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An Evaluation of Organizational Learning on the Performance of Energy Efficiency Projects:

Cases amongst Small and Medium Energy Service Companies in South Africa

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A dissertation submitted to the Faculty of Engineering and the Built Environment at the University of the Witwatersrand, in fulfilment of the requirements of a Master of Science in Building.

Johannesburg, July 2014

DECLARATION

This dissertation is being submitted to the University of the Witwatersrand for the degree of Masters of Science in Building. I declare that this dissertation is my own work, that no part of this thesis has been published or submitted for publication to any University or other institution.

Signature: _____

Full Name: Chamabondo Sophia Chanshi

Date: July 2014

DEDICATION

This dissertation is dedicated to my Lord and Saviour Jesus Christ who enables all things. To the unwavering devotion of my father, Kasakwa Ngalu Chanshi. Also to the memories of my grandparents, Smith K. Chabinga and Chamabondo S. Chanshi, may their souls rest in peace.

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I would like to express my deepest appreciation to my supervisor, Dr Senthilkumar Venkatachalam for his encouragement, moulding, dedication, guidance and patience. I am also indebted to my mentor and friend, Kennedy Aduda, for his direction, belief, genius and firmness. Furthermore to my mother Helen Chabinga who has been my pillar, I am forever grateful for her steadfast belief in me.

My sincerest gratitude is to the School of Construction Economics and Management for their assistance through the journey of academic research. Finally I am grateful to all the companies and professionals for their time and invaluable insights.

ABSTRACT

Introduction: Literature shows that an organization that participates in learning broadens its competitive advantage, capabilities and efficiency ensuring overall improved performance. This study reviews organizational learning in small and medium Energy Service Companies (ESCos) undertaking energy efficiency projects in the South African building industry. In addition, the study examines what impact the organizational learning has on the performance of ESCos. Furthermore factors and practices that influence organizational learning in small and medium sized ESCos are identified and reviewed.

Aim: The study develops a framework for the effective learning practices which lead to better performance in implementing energy effiency projects.

Design/methodology/approach: The study uses a combination of interviews, document and literature review. Interviews and literature were used to gather information on organizational learning and learning practices in small and medium ESCos undertaking energy efficiency building projects. Company documents, government policies and Eskom's operational documents were documents used for analysis. All the findings were triangulated to ensure validity and reliability.

Outcome: ESCOs are instrumental in promoting energy efficiency. This study identified current learning practices and the factors that promote learning within ESCos. This enables ESCos to strategize on the possible improvement on their performances.

Keywords: Buildings, Energy Efficiency, Energy Service Companies (ESCos), Organizational Learning, Performance, Small and Medium Enterprises (SMEs), and South Africa

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[1] Eskom is a utility company in South Africa that generates, transmits and distributes electricity to various sectors within the country and other SADC region.

Glossary of Terms

Energy Efficiency	The improvements in buildings that result in lower energy consumption. These improvements are active (technological) or passive (design) elements that assist to provide more services for the same energy input or the same services for less energy input.
Energy Service Company	An entity which has been set up by a public sector organization with or without private sector participation. This entity engages in developing, installing and financing energy projects for the purpose of delivering energy efficiency, energy management, energy savings and sustainable energy.
Organizational Knowledge	The information created by professionals and organizations through a mix of experience, contextual information, values and expert insight.
Organizational Learning	The strategic management of information which allows transfer of knowledge through the organization.
Organizational Learning process	The interaction between the sources of knowledge, knowledge and the degree of learning within an organization.
Organizational Performance	The measure of qualitative (efficiency, effectiveness and equity) and quantitative (profitability, number of clients and returns) information from projects.
Small and Medium ESCos	A business that is directly managed by an owner/s, has about 28 employees and receives a turnover of five hundred thousand rand to fifty million rand. The business typically undertakes Eskom DSM projects ranging from one million rand to fifty million rand.

Abbreviations

DEST - Danish Electricity Saving Trust
DSM - Demand Side Management
DTI - Department of Trade and Industry
EE - Energy efficiency
EEI - Energy Efficiency Index
EPBD - Energy Performance of Buildings Directive
ESD - Energy end-use efficiency and energy services
Eskom - Electricity Supply Commission and *Elektrisiteitsvoorsieningskommissie*
GIS - Green Investment Scheme
IEA - International Energy Agency
II - Information Interpretation
Info. - Information
IST - Information systems and Technology
KA - Knowledge Acquisition
KMS - knowledge Management System
KPI - Key Performance Indicators
MEPS - Minimum Energy Performance Requirements
NEES - National Energy Efficiency Strategy Goals
NBR - National Buildings Regulations
OECD - Organisation for Economic Co-operation and Development
RE - Renewable Energy
SME - Small and medium sized enterprises
SM - Small and medium
SM ESCos - Small and medium Energy Service Companies
WEC - World Energy Council

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CHAPTER 1: BACKGROUND

1.0 Introduction

The Built Environment is among the largest users of energy with the consumption of 40% of total energy (U.S. Green Building Council, 2008). Many research studies have addressed the issues around the creation, diffusion and management of the barriers towards energy efficiency initiatives and its implementation (Wene, 2011). There is a global awareness to implement energy efficiency measures in the wake of global warming and resource shortages (Kok *et al.*, 2011; Vine *et al.*, 2005; Menanteau and Herve, 2000).

