is made in any of the system drivers. The same will hold true if changes are made to the quality assurance, member's perception or CPD

opportunities. It may be possible to further simplify the system or zoom out some more in order to identify the major sections of the system which will have a direct influence in the overall system. When looking at *"Lack of incentives and enforcement", "Inadequate quality management"* and *"Quality assurance",* these themes can be combined to form a high-level theme called *"CPD System."* The two themes that could be retained (as these themes are already contained in a combination of themes) are *"Members perception of CPD"* and *"Recognised Professional Identify".* Another theme that would be retained is *"CPD opportunity for professional development"* as this could have two meanings: one where the CPD opportunities are available through the CPD system and the other is the CPD opportunity taken by the professional himself. This high-level system map can be seen in figure 4-21 below.

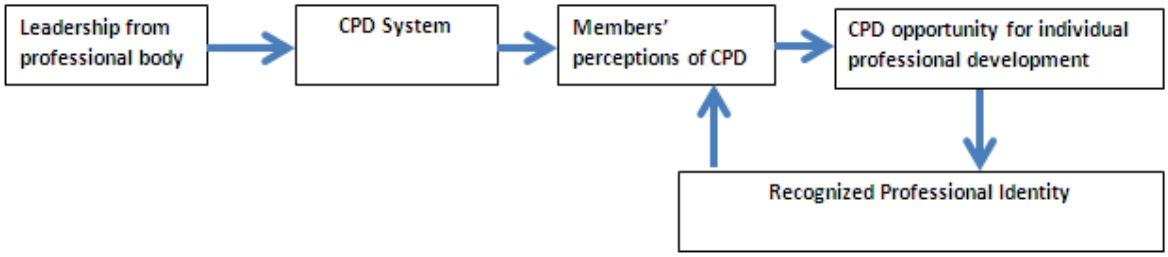

Figure 4-21: High Level System Flow Diagram

From the zoomed out system map above it is now possible to see the main elements of the system and a feedback loop is retained as this seems to be an important aspect of the system. Meaning that whenever there is a change in the engineering environment, it may necessitate a change in members' perception on if the CPD system is adequate or not, which in turn may influence which of the CPD opportunities the professional will choose to take. If the opportunity is available from official CPD initiatives or if a professional will have to find and take part in an initiative outside the regulated system to address their developmental need. The CPD opportunity utilised will in turn influence the professional's standing in the profession and in combination, all the registered professionals' efforts in continuing development may influence the overall recognition of the specific profession, which in turn may affect the members' perceptions of the CPD system. The professional body has an important function here to monitor the *"Member perception of CPD"* and

as soon as this perception becomes negative or indicates a gap in the system, may want to initiate a change within the "CPD system" to address the gap.

The main elements within the system, as identified, deserve a closer look, and each can be examined by looking at existing theoretical perspectives compared to the feelings or perceptions of the research participants or constituency.

4.5 Theoretical Meaning

4.5.1 Leadership from Professional Body

The participants in the study, who all formed part of the electrical engineering community of practice, indicated that the professional body that was regulating their practice at the time of the study needed to show clear leadership in ensuring registered professionals develop world recognised engineering competencies and needed to facilitate international recognition of their profession. But there was a significant disconnect on how each participant perceived ECSA's actual leadership performance. The feeling from participants can be gauged from the following selection of interview quotes:

> *I think partly they actually do it, but they do it through SAIEE. […] They even allocate CPD points for such topics or such lectures, to make sure people are encouraged to attend. […] I think this is one way of showing leadership, and obviously we have to understand that in any system there will be things that do not go as it should, but the intention is good to make sure people do attend. And it is up to the people now to take the opportunities that are being provided by bodies such as SAIEE which are working for ECSA, I would say.* (Transcript 2, A81 – 93)

> *Maybe from where I sit, I don't know, I think it is difficult to say. I have not seen strong leadership, but I am not saying that it is not there, but maybe it is not visible enough.* (Transcript 6, D79 – 82)

> *If ECSA were actually to do this, it will make our membership a lot more valuable, and I think it is a real need in this country at this point in time, as I think some of the university degrees are not at the level they should be. There are some good universities and then*

> *there are some that is not that good. And the only way if we are to build good engineers, is if somebody from a third party comes in and assist to set standard of qualification and thereby uplifting the profession in South Africa.* (Transcript 4, H53 -59)

Taking the quotes from participants into account it supports the theoretical perspectives as given by Greenwood et al. in section 2.4, which highlights the purpose of professional bodies as an intermediate representation between organisations and the society to ensure social expectations and practices are codified, implemented and maintained. Greenwood et al. further identified that there are few research studies in this field and so little known of how and why institutionalised practices within this environment change.

As previously indicated in the literature review, ECSA is accountable to serve and protect the safety and health of the public. ECSA achieves this "by establishing and maintaining minimum standards of practice, knowledge and skills of registered engineering persons in the country, as well as to establish and maintain standards of professional ethics among them" (ECSA, 2013). In addition to this, ECSA has implemented a CPD system through a policy, which the body uses as a mechanism to use for both the registration of professionals and for compliance to CPD requirements (ECSA, 2013, p. 3). ECSA also pointed out in their policy that they must ensure registered professionals maintain and improve their competence through a system of CPD in order to sustain their international registration. To achieve this ECSA instituted a CPD system that was linked to registration renewal of professionally registered engineers on 1 January 2007. The administration of the CPD system is also the obligation of ECSA according to the Engineering Profession Act, but the provision of CPD activities is outsourced by ECSA to recognised voluntary associations and accredited tertiary institutions according to specific criteria and guidelines (ECSA, 2013, p. 7). This was understood by some of the participants as can be seen from the quote from the participant A above.

The voluntary associations in South Africa are principally the South African Institution of Civil Engineering (SAICE), the South African Institution of Mechanical Engineering (SAIMechE), the South African Institute of Electrical Engineers (SAIEE), the South African Institute of Chemical Engineers (SAIChE), and The South African Association for Consulting Engineers (SAACE) (Du Toit & Roodt, 2008, p. 28). One of the voluntary associations for the electrical engineering profession relevant to

this research is the South African Institute of Electrical Engineers or SAIEE. From the SAIEE website their mission statement can be seen below:

> *The South African Institute of Electrical Engineers strives to be a leading and respected learned society of Electrical Engineers through:*

- *Promoting electrical science and its applications for the benefit of its members and the Southern African community.*
- *Close contact with appropriate national and international organisations.*
- *Recognising achievement by advancement of individual members to higher grades of membership within the Institute and thereby enhancing the status of the profession.*
- *Being apolitical and non-discriminatory* (SAIEE, 2013).

From the above quotation it can be seen that although ECSA is responsible for regulation of the engineering profession and for the implementation of the CPD system, the body has delegated the provision of CPD to accredited voluntary associations and higher institutions. The allocation of these responsibilities is captured in figure 4-22 below.

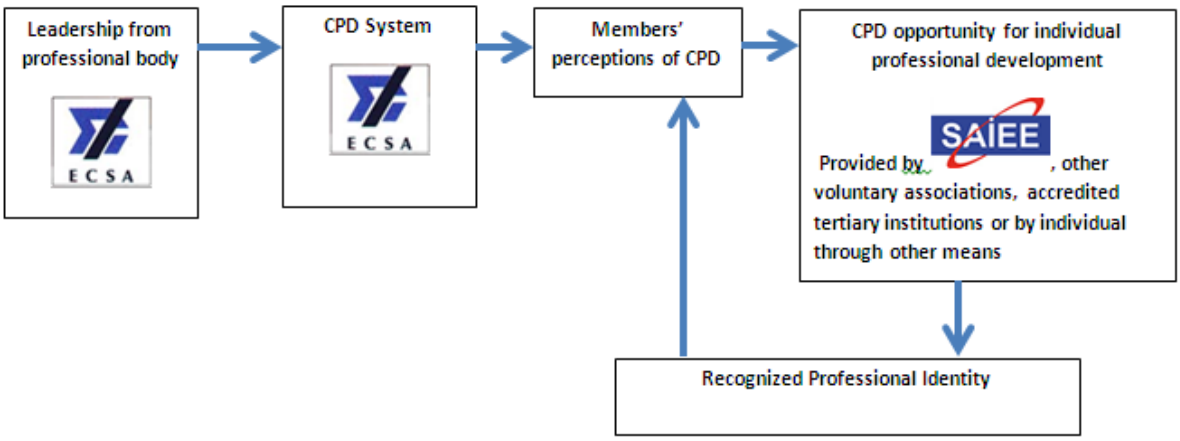

Figure 4-22: Responsibility allocation within System Flow Diagram

From the system map in figure 4-22 it can be seen that ECSA – besides its main regulatory function – does have a responsibility to give strong leadership and to drive the CPD system. From the literature review it can be seen that the CPD system that was implemented by ECSA is based on the CPD

notion of credits which reflect notional hours spent on developing engineering competence through a range of activities, which will be discussed in more detail in the following sections.

4.5.2 The CPD System

According to the research participants, the CPD system firstly needed to have an effective quality assurance system to ensure that all the members belonging to a professional body are competent professionals. Secondly, there needs to be a strong relation between the cost to belong to a professional body versus the benefit received from the professional body. Lastly, the quality of CPD interventions needs to be at the level required by engineers and be relevant to their working environment.

Some of the research participants questioned the effectiveness of the assessment process used for professional registration, as it seemed as if it was based on report writing ability rather than engineering abilities and skills, and that many members sitting on the interview panel were academics who were never practicing engineers. The selected supporting quotes from participants can be seen below:

> *I do not think that the processes that have to be followed to register and that support CPD, I do not think it is working. Any person having an engineering degree or engineering qualification would be able to do the amount of paper work needed for registration. And a person just needs to know how to, call it writing skill, a person just needs to know how to put things, or correctly write it in their report, and they will accept your report and then you are registered.* (Transcript 1, N81 – 91)

> *The persons from the professional body that I had contact with and who interviewed me, were in most cases retired professors, and half of them were never in the field. Those that were make wonderful leaders and mentors. But many do not really know what is going on in the real world, they are only academics. There was something else here that I thought of, I am not sure or did not get the impression that they are actually keeping up with changes in the engineering field themselves.* (Transcript 4, H108 – 115)

According to the ECSA website, each person that wants to apply for registration for any of the professional categories must start the registration process by completing an application form. According to ECSA, persons who have accredited qualifications as in terms of the Washington accord and who has at least three years post-graduate experience will not be subjected to a detailed evaluation. ECSA will start the evaluation of the applicant's training and experience when satisfied that the submitted application is detailed and contains all the information. Evaluation is done by members of the relevant Professional Advisory Committee. According to ECSA, all applicants are now required to sit for a compulsory "Professional Review" since January 2001, which is an interview by a panel in collaboration with Voluntary Associations (ECSA, 2014).

In South Africa, there are many practicing engineers in the industry that choose not to register with a professional body. Many seem not to believe there is any benefit in registration, or there is no real need to do so. In larger organisations, such as Eskom, there is a requirement that all engineers must register with ECSA in order to be appointed as professional engineers. In smaller engineering organisations there is no such pre-requisite, which results in the bigger organisations supporting the professional body. Within Eskom, there is also no requirement for engineering managers to belong to a professional body, and some professional engineers then choose to follow the management route, as promotional opportunities may come faster and there are fewer requirements. The following selection of supporting quotes from research participants attest to these perceptions:

> *They* (small engineering firms) *normally just have one person as a professional engineer, because they sometimes get the requirement that a professional engineer has to give final approval of a design. So in that sense a single professional engineer in a company can comply with ECSA requirement and then 20 other professionals, or engineers, who are not registered as professional engineers, can work in the same company and do all the work without being registered. And this is the gap where the lack of enforcement and incentives can be seen. So there are two sides to the lack of incentives. It is lack of incentive really from public point of view, that the public not insisting that all engineering professionals to be registered. But there is also lack of incentive from large technical organisations, such as Eskom or Telkom, in that they make the management route much easier and desirable than the professional engineering route.* (Transcript 5, B106 – 123)

> *I remember we had a chat about this during the tea break when we had the session the other day and one of the colleagues indicated that if we compared ourselves to the Transnets of this world and the Sasols, you know. Maybe those organisations are not as big as we are, but relatively speaking they are quite big engineering companies. If you look at them you will actually find that there is not enough consciousness or interest from those organisations' employees to actually pursue their registrations. […] And in our case the only reason people are pursuing it is because of the perks associated with registration.* (Transcript 6, D178 – 190)

> *My husband is an engineer and he says he cannot understand what benefit he will get at this point in time and you pay them money and you do not get anything from them, and in his own capacity and work it has never been a requirement to become a member. His career also has never been negatively affected by not being registered and he does not see any real value in becoming a member. Interesting enough my husband works for a consulting company and they do work for Transet and a lot of parastatals, even Eskom, and in their consulting capacity they have never been required to be registered with ECSA as professional engineers.* (Transcript 4, H130 – 138)

According to ECSA, the objectives of the current South African CPD system are the following (ECSA, 2013, p. 3):

- Ensure, through the creation of a culture of CPD, that all registered persons maintain their competence throughout their period of registration.
- Meet the requirements of the Act.
- Be the acceptable means for renewal of registration.
- Meet the requirements for recognition of ECSA's assessment process with regard to international agreements.
- Ensure that those South African registered professionals meet the requirements for their continued international registration.

In 2008, ECSA made amendments to their rules that were published in 2005. These rules applied to registered professionals in the categories of professional engineer, professional engineering

technologist and professional engineering technician. The document stated that the CPD system functions in cycles of five years. In section 4-3 of amendment it is stated that "During each cycle of five years every registered person must accumulate a minimum of 25 credits in order to qualify for renewal of his/her registration" (ECSA, 2008, p. 4). The document continues to state that registered professionals must obtain CPD credits in at least two of the three categories listed in the table 17 below, with at least five credits per five-year cycle from Category 1.

Table 4-12: CPD Categories (ECSA, 2008, p. 4)

Categories	Activities	Maximum Credits pa	Hours
Category 1	**Developmental Activities**	4 credits	40 hours (10hrs/credit)
Category 2	**Work-based Activities:** • Engineering Work • Mentoring of candidate practitioners	 2 credits 1 credit	 800 hours (400hrs/credit) 50 hours (50hrs/credit)
Category 3	**Individual Activities** • Membership of a recognised *voluntary association* • Other activities	1 credit 3 credits	(not linked to hours) 30 hours (10hrs/credit)

The rules require registered persons to record their CPD activities by either posting a manually completed form to ECSA or by using the online ECSA website (www.ecsa.co.za). Registered persons can record their CPD activities continuously as they complete them, but must record all activities done annually no later than 30 days after the completion of each annual cycle. The rules then state that each registered person must retain the evidence of all CPD activities undertaken during each five-year cycle and must be able to provide the proof if ECSA so requests (ECSA, 2008, p. 4-5). The rules also explain the process that will be followed for auditing and application for renewal of registration.