In South Africa; despite much research and interventions, the energy challenges continue to persist. Eskom is unable to generate enough capacity as development that is dependent on energy intensive activities continues (Covary and Girdwood, 2013; CSIR, 2008; City of Johannesburg, 2008). This is evident by the recurring power-cuts and the difficulty with ensuring a stable electricity supply. South Africa with its large coal reserves; has heavily subsidized electricity, this has led to low energy prices and a diversion from energy efficiency improvements (Urge-Vorsatz *et al.*, 2007; Department of Minerals and Energy, 2005). Historically, the excess electricity capacity resulted in cheaper electricity prices allowing consumers to take energy for granted as seen by the high energy consumption (Winkler, 2007; DME, 2005). The electricity supply insecurity as a result has compelled the South African Government to use energy efficiency as an approach to manage energy. The Energy Strategy sets a final overall national Energy Demand Reduction target of 12% by 2015, despite the country's infrastructure development (DME, 2005).

The Energy Efficiency and Demand Side Management program (EEDSM) are now one of the choices of strategy implemented to meet the national energy demand reduction target (DME, 2010). EEDSM are activities that are initiated by the electricity suppliers (Eskom) that promote resourceful use of electricity from the demand side (The customers) (Calymer, 2006). The EEDSM programme involves the use of Energy Service Companies (ESCos) to install energy efficiency technologies and various energy services on behalf of Eskom (Singh, 2008).

1.1.1 SMEs and Energy Service Companies

Small and medium sized enterprises are commonly defined as registered businesses with less than 250 employees (International Finance Corporation, 2009). SMEs are further classified by their turnover bands of less than fifty million Rand, ownership profile and businesses that are not part of larger businesses (PWC and KFW, 2012; Mahembe, 2011). Energy service companies in South Africa can also be classified as small and medium sized or large entities (PWC and KFW, 2012). SM ESCos are similar to traditional SMEs in classification as they have less than 250 employees; they are directly managed by owners and have a small market share (Mahembe, 2011).

In South Africa, SM ESCos are relatively new organizations that are being developed. These organizations undergo steep financial and learning curves to assume their energy businesses. SM ESCos can thus be considered as a learning organisation (Bertoldi and Rezesy, 2005). Additionally, South African ESCos are generally public sector driven, but procured and operated by the private sector (Eskom, 2010). ESCos design viable energy efficiency projects which ensure buildings are energy efficient (Crossley, 2007). These ESCos involved in EEDSM projects are paid based on energy services offered (Van Tonder, 2012, DME, 2010; DME, 2005).

1.1.2 Organizational Learning in ESCos

Organizational learning forms part of the process "where routines, beliefs and actions adapt incrementally to past experience through feedback from organizational actions and their outcomes in relation to targets" (Ellistrom, 2010). Learning within an ESCos organization occurs through many mediums such as individuals, teams/groups or between organizations (Locke and Jain, 1995). The learning occurs through: individuals' skills, knowledge, insights and experiences (Attewell, l992). Furthermore, learning is a sequence of three phases: information acquisition, information interpretation and behavioural and cognitive changes (Chatterjee, 2010). Learning within organisations is important as it assists to generate and update knowledge in organizations (Lines, Sáenz and Aramburu, 2011). Therefore organisational learning adapted to ESCos can produce core competencies that promote performance (Hitt *et al.*, 2002).

1.1.2.1 Processes of Organizational Learning

The process of organisational learning is dependent on learning and the management of information. Hernaus *et al.* (2008) suggest that information acquisition, interpretation and behavioural and cognitive changes govern the processes of learning; thereon organisational learning. The process of learning involves perceiving and processing information such as experience and then permanently changing it into knowledge or skill as a result (Dodgson, 1993; Weiss, 1990). The appropriate management of this knowledge and intellectual capacity is vital in sustaining competitive advantage and performance in an organisation (Yeo, 2003). Literature shows that implementing strategies, structures, values and norms for organisational learning leads to positive results in the performance of the organization and its members (Berthoin-Antal *et al*., 2003).

1.1.3 Factors influencing Organisational Learning

Many factors influence the organizational learning within ESCos. Literature has identified the following factors as most significant: (1) Adopting a learning strategy and participative policy-making, (2) Supportive leadership and strategic management, (3) Supportive organization structure and learning culture, (4) Reward mechanisms and (5) Teamwork and team learning, (6) The local and international market and (7) Technology. According to Gephart *et al.* (1996), the influence of supportive and strategic management/leadership creates an organizational structure that promotes a learning culture. These organizational structures are usually flexible enabling speedy organizational learning and implementation (Pedler *et al.*, 1991). The organizational structure amongst other determinants plays a significant role in learning. Clear organisational structures can provide unhindered learning processes. Grossi *et al*. (2007) state that the structure considers a multiplicity of aspects namely: authority, communication, delegation, responsibility and control among others. If these aspects are considered in the learning organisation, the structure develops strategies that promote and investigate factors that support productive learning to achieve organisation targets (Rubelo and Gomes, 2008). Furthermore flexibility in the organizational structure also allows individual and team learning (McGill *et al.*, 1993). This allows for active participation in policy making and eventually the adoption of a learning strategy (McGill *et al.*, 1993). ESCos can benefit from ensuring these factors are present in their learning organization.