Taking into consideration the experience and concerns highlighted by the individual participants during their respective interviews it seems that some improvement to the system and communication philosophy could have a positive influence on the current perceptions of registered engineering professionals. Participants' perceptions can be seen from the selected quotes from the individual research participants captured below:

> *I think it is mostly a case of people not liking the admin, myself included, and that is just how it is, and it has to be done, and I don't know if us complaining will achieve anything. That is just how it is, it could be better, I think it could do with improvement, but it is also an onus that rests with us, it us ultimately there to ensure the development of the profession and its members.* (Transcript 7, F184 – 199)

> *The online system is horrendous, I gave up with online system long time ago, as it bombs out, the courses are not loaded on time, and as it says in the statement there is no help or anything. This I rather use the normal forms to claim my points*. (Transcript 4, H206 – 209)

> *So personally I am just fed-up with the system as well. In this year I have no idea how many CPD points ECSA require from me, as I get no feedback from them whatsoever, unless I go onto the website. On the website to read what CPD points an engineer or technologist needs, gets a bit confusing as well.* (Transcript 3, O393 – 397)

When looking at the ECSA amended rules as stated above, this falls directly into the type of CPD scheme as described by Lester in section 2.5. Maybe the learning cycle approach as suggested by Lester in 1999 would be a better system, as this approach would require registered professionals to identify their own needs by drawing up an individual development plan and where the importance of the learning process and the results of learning are put above that of quantitative inputs (Lester, 1999, p. 3).

4.5.3 Members' perception of CPD System

Many of the participants in the research felt that the existing CPD activities available have little relevance to their immediate work environment and it is becoming increasingly costly to maintain CPD requirements, which negatively influences their perception of the CPD system. In their paper Boud and Hager suggested that there is a need to move away from the CPD notion of accumulating points or hours and that there should be a bigger focus on the notion of practice where CPD should be located in what professionals do and how they do it (Boud & Hager, 2012, p. 18). They continue to explain that professional development is a concept that indicates an ongoing education of

professionals at various stages of their professional careers. Referring to the definitions as given by dictionaries Boud and Hager indicate that continuous development has connotations with concepts such as “growth, evolution, and gradual unfolding, and this professional development can be seen as the idea of professionals being in the process of becoming” (Boud & Hager, 2012, p. 20). But, according to Boud and Hager the term ‘Professional Development’ has gained wide acceptance, but the actual connotation has been forgotten and became increasingly connected with the metaphors of learning acquisition and transfer. Professional bodies knowing that the public expect that professionals are aware of new knowledge and need to keep themselves up to date, follows a simplistic view that it is only a matter of acquisition of knowledge that require participation in developmental activities (Boud & Hager, 2012, p. 20). According to Boud and Hager these CPD activities are pre-defined by so-called experts who believe they know what is needed by the professionals, and the activities are pre-packaged material supplied by developers that can be used to update professionals. They argue that pre-defined CPD activities serve to create a gap between professional development and the experience professionals gain from their respective practices and interaction with others in their communities of practice over time (Boud & Hager, 2012, p. 20). These views are shared by participants in the study, as can be seen from the quotes below from Participant H and N from their individual interviews.

> *I am still undecided if CPD should be a compulsory thing. I agree that it has the potential to give engineering professionals the opportunity to develop, whether or not we should in our industry make it a compulsory thing to accumulate points; I have not bought into it as yet. I would develop myself within the area I work in on things that are relevant to my particular area, which what is available from CPD are not at the moment. Maybe if there was lots of relevant stuff, CPD being compulsory would not be an issue as you would not see it as a compulsory thing, you would see it as a benefit and not as something that you have to do, which is how I currently feel.* (Transcript 4, H11- 24)

> *The whole point system or CPD system as it is being managed at this stage, although it will give a person in my position the opportunity as you said, it definitely makes it possible and would help you to develop, I do not think it is always the development that I actually need.* (Transcript 1, N37- 40)

The cost of becoming a professionally registered engineer and maintaining the registration was a hotly contested topic between participants, with some seeing the value and others perceiving the whole CPD system to be a money making scheme. According to some of the participants, this is one of the factors why practicing engineering professionals outside bigger organisations do not want to register and why some of the registered professionals are letting their registrations lapse. The cost to comply with the registration requirements also created a perception with some practicing engineers that the whole CPD system is becoming a money making scheme, not supporting real development of professionals. The different viewpoints from the individual interviews as can be seen from the selected quotes below:

> *That is not entirely true. I think you can go attend courses that are relevant to your work environment that maybe are not run by SAIEE for instance, that are maybe done through UNISA, which could be a bit cheaper. But the CPD system does cost money, I mean everything costs money, and especially if you want to get some quality out of it. The only other way I could see it being done, is maybe like what they have got in India. They got these videos and stuff on power systems and so forth, engineering technical videos to develop people understanding of concepts, to maybe try and reduce costs. The only thing is that you need feedback and that costs money.* (Transcript 7, F166 – 174)

> *I am in a big organisation, so it is difficult for me to comment. But if I would have been in a private organisation I may not have put as much effort in to keep my registration current, as it does get very costly, specifically for an individual.* (Transcript 1, N293 – 296)

> *I don't know if I would really agree with calling it a money making scheme, I would not go to that extent. But I know there was a strong sentiment from my colleagues when we met. But I would say the theme itself, which is members' perceptions, I think, is a case of people not seeing the benefits, you know. I do not know if I can actually call it the career benefits of one being registered as an ECSA member.* (Transcript 6, D336 – 241)

> *I strongly agree with that perception that the CPD system is a money making scheme, at this time.* (Transcript 4, H201)

4.5.4 CPD Opportunity for professional development

For most engineering professionals, CPD has become a necessity as technology and the work environment changes at an increasingly fast pace. Guest supports this by his argument that:

> *…professionalism relies increasingly on the ability to respond quickly and effectively, and in a global context, to technological and organizational change, as well as to changing market conditions, client requirements, government policies and national and international regulations* (Guest, 2006, p. 274).

Participant A supports this view and stated that:

> *New things are discovered daily, old methods are improved or new ones are being developed. It is the responsibility of engineers to improve the life of those living in society and if we stick to our old ways of doing things, we lose the opportunity to do things in a better and in an improved way.* (Transcript 2, A16 – 19)

Participant A continued to explain that the evolution of computer technology has advanced at such a pace that sophisticated data manipulation and number manipulation that could not have been easily done three years ago, can now be done on personal laptops or desktop computers. The participant indicated that this is important because the development of technology gives new engineers the advantage as they can do things simpler, faster and can solve more complex problems that could not be easily solved before. Most of the other participants agreed that technology is fast changing the engineering environment and if engineering professionals did not actively put an effort in to keep up to date, they would not be able to practice competitively. Jenson found that all professional groups have adapted to fit into the knowledge society by continuously working on renewing their knowledge base (Jenson, 2007, p. 494). Her views were supported by the point participant B made when he argued that even if there was no CPD system people would still develop themselves, but that:

> *The CPD system just makes registered people develop themselves much further and a much larger percentage of people developed themselves thanks to the CPD system.* (Transcript 5, B 9 – 17)

As discussed in section 2.2, Collin *et al.* indicated that CPD or lifelong learning is any means by which a person can maintain their professional knowledge and skills, and it can take on various forms, such as learning from formal educational courses or by gaining experience through work practices. Collin *et al.* also highlight the problems identified with transferring the skills learned in the

classroom to the workplace and stated that in reaction the amount of learning activities have increased over time and now include informal workplace activities. They further indicated that informal professional learning also opens up a whole new avenue of research.

Considering the scope of informal learning and taking into account that most professionals now have access to the internet, giving them instant access to information such as Google Scholar, Engineering Journals, supplier specifications, engineering forums, YouTube, open source learning and self-help tutorials, CPD providers cannot ignore this alternative to formal learning scenarios. Grierson (2000, p. 231) noted the recent developments in computer technologies relating to "information, communication and interaction over networks – the Internet, the World Wide Web, email, distribution lists, discussion forums, newsgroups, chat groups, audio and video conferencing, desktop conferencing and whiteboards" could enhance CPD programme offerings. These developments could help to make CPD activities more accessible and on demand at a reduced cost and would still offer a rich learning experience.

4.5.5 Recognised professional identity

There are many additional skill requirements besides engineering competencies that an engineering professional has to be well versed in, in order to compete on an international level on par with their peers. Lester (2009, p. 226) highlighted that the "most obvious sets of influences in recent times come from changes in the nature and organisation of work and in the balance of skilled to less skilled work." Lester continues to identify several factors that influence and impact the environments that people work in today. The first is that there is a movement across the workforce towards higher skill and knowledge intensive work. Secondly, Lester referred to the work of Leitch (2006) who argued that greater proportion of employment can be seen as professional or managerial and requires higher skills from a larger proportion of the workforce. Next, Lester highlighted from the work of Handy (1989) and Bayliss (1998) that there is an observable decline in single-organisation careers, which necessitate a move to self-directed careers and the need for greater self-management (Lester, 2009, p. 227). He further argues that there are two groups of professionals for whom it is vital, if they want to develop the status of their profession, to redouble efforts in communication to a diverse group outside their profession; they are engineers and scientists (Jones, 2003, p. 171). Jones identified some contradicting concerns of the depth versus

the breadth of knowledge that engineering professionals should acquire during initial education. He questions what the appropriate training is to achieve a cohesive body of knowledge, within the allowable time and resources available and if this relates to the employment needs of the professional engineer. He listed other subjects that should be addressed, which will affect the professional's life such as (Jones, 2003, p. 172):

- Understanding of financial processes;
- Environmental and ethical awareness in undertaking professional duties;
- Increasing necessity to be entrepreneurial in approach;
- Conscious of the impact of technical disruption.

This is strongly supported by a quote from participant D who stated that:

> *What is important for me, or what stand out from our group discussions, is that in today's world you need a well-rounded engineer. So therefore development should address technical and non-technical knowledge and skills. For technical I think there is a lot of material, which I think is quite sufficient. But in terms of non-technical there is still a lot of work that needs to be done. Engineers should be trained on financial issues, on project management, legislation and contract management.* (Transcript 6, D17 – 23)

Patil and Codner (2007, p. 640) in their paper reviewing the existing accreditation systems for engineering worldwide listed the important purpose of accreditation of engineering education as:

a) Public accountability;
b) Guarantee for quality;
c) Academic reputation (local and international);
d) Professional recognition and registration;
e) International mobility;
f) Academic improvement;
g) Educational marketing and competitiveness.

Then as discussed in section 2.2, Patil and Codner from their study found “that engineering graduates from university courses lack important skills, such as communication, decision-making, problem solving, leadership, emotional intelligence and social ethics” (Patil & Codner, 2007, p. 646). They also indicated that important key issues required to develop global engineering professionals as global mobility, multicultural workplace environment, internationalisation of engineering education and increasing the number of engineering graduates. In figure 2.1 Patil and Codner also described the global competencies that an engineering graduate would need to function effectively in the global arena.

4.6 Conclusion

In chapter four, the results of the research that was done using the methodology explained in chapter 3 was shared with the reader. The results included the group tabular IRD that was developed, which was required to develop the group SID. Firstly a cluttered SID was developed that showed all the direct influences between the ten themes. This cluttered SID, seen in figure 4-1, is busy and it was necessary to manipulate the cluttered SID by removing all optional and redundant influences and thereby creating an un-cluttered SID. The SID could then be used to create a group system flow diagram. Next, the placement of each of the themes within the system was described to show if the particular themes were drivers or outcomes and how each influence the other.

Then the data from separate individual interviews was combined in order to perform theoretical coding and to produce a combined individual tabular IRD that was then used to develop a cluttered SID. Once again all optional and redundant influences were removed and an un-cluttered SID was developed as can be seen in figure 4-12. From un-cluttered SID, a combined individual system model flow diagram was developed that clearly showed the system influences. The two system flow diagrams were then compared and subsequently simplified in order to identify the main system influences.

With the main system influences identified the quotes from individual interviews and the academic views were used to discuss each main system influence in more detail. From this discussion, it became apparent that both the academic references used and the reality as experienced by individual participants showed some level of similarity. From the information gathered there are

also explicit suggestions and proposals that could be used to improve the CPD system and its requirements to make it more relevant to the specific practices of engineering professionals. These research findings are concluded in chapter 5.

5. Conclusions and possible implications

5.1 Introduction

In the previous chapter, the results of the research were captured with the interpretation and discussion of the main system influences, identified through zooming out and simplification of the system flow diagrams that was developed from the focus group and the individual interviews. This chapter presents the findings in terms of the research questions, the implication for CPD for electrical engineering professionals, the limitations of the study and recommendations for future studies.

5.2 Possible implications for CPD Provision for Engineering Professionals

In Chapter 1 there was an introduction to the why there is a need for CPD for engineering professionals, who the engineering professionals are that were the focus of the study and what CPD requirements were set by the professional body ECSA. From this, the research question was formulated which guided the research. The sub-questions, identified to support the main research question of "What are the continuing professional development needs of electrical engineering professionals in South Africa?" were the following:

- What is the knowledge, skills and competencies electrical engineering professionals need to be able to compete successfully with international counterparts?
- What are the perceptions of electrical engineering professionals with regards to the current CPD system?
- What are the perceptions of engineering professionals with regards to the choice of CPD offerings available in the market at the time of the study?

In this section the findings of the research will be discussed briefly within the context of the sub-questions which will provide a conclusive set of answers to the main research question.

5.2.1 Global knowledge, skills and competencies for Electrical Engineering Professionals

The first sub-question of this research was to identify the knowledge, skills and competencies electrical engineering professionals need to be able to compete successfully with international counterparts. In chapter 2, literature was reviewed that defined the CPD for the twenty-first century. To remain competitive, engineering professionals need to learn faster than their competitors and initial engineering education will have a limited lifespan. In chapter 4, some of the additional knowledge and skill requirements besides good engineering competencies were identified, which an engineering professional has to be well versed in to compete on an international level. It was shown that there is a worldwide recognition that successful engineers in the twenty-first century require more than just technical skills. Some of the knowledge and skills identified during this study included:

- Business acumen;
- Cultural dynamics;
- Contract management;
- Consciousness of the impact of technical disruption;
- Decision-making;
- Economics;
- Effective communication;
- Emotional intelligence;
- Environmental awareness;
- Entrepreneurship;
- Interpersonal intelligence (ability to understand other people);
- International Labour Relations and market;
- Leadership;
- Management;
- Understanding of financial processes;
- Project management;
- Political and social issues;
- Safety;
- Sustainability;
- Social ethics.

These non-engineering knowledge and skills sets were identified from quotes from participant interviews in section 4.5.5, as referenced from the research done by Jones (2003, p. 172) and the global competencies mentioned by Patil & Codner (2007, p. 646).

5.2.2 Electrical Engineering Professionals' perception of the current CPD System

In the past CPD was seen as an optional extra for practicing engineering professionals, but due to industry and social pressures, CPD has now become compulsory, and every registered engineering professional is required to update and maintain his/her engineering competence. Through individual interviews with the participants, it was possible to gauge what their perceptions were with regards to the compulsory CPD system. In chapter 4, section 4.5.3 the findings of their perceptions of the CPD were discussed, and it showed that there were several negative perceptions that were identified. The first was that the existing CPD activities have little relevance to their immediate work environment, secondly that it is becoming increasingly costly to maintain CPD requirements and lastly that the quality assurance for professional registration could be improved.

Both from participants and from further literature review it was clear that the current CPD notion of accumulating points or hours through attendance was not effective. The results indicated that the notion of practice, where CPD should be located in what professionals do and how they do it, is key to CPD success. Most participants felt strongly that if available CPD initiatives could be more relevant to their specific area of practice that it would positively influence their perception about the whole CPD system.

Then the cost to comply with the registration requirements seemed to have created a perception with some participants in this study that the whole CPD system is becoming a money making scheme, not supporting real development of professionals. From the interviews, some of the participants named this as one of the key factors why practicing engineering professionals outside bigger organisations do not want to register and why some of the registered professionals are letting their registration lapse. There were also a few participants who indicated that they understood why CPD was costly and that it was important to understand the reason for compulsory CPD and the value that could be derived from the current system.