1.1.4 Strategies and practices of Organisational learning

There are no studies that clearly illustrate how ESCOs learn as an organisation and set out strategies and practices pertaining to organisational learning. However studies on organisational learning and theory could be utilised to guide learning strategies and practices in ESCos if they intend to improve their performance. Ellistrom (2010) states that the benchmarking of organisational learning practices and strategies should stem from individual learning, team/group learning, inter-organisational learning and experience. It is further advised that all learning in an organisation be shared throughout the organization (Rubelo and Gomes, 2008).

1.1.5 Organizational performance and performance indicators

Organisations usually prioritize monetary profit as a performance indicator. Organizational performance has been defined as involving both financial and non-financial outcomes (Yeo, 2003). Organisational efficiency, effectiveness and equity are performance information that can be used to measure performance (Askim, Johnsen and Christophersen, 2007). Behavioural and cognitive changes are also other important indicators to consider when evaluating organisational performance (Hernaus, 2008). Learning is explicitly linked to improved organisational performance (Teece *et al.*, 1992). The difficulty for ESCos lay in limited energy management infrastructure and the missing link of technical staff (the technical knowledge) and strategic management (Urge-Vorsatz *et. al.*, 2007). In South Africa the lack of managerial capabilities, the inexperienced ESCo industry and skill shortages hamper the performance of ESCos trying to implement energy efficiency measures.

1.1.6 Challenges of ESCos and Organizational Learning

The difficulty for SM ESCos is as a result of the limited energy management infrastructure and the missing link of technical staff and strategic management (Urge-Vorsatz *et. al.*, 2007). This contributes to the business failure rate of 70% - 80% in SM ESCos (Fatoki and Van Aardt Smit, 2011; Terziovski, 2010; Van Eeden *et al.*, 2003). The lack of managerial capabilities, the inexperienced industry and skill shortages hamper the performance of ESCos which implement energy efficiency initiatives (Urge-Vorsatz *et al.*, 2007; Volschenk, 2007). The lack of skills and management capabilities further limits the learning obtained through:

individuals' skills, insights and experiences affecting organizational learning in ESCos (Attewell, l992). Thus ESCos remain involved in small and low technical project environments (Bertoldi and Rezesy, 2005). Furthermore the lack of strategic management encourages a poor skill expansion, low technical knowledge uptake and a lack of experience in the industry (Volschenk, 2007).

The use of ESCos by Eskom continues to realize benefits to the country's energy landscape (Eskom, 2010). The energy efficiency (EE) initiatives set by Eskom have seen an increase in verified accumulated demand savings (Dames, 2012). Nonetheless the increased energy demand and the lag in uses of energy efficiency technologies indicates that the expected performance implemented through the EE initiatives is not up to the expected mark (DME, 2012). Thus, it is useful to review the ESCos responsible for implementing the EE initiatives.

1.2 Rationale of Study

The effort by Eskom to boost the electricity supply encourages the improvement of energy efficiency measures (Dames, 2012). Eskom uses ESCos as a strategic vehicle to implement their Integrated DSM initiative (Eskom, 2010). In South Africa, some of the SM ESCos are responsible for implementing energy efficiency measures in buildings which contributes to the alleviation of the energy challenges in South Africa. However these SME ESCos face many challenges that hamper performance. The ineffective organisational learning creates a gap between the ESCos' energy service targets which may lead to poor performance (Rebelo and Gomes, 2008; Yeo, 2003; Berthoin-Antal *et al*., 2003). Improving the performance of SM ESCos involved in energy efficiency projects in buildings may be achieved by reviewing their organizational learning (Hitt *et al.*, 2002). Ineffective organizational learning in ESCos may contribute to the slow progress of energy efficiency projects in buildings. In turn South Africa's energy reduction targets set by the Energy Strategy are not met and the economy continues to suffer as a result of energy shortages (Von Alvensleben, 2013; DME, 2005).

Further research examining the processes of organisational learning within SM ESCos will be beneficial to the achievement of energy efficiency targets. With the view of improving organisational performance; the processes of organisational learning is reviewed in relation to the ESCos, learning strategies and practices for energy efficiency projects in buildings. This

research is motivated by the need to understand the organisational learning within SM ESCos undertaking energy efficiency projects for buildings.

1.3 Problem statement

The use of ESCos in the energy industry is crucial in energy efficiency projects' delivery. In South Africa, ESCos are valuable and are employed to meet various Energy Efficiency initiatives by the government. Their poor performance has however been reported in past research. Many reasons have been attributed towards their poor performances. In particular, organizational learning within ESCos contributes significantly towards the organization's performance. ESCos operating in the built environment require: a mixture of various levels of participants, diverse skills and adequate information management. However the organizational performance of ESCos has been stifled by the lack of organizational learning practices. It is evident from the literature that ESCos may not be able to fully acquire, interpret, manage and retain information adequately. Furthermore, this lack of information and knowledge management prevents the ESCos from sufficiently reviewing lessons learnt. This results in decreased organizational capability (Jones, 2000) and the lack of behavioral and cognitive changes that reduce organizational efficiency (Chatterjee, 2010; Skerlavaj *et al.,* 2007*).* Thus, the reduced efficiency leads to the misconception and underutilization of the allocated budget for energy efficiency initiatives.

In simple terms the research problem can be stated as "*There exists an inadequate organizational learning among South African Energy ESCos, which impedes performance among SM ESCos".* At present there is no study which outlines the patterns by which ESCos in South Africa learn. Hence evaluating the existing learning practices and preparing a framework for effective learning will enhance their performance in delivering energy efficiency projects.

1.4 Research Questions

The research demands the following main question:

How does organizational learning within SM ESCos impact on the performance of energy efficiency building projects in South Africa?

To answer the main research question, the following sub-questions were generated:

i. *How does organizational learning occur in SM ESCos undertaking energy efficiency building projects?*
ii. *How do internal and external factors influence organizational learning in SM ESCos undertaking energy efficiency building projects?*
iii. *How are SM ESCos undertaking energy efficiency building projects in South Africa performing?*
iv. *How do the organizational learning practices facilitate performance in SM ESCos undertaking energy efficiency building projects in South Africa?*

1.5 Aim and Objectives

The aim of the study was to investigate the organizational learning practices towards the expected performance of EE projects in South African ESCos. The study developed a framework for the effective learning practices which lead to better performance in implementing EE projects. As such, the specific objectives were:

a) To identify and investigate the various learning patterns, indicators and practices within SM ESCos in South Africa.
b) To identify the internal and external factors that influence effective learning practices in SM ESCos.
c) To determine the level of performance and key performance indicators by SM ESCos undertaking Energy Efficiency building projects in South Africa.
d) To examine how the organizational learning processes and practices within SM ESCos impacts on the performance of energy efficiency building projects in South Africa.

1.6 Scope

The research is underpinned by various areas of organisational theory. The study reviewed processes of organisational learning within SM ESCos. This decision allowed the study to examine internal organisational learning in SM ESCOs by obtaining a holistic view on issues of skill, practices and strategies, human resource management, knowledge management and efficiency in relation to business performance (Ellström, 2010, March, 1991 and March and

Olsen, 1976). The study reviewed a number of projects which had been completed against the allocated or targeted projects. This allowed the study to focus on the impact organizational learning has on business performance through improved project performance achieved by effective learning practices.

1.7 Limitations

The geographical and cost limitations allowed the study to use limited cases of SM ESCos located in and around the Gauteng province. The study only reviewed intra-organizational learning within SM ESCos. In addition, only the DSM initiatives implemented by SM ESCos in South Africa were reviewed.

1.8 Assumptions

The following assumptions were made in the study:

i. ESCos are learning organizations.
ii. Organizations that learn encourage effective learning processes that lead to improved performance.
iii. Best practice for learning processes leads to effective organizational learning.
iv. Small and medium ESCos also have a business failure rate similar to that of SMEs.
v. The proposed respondents will answer the interview questions honestly.

1.9 Justification of study

Electricity supply insecurity issues compel the South African Government to use energy efficiency as an approach to manage energy supply and usage. The study specifically chose to examine the organizational learning of SM ESCos. Learning assists to generate and update knowledge in organizations which aligns with the organisation's visions and targets (Lines, Sáenz and Aramburu, 2011; Senge, 1990). Such effects of knowledge are further strengthened to the degree that firms develop and deploy superior structures and routines for utilizing knowledge in their products and processes (Nickerson and Zenger, 2004). The possession of superior knowledge acquired through organisational learning broadens

competitive advantages, capabilities and efficiency ensuring overall improved performance (Lines, Sáenz and Aramburu, 2011).

ESCos are crucial and effective vehicles that promote and implement energy efficiency initiatives (Vine, 2005). In South Africa, both small and medium sized to large ESCos are used to implement energy efficiency initiatives. However, SM ESCos are particularly prone to business failure. Among many factors that influence business failure rates is the lack of review of current learning patterns, learning from past mistakes and assessing the level of learning occurring in the organization. SM ESCos are faced with complex projects, diverse participants and diverse knowledge. Learning becomes important to ESCos and the Energy Efficiency agenda because the projects are diverse and often have different project set-ups. Furthermore, organizational learning facilitates and connects the multi-aspects to ensure the projects' targets are met.

1.10 Methodology

The study's research agenda and methodology is briefly outlined in Figure 1.10.

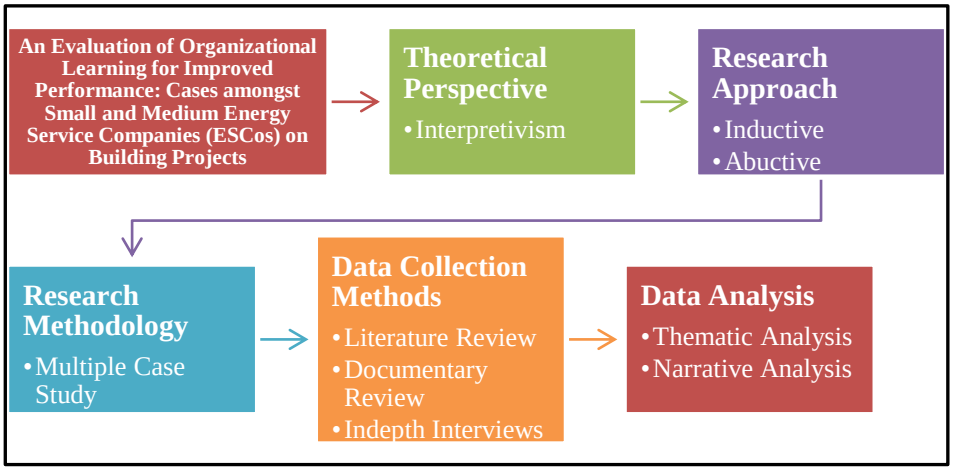


Figure 1.10 Research Methodology

The selected theoretical perspective of the study was the Interpretivist paradigm and qualitative methods were utilized. The study used the inductive approach that started the research with theory developed from reading academic literature and then designed a strategy to test the theory (Saunders *et al.*, 2012). However some elements of the abductive approach were used as themes and patterns were identified and existing theory was used to modify and