Lastly, there was a negative perception of the quality assurance of professional registration and CPD initiatives. Some participants indicated that they did not think the professional registration process

was effective in ensuring that only competent engineering professionals get registered. Some of the issues mentioned were that only a well-written report is needed for registration and that many association members sitting on evaluation panels were not practicing engineers themselves.

5.2.3 Electrical Engineering Professionals' Perception with regards to the choice of CPD offerings

From the issues and concerns raised by research participants it was possible to identify their perceptions with regards to the current CPD offerings that gave a better understanding on whether the available CPD offerings effectively supports registered engineering professionals. The perceptions identified in this study are listed below:

- Courses not relevant to specific engineering environment,
- Professionals only attend CPD initiatives to accumulate points and not competence,
- CPD courses are becoming increasingly more expensive,
- Mostly big companies are able to afford the available courses,
- Many engineers not seeing value in attending CPD initiatives,
- Engineering professionals feel they are unable to influence what is available for CPD.

Although the above issues and concerns were raised, section 4.5.3 also showed that participants agreed that CPD is needed due to a fast changing technological and business environment and that the current CPD system and offerings do help more engineering professionals to develop themselves further. Almost all the participants agreed that the current CPD system could be improved and that the advances in computer technology and online presence may help to increase the content available and relevancy, and may help to reduce cost of the CPD. Their view that CPD should make more use of advances in computer technology was strongly supported by the academic view found in literature from academics such as Greirson (2000), Allan and Lewis (2006), Merriam et al. (2007) and McWhorter (2013), reviewed in chapter 2, section 4.

5.2.4 Possible improvements to enhance CPD System

The research further shows there may be a need to review the current CPD requirements, where the development focus should be, and the current delivery methods. As previously stated most

professionals would develop themselves, even if there were no CPD system. This development would be directed at the particular engineering environment they practice in and would only cover what needs to be covered in order for them to keep abreast of advances and changes relevant to them. With the introduction of compulsory CPD requirements, registered professionals are attending CPD to accumulate points, yet with many of the available CPD initiatives having little or no direct relevance to their immediate environment. From this limited study it was identified that there may be a need for the current CPD requirements to be re-evaluated and to look if moving the focus of CPD to the notion of practice within the workplace could help in achieving real competence. Secondly through participant interviews, as can be seen in section 4.5.3, there was a need identified to re-look at the current way CPD initiatives are developed and delivered to try and address the following:

- Relevancy to specific engineering practices;
- Range from basic to advanced,
- Affordability to the wider community of engineers;
- Be designed to build competence;
- Give constructive feedback to attending professionals;
- Attendance to be flexible and on demand by making use of available computer technology;
- Improvement communication to CPD system members;
- Based on the actual needs of registered professionals;
- Designed towards improving international professional standing.

ECSA, the professional body, is responsible for registration of professional engineers and ensuring effective CPD of registered engineering professionals. From this research several concerns were identified, that if addressed could help improve the perception of engineering professionals of the mandatory CPD requirements and ECSA as the professional body. Possible improvements identified from the interviews with research participants' can be seen as the following:

- Members want to see clear leadership from ECSA;
- Effective administration of CPD system;
- Enhancement and improvement of online CPD system;
- Need better support for online CPD system;
- Reducing administration and financial burden on registered members;

- More and better communication from ECSA to registered members;
- More and better interaction between ECSA and members;
- ECSA to give more guidance to registered professionals on what professionals should focus on with regards to CPD;
- Members expect ECSA to host certain amount of CPD initiatives themselves;
- ECSA must set and maintain the quality of CPD initiatives;
- ECSA must set and drive the quality of engineering qualifications;
- ECSA to better facilitate effective mentorship system for engineering professionals within the industry;
- ECSA to enhance and maintain the quality of the professional registration process in order to ensure applied engineering competence of those professionals that want to become registered professionals;
- ECSA must facilitate international recognition of registered professionals and their competencies.

When taken into account the proposed improvements, as highlighted above, it becomes clear that there are possible implications shown by this study that could help in making CPD for engineering professionals more effective. It must also be said that the strategic documents pertaining to ECSA that were reviewed (Campbell, 2010), have shown that ECSA recognised some short comings in the CPD system and provision, and have set new strategic objectives that could enhance CPD for practicing engineering professionals. In addition, ECSA has clearly taken initiative for international recognition of the qualification and competence of engineering professionals that are practicing in South Africa and are registered with ECSA, as was discussed in section 2.4.

5.3 Possible Policy Implications

This study investigated the needs of the CPD requirements of a selected group of electrical engineering professionals that may enable them to practice in the global arena. The policy that directly affects them has been identified as the ECSA “Policy on Continuing Professional Development”. The study identified that the current CPD system that has been implemented in South Africa was based on one of the older conventional CPD schemes that emphasise quantitative inputs expressed in number of hours that professionals need to spend on courses or some kind of developmental activity, without relating to the quality of learning or the relevance to the individual.

This research may help to facilitate the repositioning of the CPD policy and help to open a needed debate on what is CPD for and how it should be conceptualised as proposed by Boud and Hager (2012).

5.4 Limitations and recommendations for future studies

Following is an explanation of the research limitations of this study and recommendations for future studies.

5.4.1 Research limitations

This research study was part of a Master's programme by coursework, which requires the completion of a mini-thesis of limited scope as the research component. Following is a short discussion on challenges faced during the research and what the researcher believes the limitations of the research are. IQA across all constituencies that have a connection or are involved with a certain phenomenon may have provided a more complete picture of the phenomenon studied. Because this was only a mini-thesis, it was decided to work only with one constituency that practice within the engineering environment, specifically the field of electrical engineering. The study only focused on the perceptions of a small sample of mostly ECSA registered electrical engineering professionals who practice and work within the electrical utility Eskom. With only one constituency selected, there were some activities that would normally be done within IQA research such as the comparison of different SIDs of different constituencies that could not be done.

Only a statement or definition that was developed by the researcher from the cards developed by the focus group was included, rather than an individual statement by each participant. Each participant was then asked if they agreed, did not agree, partially agreed or would like to change those pre-developed statements. Individual mindmaps were not developed in this study, but rather a combined individual mindmap. For the purpose of this study, the theme definitions or statements seemed to have been sufficient, but giving each participant the opportunity to develop their own theme statement would have given more insight into each one's reality of the phenomenon.

The main challenge that was experienced during the first phase of research was the availability of the participants that volunteered to take part in the study. From the original 20 ECSA registered

electrical engineering professionals invited, only 15 accepted, and only seven eventually arrived for the focus group session. Unavailability was mainly due to work pressures and the fact that the research was done within a very small business unit within Eskom. At the time, one additional practicing engineer not registered with ECSA then indicated his interest to take part in the focus group session. The request was discussed with the research supervisor, and it was decided to continue the focus group session with the seven ECSA registered engineering professionals and the one non-registered professional engineer. The implication for the research was that the perceptions towards the studied phenomenon were not purely from registered professionals that were part of the selected constituency, but may have been diluted by a member of a different constituency of practicing engineers not registered with ECSA. The dilution seemed to influence some of the research results from the data collected from the focus group. During the individual interviews it was decided to focus only on ECSA registered engineering professionals and after analysing data it was definitely clear that on some of the themes identified during the focus group, the perceptions expressed during the focus group was somewhat more temperate during individual interviews. This could be because the practicing engineer not registered with ECSA influenced the data, or that those members from the focus group who took part in individual interviews had time to reflect on their feelings and gave more moderate responses.

As indicated above due to time constraints, it was also decided not to have individual interviews with all those that volunteered for the study. After discussion with the research supervisor, it was decided that a mix of registered engineering participants from the focus group, and some that have not attended the focus group would be selected for individual interviews. The individual interviews were then conducted with the seven selected ECSA registered engineering professionals. Taken the overall results of the comparison between the focus and combined individual mindmaps, it can be seen that there were slight differences, but the overall outcome remained very similar.

5.4.2 Recommendations for future studies

During the study conducted to identify the experience of selected electrical professionals with regards to the current CPD system and what they perceived their professional development needs were, several additional opportunities for future research were identified. Firstly, this was a limited study including a small sample of practicing electrical engineering professionals from one company,

which seemed to only touch the surface of the phenomenon. There is an opportunity to do a more comprehensive research study including all constituencies that practice within the engineering environment or have any influence on the CPD system. A more comprehensive study would give a much better understanding of what is required from CPD for engineering professionals and the systems that regulate their profession. Other research questions that have been identified during this research and which may be investigated in future include:

- Is there a culture of CPD within South African engineering profession?
- There are more than 180 000 practicing engineering professionals, what is the reason for most of them to not register professionally?
- What are the soft and hard skills and competencies needed by a global engineering professional that will enable effective practice in the global arena?
- Identification of the most effective CPD system that would help to create capable professional engineers?
- Why are Engineering Professionals so sought after in other industries?
- How do unregistered engineers ensure competence?
- How to retain professional engineers within the engineering practice?
- How and why do professional associations change institutionalised practices within the engineering environment?
- What would be the best CPD approach in South Africa to put the importance of the learning process and the results of learning above that of quantitative inputs?
- Can South African engineers remain competitive in the world labour market?
- What is the best method for effectively transferring skills learned in the classroom to the work environment?
- What mechanisms can be used to make CPD activities more accessible, affordable and available on demand?

5.5 Conclusion

This study had limitations and only focused on a selected group of electrical engineering professionals in one organisation, one of the many constituencies within the engineering fraternity who are close to the phenomenon of CPD, but have little influence over the system itself. The main

aim of the research was to identify, through using the IQA research methodology, what the CPD needs of the selected electrical engineering professionals were that would enable them to compete successfully with their international counterparts. The section of “Possible Implications for CPD Provision for Engineering Professionals” as discussed earlier in chapter 5, answered the research sub-questions as was set out in chapter 1, section 1.2.2. When taking into consideration these discussions, the academic view and the current CPD reality identified through the literature review in chapter 2, it can be seen that the perceived and proposed CPD needs for the selected group of electrical engineering professionals have been identified. Yet, as indicated under “recommendation for further studies”, to truly identify the actual needs of practicing engineering professionals, a more detailed study need to be done, which will include all the constituencies that practice within the engineering environment or have any influence on the CPD phenomenon. Lastly taking into account that the IQA was selected as the research methodology for this study and that it is based on systems theory, it is assumed that another researcher, using the same research method and tools, and interviewing participants within the same field of study, wich work in the same kind of working environment, would be able to get similar, but not exactly the same results. Marginal diffrences in results of future engineering CPD studies using IQA methodology would most likely be due to diversity in cultural and work experience of participants and changes in global CPD practices and new reseach in this field of study.

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Annexure A: Consent to Participate in Research

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STELLENBOSCH UNIVERSITY

CONSENT TO PARTICIPATE IN RESEARCH

"Electrical engineering professionals', continuing professional development needs

You are asked to participate in a research study conducted by Jan Muller (BML, M.Sc), from the Centre for Higher and Adult Education at Stellenbosch University. You were selected as a possible participant in this study because you are an Electrical Engineering Professional registered with ECSA.

1. PURPOSE OF THE STUDY

In order for South Africa to stay competitive in the global market and the rapid rate of technological advancement, there is a need for engineering professionals to continuously undertake professional development. The main aim of this study will be to identify the areas and subject matter, engineering professionals believe they should focus on for further professional development. The secondary aim would be to identify preferred delivery methods for continuous development subject matter.

2. PROCEDURES

If you volunteer to participate in this study, we would ask you to do and take note of the following things:

Be part of a small focus group where Interactive Qualitative Analysis (IQA) methodology will be used to define the similarities or "affinities" of the system that represent the groups' experience with regards to Continuing Professional Development.

Take part in a “one on one’ open interview with the researcher, to discuss your view and get insight into what you think is important in the professional development of Electrical Engineering Professionals to make them internationally competitive. This interview will be completed within an hour’s time.

That during the interview the researcher will take notes and audio recordings of the discussions that take place for referencing during the analysis phase of research.

The researcher will after agreement set an official appointment with the participant in a closed venue, where uninterrupted and private interview will be held.

The researcher will get permission from participant’s manager to conduct the interview if and when required.

3. POTENTIAL RISKS AND DISCOMFORTS

The interview topic is an intricate part of any Engineering Professional’s career and is not normally a contentious or sensitive issue to discuss, and this no problems or special requirements are foreseen.

The actual audio recording of the discussion may make you feel uncomfortable and will be done as unobtrusive as possible by making use of a “Livescribe’ pen that will also be used for taking notes. Further it is important to take note that the audio recording will only be used for clarification and referencing by the researcher when research analysis are done and will be destroyed by deleting it when research is completed.

Permission for performing the research has been obtained from the acting National Control manager and Corporate Specialist, Gavin Hurford to perform the interviews at Eskom, National Control during working hours. If you want to participate and still feel permission is needed from your immediate manager the researcher will ask for permission and will inform you as soon as received.

4. POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY

The research itself aim to identify what you as an Engineering Professional feel is important in your development to be able to compete on the same level as your international counterparts, and will be made available to ECSA and other CPD providers to help guide them in formulating and providing subject matter needed by yourself for your professional development.

Depending on the findings of the research, there may be a possibility that it will influence the current method of delivering some CPD initiatives by aligning to advances in social media and internet technologies.

5. PAYMENT FOR PARTICIPATION

Participation in this research is voluntary and there will be no payment or incentives given for your participation.

6. CONFIDENTIALITY

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of numbering all responses and transcripts in an alphabetical order, with each participant allocated a letter. All data and audio recording will be kept safely in a locked folder only accessible by the researcher for the duration of the research. On completion of the research all audio recordings will be destroyed by deleting it from the recording device and software application.

The only data that will be kept and stored in an electronic format will be the transcripts, notes and completed research which will be coded as described above to unsure your anonymity. When the results of the research is published there will be no mention of names of any participant that took part in research, and when referencing part of any participants discussions or views, participants will only be referred to by the allocated alphabetical code.

7. PARTICIPATION AND WITHDRAWAL

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so.

8. IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about the research, please feel free to my Supervisor
Prof. Liezl Frick
E-mail: BLF@sun.ac.za

9. RIGHTS OF RESEARCH SUBJECTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research subject, contact Ms Maléne Fouché [mfouche@sun.ac.za; 021 808 4622] at the Division for Research Development.

SIGNATURE OF RESEARCH SUBJECT

The information above was described to me by **Jan Muller** in [Afrikaans/English] and I am in command of this language or it was satisfactorily translated to me. I was given the opportunity to ask questions and these questions were answered to my satisfaction.

I hereby consent voluntarily to participate in this study. I have been given a copy of this form.

_____

Name of Participant

_____ _____

Signature of Subject **Date**

SIGNATURE OF INVESTIGATOR

I declare that I explained the information given in this document to _____ [*name of the participant]. [H*e/she] was encouraged and given ample time to ask me any questions. This conversation was conducted in [*Afrikaans/English]* and no translator was used.

_____ _____

Signature of Investigator **Date**

Annexure B: Focus Group Affinity Relationship Table

Affinity Name
1.
2.
3.
4.
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10.