recommend best practice (Saunders *et al.*, 2012). The concepts of organizational learning and learning processes were generally well defined however not well described in relation to their application in SM ESCos in South Africa. Thus, the use of an inductive approach was suitable. The findings obtained from the field by way of in-depth interviews were categorized into themes and patterns to suggest a best practice and build on organisational theory. The use of the multiple case study method aided the study to obtain insight and multiple perspectives into the processes of organisational learning within SM ESCos in South Africa. The case study approach provided an understanding of similarities and differences in organisational learning of different SM ESCos. This study strategically chose to use several data collection tools to satisfy reliability, construct validity, internal validity and external validity.

1.11 Outline of Chapters

The thesis is divided into 6 chapters namely the introduction, literature review, research methodology, data analysis, discussion and conclusion and recommendations. The above mentioned chapters are discussed below:

Introduction: The introduction provides the background to the study, the rationale, the problem statement, the research question, the research objectives and methodology. This chapter provided the grounds for the study.

Literature review: The literature review identified and examined the crucial theoretical framework reviewed and written on: energy efficiency, learning, organizational learning, organizational knowledge, energy service companies, performance, factors and challenges affecting learning.

Research Methodology: The chapter explained and justified the research approach the study utilized to satisfy the research objectives. The research was described in terms of the paradigmatic framework, research philosophy and the choice of methodology and research techniques.

Data Analysis: In this chapter the field findings were presented in respective themes.

Discussion: The focus of this chapter was to present the analysis and interpretations of the research findings.

Conclusion and Recommendation: The final chapter concluded the study. This chapter highlighted the findings which established the proposition for improvements and the shortcomings. The chapter also suggested recommendations for future research.

1.12 Ethical Consideration

The study adhered to the ethical conditions stipulated by the University of the Witwatersrand. Furthermore, voluntary permission was obtained from the participants. Extra care was taken to assure both the University and participants that the research was solely for academic purposes and was not used commercially. The research was careful not to violate human rights, use vulnerable populations and put participants at risk.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter presents an overview of Organizational Learning in small and medium sized ESCos. The study focuses on evaluating organizational learning in small and medium-sized ESCos in South Africa that undertake energy efficiency projects in buildings. The study further seeks to evaluate the impact that learning has on performance. The literature reviewed is presented as follows: sections 2.2 and 2.3 reviews issues pertaining to the general and South African energy landscape and the current state of energy efficiency in buildings. Thereafter section 2.4 discusses ESCos from the global and local perspective. In conclusion section 2.5 and 2.6 examines various aspects of organizational learning including factors and performance in small and medium sized ESCos.

2.2 Energy

Energy is integral to day to day activities. According to Ghosh and Prelas (2009), energy is necessary in two forms: electricity and liquid fuel mainly for transportation. Energy is defined as an observable quantity available in the surrounding and can be classified as either renewable or non-renewable (Chiras, 2011). Renewable energy is the collective term that summarizes energy derived from regenerative resources (Andexer, 2008). The renewable energy sources are reproducible non-fossil sources such as: solar, wind, hydropower, biomass to name a few (Andexer, 2008). Non-renewable energy sources are finite and dependent on natural processes and resources such as fossil fuels (Ghosh and Prelas, 2009). Some of the energy sources considered as non-renewable are: petroleum (oil), uranium and thorium (nuclear energy), natural gas and coal (Ghosh and Prelas, 2009). The challenge is non-renewable energy sources are quickly depleting while renewable energy is hard to produce, harness and diffuse. Generally, the world relies on fossil fuels and natural resources as energy to produce electricity. Figure 2.1 illustrates the different types of energy sources used and the respective quantities that have been and will be used over fifty years.

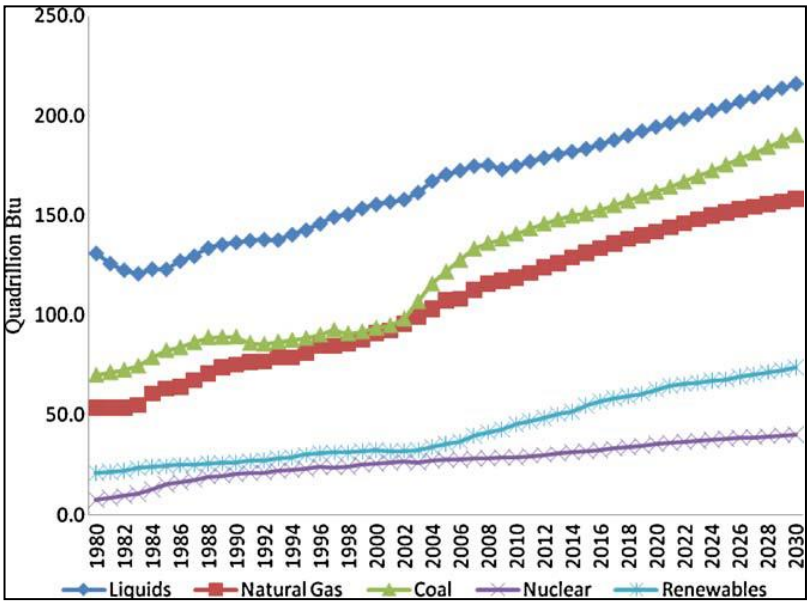


Figure 2.1: Historical and projected world energy demand by fuels
(Source: Akorede *et al.*, 2010)

According to Akorede *et al.* (2010), the world energy demand reflects a total increase of 44% over the projection period and a net electricity generation worldwide of 31.8 trillion kWh in 2030. Figure 2.1 illustrates the different sources of energy namely liquids, natural gas, coal, nuclear and renewables. The diagram indicates the level of historical and projected demand of these fuels in Quadrillion Btu (a unit used to measure the consumption of energy).

The focus on energy was majorly influenced by the energy crisis in the 1970s. The energy crisis was a sharp rise in price in the supply of energy resources, diminished supplies and increased worldwide energy demand (Black and Flarend, 2010). The energy crisis began to occur between 1970 and ended in the late 1980s (Cassedy and Grossman, 1998). Before the 1970s energy crisis, it was noted that the demand for electricity would constantly increase (Akorede *et al.*, 2010; Chapman *et al.*, 1972). It is reported that post the world war decades; the energy consumption globally had increased by more than all the history of energy consumption from the 1940s (Mieczkowski, 2005). The Arab oil embargo compounded by price controls that the Nixon's administration (the American presidency in the 1970s) caused an imbalance on the supply and demand (Mieczkowski, 2005).

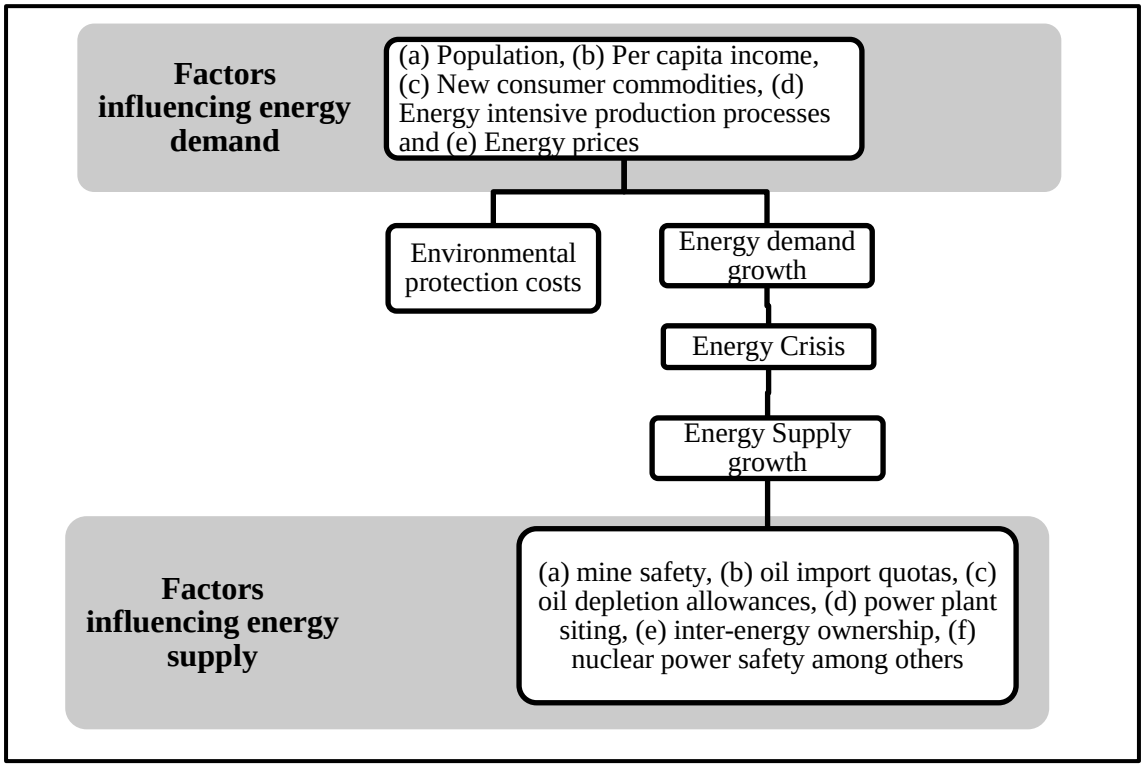


Figure 2.2: The dynamics of the Energy crisis

(Source: Adapted from Chapman *et al.*, 1972)

Chapman *et al.* (1972) illustrate in Figure 2.2 the dynamics of the energy demand and supply on the energy crisis. The increased energy demand was not met due to the factors that influenced the supply of energy. The result of the increased energy demand and low energy supply were costly impacts on the environment and caused the energy crisis. The energy crisis had a worldwide impact on the availability of energy resources. This lead to the review of different energy approaches such as energy efficiency and alternative energy resources.

2.3 Energy Efficiency

There is a global awareness of the need to implement energy efficiency measures in the wake of global warming and resource shortages (Kok *et al.*, 2011; Vine *et al.*, 2010; Menanteau and Lefebvre, 2000). It is noted that improving energy efficiency is often the most economic and readily available means of improving energy security and reducing greenhouse gas

emissions (IEA, 2008). Therefore energy efficiency is a shared policy goal of many governments around the world (IEA, 2008).