Possible Relationships
A → B
A ← B
A <> B (No Relationship)

Focus Group Affinity Relationship Table	
Affinity Pair Relationship	**Example of the relationship either in natural language or in the form of an IF/THEN statement of relationship**
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Annexure C: Facilitator Meaning Reference and Interview Protocol

Affinity Name
1. CPD opportunity for individual professional development
2. Quality assurance
3. Leadership from professional body
4. Ideal identity of model engineer
5. Professional recognition/perceived professional identity
6. Lack of incentives and enforcement
7. Inadequate quality management
8. Desired end state
9. Members' perceptions of ECSA/CPD – financial
10. Members' perceptions of ECSA/CPD system – process to comply

Defining the meaning of the themes

Facilitator Theme/Affinity Meaning Reference	
Affinity Number	
1	CPD is needed to give engineering professionals the opportunities to develop and to be kept abreast of technological advances. Cards: • CPD system does help drive individual development • Need forward looking training • Offer opportunities got technological development

2	Quality assurance of CPD initiatives and system are required to ensure the professional competence of engineering professionals are current and recognized by international professional bodies. Cards: • International Recognition • It's a way of checking if engineers are keeping up with their profession • Assessment of the status of the profession • Professional competence
3	The engineering professional body need to show real leadership in the development of world recognized engineering competencies, through participation, taking initiative, mentoring others and facilitating international recognition. Cards: • Walk the talk leadership • Effective mentorship • Facilitate International recognition
4	The model professional engineer need to maintain strong technical competencies, while also gaining the required non-technical competencies and leadership needed in the engineering environment, to enable the ability to function effectively in any environment, while working with a diverse group of people. Cards: • Caution to not pollute engineering component • Well-rounded engineer • Balanced in technical and other non-technical competencies • Adaptable skills • Flexible • Multi skilled • Diverse • Not purely technical • Strong leadership skills (x2) • Good mentor

5	To belong to a professional body means members also have a responsibility to participate and make sacrifices for the improvement and upliftment of the body and the profession which will result in members building a reputation of effective and competent engineering professionals and thereby achieving international recognition. Cards: • Need to make some sacrifices • Networking • Socializing • Peer recognition • Reputation • Brings confidence to the profession • International Professional status • International recognition • Participations in professional body essential
6	Due to mostly bigger organizations supporting and requiring professional registration many engineering professionals will rather become managers, resulting in many engineering managers not being professionally registered. Cards: • CPD mostly not compulsory outside bigger companies • CPD and ECSA registration essential in organisations such as Eskom, yet absolute in other areas of practice • Easier for professional to follow management route as there is less requirements • Not a national priority • Engineering managers are not required to be registered as engineering professionals
7	The current CPD system implementation is very poor as there are no effective quality management system, and this many courses on offer for CPD are easy and do not truly develop members, and some initiatives are accepted without any evaluation. Cards: • Any course can be used to claim CPD without adequate QA • Most available CPD courses easy, maybe too easy • Skeleton, no real structural substance, need more meat/substance • Good concept poor execution • Good idea but awful implementation • Room for improvement • Necessary but confusing • Mostly quantitative need more quality

8	An effective CPD system should have high quality courses on demand that are relevant and current to the engineering environment, supports the economy and give constructive feedback on the development progress of members. Card: • Current and relevant • If done correctly they are useful • Good intentions for CPD • Supports economy • Supports greater insight in power industry • Need more constructive feedback
9	The current CPD system are seen by members as a money making scheme, that only Big organizations can afford to support. Cards: • Cost too high for professionals outside large organisations • Large organisations pays for membership • ECSA and SAIEE money making scheme • Current CPD provision a money making scheme • Big money making business • Cash cow for providers

10	Members find the current CPD system frustrating as it is confusing to navigate, there is little real support, it is an administration nightmare and most of the courses or training is not relevant, which result in many engineering professionals choosing not to register with the professional body. Cards: • The evaluation process needs some improvement • System very frustrating (x2) • Find current system useless • CPD system to be improved • Meaningless • Confusion • Discouraging • Lack support • Administration • ECSA does not do anything for me – CPD has bad association • Available courses not relevant • Lacking coordination • Inconsistent • Uncontrolled • Unstructured • Fragmented (x2) • Contradictory (ECSA to ensure technical competence, now also including soft skill) • Un-firm (Not specified rigorously)

Start interview with verbally and loudly stating the date, asking the person to give their name, professional level and what relationship they have with regards to CPD for Engineers (he is an chief engineer registered with ECSA, etc). Explain to participant that you will be naming some of the themes that were developed during the focus group. Explain that each theme will be named and a short description will be shared and that you would like them to tell you if they agree with the defined meaning (if not then help improve definition or summary), and then to share with you what this theme means to them within the context of CPD, and if they have any experience that they could share.

1. **Axial Questions and probing**

   Interview Probes:

- What does the theme mean to you?
- Tell me about your experience with the theme?

- What do you mean by that?
- So why is that important to you?
- You said that…….Can you give me an example?
- Provide examples if interviewee does not respond or is unclear.
- Summarize when making a transition to the next topic. Tell the respondent what will be asked next (direct announcement format).
- Be especially attentive to metaphorical language. Probe each instance with the purpose to examine the logic and structure of the metaphor.

Note: On completion of first part, Hand the participant a copy of the ART form explaining that this is a copy of themes that was just discussed and the interview will continue to explore the relationships between the themes and reasons for the relationship, then continue with following

2. Asking theoretical questions and probing

- Give respondent a copy of the ART to guide second phase of interview.
- Begin theoretical coding phase with introduction such as:
    - "Now that we have talked about each of the topics, I would like to explore the connection you see between them".
- Proceed through the ART, asking whether or not the respondent perceives a relationship between the elements of each pair.
    - If a relationship is identified, ask for examples, and then translate the respondent's statement into a clarifying statement so that the direction of the relationship may be accurately coded.

Annexure D: Combined Interview Axial Code Table – Theme 3

Combined Interview Axial Code Table – Theme 3		
Transcript Line	**Axial Quotation**	Researcher Notes
Transcript 2, Participant A		
76	Q: Then we go to the third one which is "Leadership from professional	
77	body". And how I defined it, or the statement I wrote was, "The engineering	
78	professional body need to show real leadership in the development of world	
79	recognized engineering competencies, through participation, taking initiative,	
80	mentoring others and facilitating international recognition".	
81	A: Okay, this they need to show. I think partly they actually do it, but they do it	
82	through SAIEE. They use them, ahh, with international lecturers arranged,	
83	They use that platform, to you know, to invite people and to encourage people	
84	to attend. They even allocate CPD points for such topics or such lectures, to	
85	make sure people are encouraged to attend. Now I think that is part of ensuring	
86	people are developed and people know what is out there, what other	
87	professional bodies are doing, what other professionals are researching, what	
88	have they discovered and all those things. I think this is one way of showing	
89	Leadership, and obviously we have to understand that in any system there will	
90	be things that do not go as it should, but the intention is good to make sure	
91	people do attend. And it is up to the people now to take the opportunities	
92	that are being provided by bodies such as SAIEE which are working for	
93	ECSA, I would say. And attend those things, and make sure that they get, I	
94	mean make sure they attend, that obviously they can develop networks with	
95	these international guys, and in a way they can also be mentored by them	
Transcript 5, Participant B		
43	Q: Then we go to number three, which is, "Leadership from professional	