2.3.1 Energy efficiency overview: Global

The last few decades have witnessed considerable progress in energy efficiency. Since the 1990s, there has been an annual global decrease of 1.3% in the energy intensity i.e. the energy required per unit of GDP (Enerdata, 2013). However, globally the energy demand and consumption is increasing due to increased electricity demand (Enerdata, 2013). According to EIA (2007), energy consumption increases are driven by population growth and economic growth. In industrialized or mature economies some major contributors to energy consumption are: increased demand in electricity, the growing transport sector and the rapid expansion in the service economy (IEA, 2008). Figure 2.3 illustrates the history of different energy consumptions of various countries between 1990 and 2005. The diagram is indicative of energy consumption in different sectors.

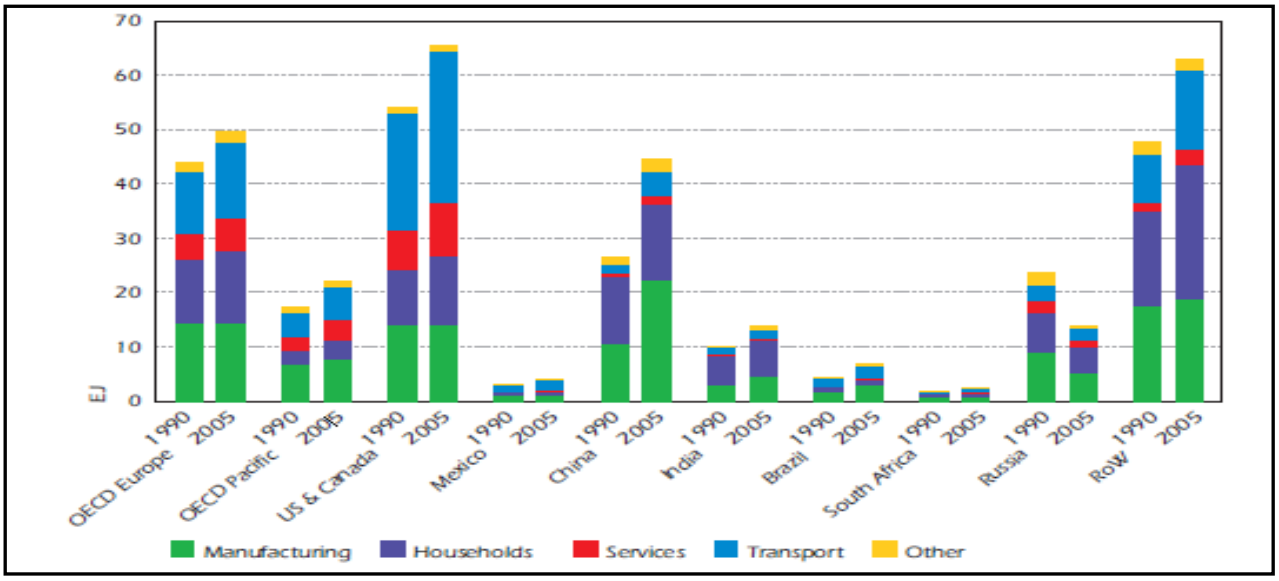


Figure 2.3: Total Final Energy Consumption by Sector
(Source: IEA, 2008)

In Figure 2.3, the IEA (2008) illustrates the past and projected energy sources and consumptions of various continents and regions between 1990 and 2030. Figure 2.4 further indicates the annual growth in energy consumption and the use of different energy sources.

Region/Source	Year					Growth
Region	1990	2004	2010	2020	2030	% Annual growth 2004–2030
OECD North America	100.8	120.9	130.3	145.1	161.6	1.1
OECD Europe	69.9	81.1	84.1	86.1	89.2	0.4
OECD Asia	26.6	37.8	39.9	43.9	47.2	0.9
Non-OECD Europe & Eurasia	67.2	49.7	54.7	64.4	71.5	1.4
Non-OECD Asia	47.5	99.9	131.0	178.8	227.6	3.2
Near East	11.3	21.1	26.3	32.6	38.2	2.3
Africa	9.5	13.7	16.9	21.2	24.9	2.3
Central & South America	14.5	22.5	27.7	34.8	41.4	2.4
Total OECD	**197.4**	**239.8**	**254.4**	**275.1**	**298.0**	**0.8**
Total Non-OECD	**150.0**	**206.9**	**256.6**	**331.9**	**403.5**	**2.6**
Source						
Oil	136.2	168.2	183.9	210.6	238.9	1.4
Natural Gas	75.2	103.4	120.6	147.0	170.4	1.9
Coal	89.4	114.5	136.4	167.2	199.1	2.2
Nuclear	20.4	27.5	29.8	35.7	39.7	1.4
Other	26.2	33.2	40.4	46.5	53.5	1.9
TOTAL WORLD	**347.3**	**446.7**	**511.1**	**607.0**	**701.6**	**1.8**

Note: does not include traditional biomass
Source: EIA, 2007

Figure 2.4: World total marketed energy by region and fuel, 1990-2030 (quadrillion Btu) (Source: EIA, 2008)

Figures 2.3 and 2.4 give a clear indication of the high demand for energy using different energy sources over the various sectors (EIA, 2008). Supplying the ever increasing demand of energy is not feasible and requires using energy more efficiently. The level of implementation related to Energy Efficiency measures varies in different countries and sectors. According to Pasquier and Saussay (2011), the following countries are some examples of progressive energy efficiency implementers:

Australia - Australia has an exemplary Minimum Energy Performance Requirements (MEPS) programme, which includes standard procedures for compliance, monitoring and enforcement of Energy Efficiency.