44	body". The way I defined it, or the statement I wrote from group discussions	
45	was, "The engineering professional body need to show real leadership in the	
46	development of world recognized engineering competencies, through	
47	participation, taking initiative, mentoring others and facilitating international	
48	recognition".	
49	B: I think that is a true statement, yes.	
50	Q: Taking the current professional body and that statement, and you need to	
51	compare what you need from a professional body, or how do you see the	
52	current professional body with regards to leadership?	
53	B: Uhmm, Ja, I think that ECSA is not really capable of providing the	
54	Leadership in this definition. They are making use of help from, uhmm, what	
55	they call subject specific bodies such as SAIEE or SAIME to help them in that	
56	regard. Unfortunately even though they get help from bodies such as SAIEE	
57	and SAIME, it is my understanding that people perceive South African	
58	Engineers as inferior in general and that we are not recognized internationally	
59	And that we are not competitive internationally. That is just my understanding	
60	of people's perception	
Transcript 6, Participant D		
70	Q: Okay then we go to three which is, "Leadership from professional body"	
71	And the statement I put down was, "The engineering professional body need to	
72	show real leadership in the development of world recognized engineering	
73	competencies, through participation, taking initiative, mentoring others and	
74	facilitating international recognition".	
75	D: Ja, that is fine, that's okay, nothing really to add there.	
76	Q: From your personal point of view, taking ECSA as an example, do you	
77	think they give that leadership, or show that leadership, uhmm, and facilitate	
78	the recognition?	
79	D: Mmmm, maybe from where I sit, Uhmmm, I don't know, I think it is	
80	Difficult to say. I could not confidently say that they, uhmm, I have not seen strong	

81	leadership. But, I am not saying that it is not there, but maybe it is not visible	
82	Enough. I think one that this statement is covering is mentorship, and I think	
83	there are some initiatives that are there, you know to encourage mentorship,	
84	But I think in my view a lot more will have still to be done there to ensure	
85	young professionals in particular are assigned those mentors and that there is	
86	actually a rigorous process in place to ensure these guys are groomed to	
87	Become fully fledged engineers. Particularly these days we are competing with	
88	other industries, where people come in and they are not looked after and they	
89	do not have a clear road map of where they need to go and what training and	
90	development they have to do, people can easily think that the career they are in	
91	is not as interesting as they though it is. And the career is interesting, but that	
92	support and guidance is actually lacking, I think instead people would want to	
93	be ECSA registered for the wrong reasons in my view, and that is incorrect, I	
94	think nothing wrong with perks, but we need to have the important priorities	
95	first, you know. You should pursue your registration because it puts you in a	
96	good standing as far as your career goes, and the benefits should follow	
97	afterwards. Registration should not only be for benefits as then priorities is a	
98	bit mixed up I would say.	Time: 13:46 (LS P30)
Transcript 7, Participant F		
40	Q: Now let's look at number 3, "Leadership from professional body" which is	
41	the theme and the way I explained it here is, "The engineering professional	
42	body need to show real leadership in the development of world recognized	
43	engineering competencies, through participation, taking initiative, mentoring	
44	others and facilitating international recognition."	
45	F: Mmmm	
46	Q: So	
47	F: I agree with that statement.	

48	Q: So the question is how do you experience the current body with regards to	
49	the leadership statement I just shared with you? And remember this is your	
50	individual feeling, it can be a perception or something you have experienced.	
51	So comparing the statement to the current ECSA professional body, What	
52	level is its leadership at?	
53	F: I have had one experience of attending a international seminar, and if I	
54	compare it to that, it is not really that bad. It is probably not far of the mark.	
55	That is from what I see, what happens behind the scene I do not know. There	
56	Still seems to be a lot of questions being asked. Uhmm, people don't have	
57	answers. But in saying they are not far of the mark, uhmmm, I also think there	
58	Is some room for improvement. If you look at ENTSO-E they are tackling a	
59	problem in operations and market development . They meet on an annual basis	
60	and they discuss issues relevant to System Operators across Europe. Uhmm it	
61	may be good if ECSA would take more of a leadership role in answering	
62	questions there, otherwise it is a case of the System Operator in Eskom are	
63	Actually taking a leadership role there. But maybe because of the fact that,	
64	Uhmm maybe it is not fair to make the comparison with an European body	
65	With a South African body.	
66	Q: Okay can I ask the question differently, if we compare our body to a similar	
67	Body. ENTSO-E maybe is a body specific to System Operators, but also have	
68	Engineering council, can we make a comparison?	
69	F: mmmm	
70	Q: If you can't it is fine	
Transcript 4, Participant H		
47	Q: Okay let's look at number three. Number three have to do with	
48	" Leadership From the professional body". And the statement I put together	
49	From all the discussion in the focus group is, "The engineering professional	
50	body need to show real leadership in the development of world recognized	
51	engineering competencies, through participation, taking initiative, mentoring	
52	others and facilitating international recognition".	

53	H: I agree with that entirely. If ECSA were actually to do this, will make our	
54	membership a lot more valuable. And I think it is a real need in this country at	
55	this point in time, as I think some of the university degrees are not at the level	
56	they should be. There is some good universities and then there are some that is	
57	not that good. And the only way if we are to build good engineers, is if	
58	somebody from a third party comes in and assist to set standard of qualification	
59	and thereby uplifting the profession in South Africa.	
Transcript 4, Participant H		
101	Q: Okay, let's move to theme number 3, and I have defined it as ….	
102	"The engineering professional body need to show real leadership in the	
103	development of world recognized engineering competencies, through	
104	participation, taking initiative, mentoring others and facilitating international	
105	Recognition".	
106	N: Yes…so we are talking specifically about ECSA?	
107	Q: Yes	
108	N: I agree with the definition and do not think ECSA are getting it right.	
109	The persons from the professional body that I had contact with and who	
110	Interviewed me, was in most cases retired professors, and half of them was	
111	never in the field. Those that was makes wonderful leaders and mentors	
112	But many do not really know what is going on in the real world. They are	
113	only academics. Ahmmm. There was something else here that I thought of	
114	Ummm.. I am not sure or did not get the impression that they are actually	
115	keeping up with changes in the engineering field. Then "mentoring others' is	
116	not really being implemented correctly. Mmm the whole mentorship thing..	
117	In Eskom they are trying hard to improve mentorship things… Mmmm it is	
118	also not in all areas in Eskom, I know of many people in Distribution who	
119	never had a mentor. And there is many people like me in the organization that	
120	is on a higher level and still feel we need mentorship, but there is no real way	
121	for us to get a mentor, as they just say why do you need a mentor as you are	

122	already a chief engineer. So I think the whole mentorship concept, is being	
123	misunderstood in most parts of the organization. And it makes…it closes a	
124	lot of opportunities	
Transcript 3, Participant O		
71	Q: Ok then to number 3, “Leadership from professional body”. And if you	
72	Look at number three the statement I wrote is “The engineering professional	
73	body need to show real leadership in the development of world recognized	
74	engineering competencies, through participation, taking initiative, mentoring	
75	others and facilitating international recognition”.	
76	O: Mmm, I agree with that statement. At the end of the day everything should	
77	be world recognized, that’s true, internationally. But it is up to the individual	
78	To take the initiative for their own, uhm, personal, ummm, development. But	
79	when it comes to mentoring others, obviously you need to know your subject	
80	matter. You must be a subject matter expert, before you can mentor others.	
81	That should be important as well.	
82	Q: Okay, let me put it this way, Umm, this specifically is within the context	
83	of ECSA the body. Meaning the people sitting at ECSA.	
84	O: Oh, Okay.	
85	Q: So thinking about that?	
86	O: so for me , I think ECSA, the engineering team sitting at ECSA, should go	
87	through the topics and should choose at least 5 topics that came up in the last	
88	six months and develop courses. Develop individual courses for those topics	
89	and add the CPD related points and then get lecturers registered with ECSA.	
90	So ECSA should be bringing the initiatives out and any one lecturing the	
91	content must be with ECSA and then send this out to an individual like	
92	myself. So for me personally that are registered with ECSA, I want ECSA to	
93	take that initiative, because I am paying them money at the end of the day,	
94	R2000 and something a year and we are not getting that value out of them. Not	
95	even getting annual reports, or getting anything posted to you, e-mails are	
96	Scarce. So for what purpose, as it feels like you are only wasting money.	

97	Eskom makes it a requirement to have ECSA registration to further your	
98	development, but at end of the day I am paying ECSA two thousand rand a	
99	a year, but I am not getting any e-mails from them, or very seldom do I get	
100	Any e-mail from ECSA, or any mail from ECSA, so we are not getting any	
101	facilitation from ECSA that we need	