Canada - Canada has established an Energy Efficiency Act that evaluates energy efficiency policies and programmes namely the (a) the strengthened energy efficiency policies across all

sectors and (b) the Global Superior Energy Performance (GSEP) international task group to advance implementation of the ISO 50001 energy management systems standard.

Czech Republic –The Czech Republic has put into practice: the Energy Performance of Buildings Directive (EPBD) and the Green Investment Scheme (GIS).

Denmark - Denmark finances energy related issues of all sectors through the Danish Electricity Saving Trust (DEST) and has an established knowledge centre for professionals to access energy saving information on materials and methods.

Germany - The German Act on Energy Services and Energy Efficiency Measures ensures energy end-use efficiency and energy services (ESD) are enacted as German Law.

2.3.2 Energy efficiency overview: South Africa.

According to EIA (2007) increased energy demand in developing countries will contribute 46 to 58% of global consumption between 2004 and 2030. It is thus relevant that issues of energy efficiency are promoted in developing countries. South Africa is one of the developing countries reported to be among the top 15 most energy inefficient economies in the world according the EEI (Greene, 2006). In addition, electricity generation in South Africa is dominated by only Eskom and Sasol which proves to be challenging in terms of capacity and efficiency (Regan and McNamara, 2012). Figure 2.5 is a diagram that depicts the energy demand in South Africa.

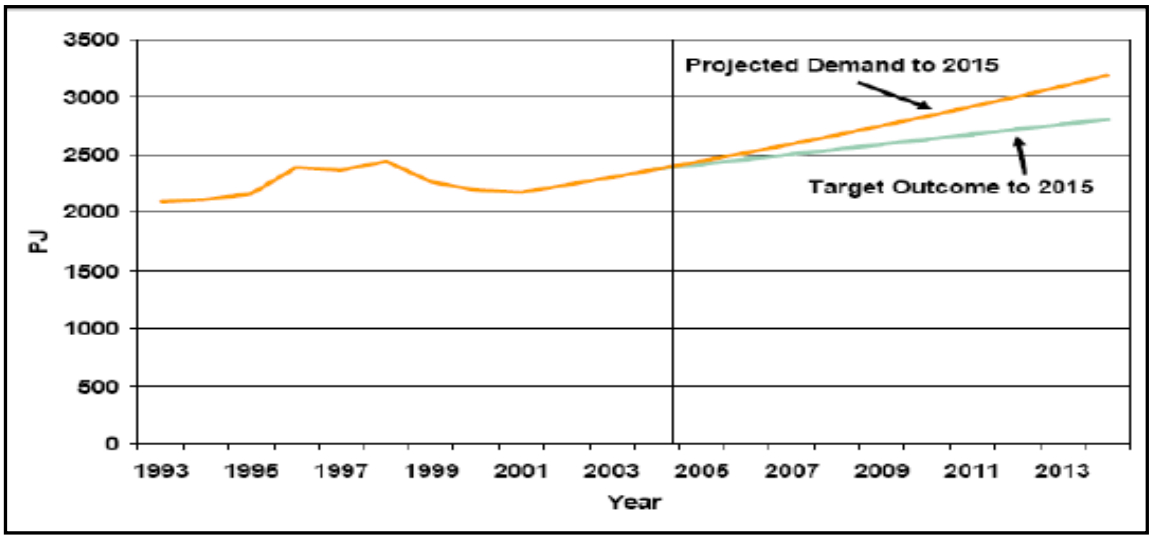


Figure 2.5: The projected electricity demand as per the National Energy Efficiency Strategy (Source: DME, 2008)

According to the DME (2008), Figure 2.5 is an indication of the potential energy savings that can be achieved over the next nine years in South Africa. The intense energy use, lack of electricity generation capability and efficiency has prompted an urgent directive to review electricity supply and demand. An identified overall 20-30% of energy efficiency potential exists in South Africa (DME, 2010). The White Paper on Energy Policy published in 1998 had already established and recognized the need for the efficient use of energy in South Africa. The White Paper recognizes the need for energy and summarizes this well by stating:

"Significant potential exists for energy efficiency improvements in South Africa. In developing policies to achieve greater efficiency of energy use, government is mindful of the need to overcome shortcomings in energy markets." - The White Paper on Energy Policy (1998)

Before the energy shortages; it is reported that in the 1990s Eskom experienced excess capacity prior to the dramatic economic shrinkage exacerbated by Apartheid (DME, 2008). Post the economic shrinkage; Eskom encouraged electricity load growth through negotiated low prices of coal based on long-term contracts (DME, 2008). Additionally; DME (2008) states some of the contributors to the high energy consumption, shortages and diversion away from energy efficiency are:

- Energy conservation was not on the agenda until recently
- Electricity sales were promoted together with initiatives to switch from other fuel sources to electricity
- Mass electrification of previously disadvantaged areas without adequately planning for its supply implications in terms of peak and energy demand.
- The provision of free basic services to the poor without seizing the opportunity to promote efficient use of the resource in the broader residential sector.
- Energy efficiency investment has remained cost-ineffective due to low electricity prices and consequent long payback periods.
- Post 1994 rapid economic growth, which created additional demand not properly factored into Eskom's long-term planning.

Regardless of the aforementioned contributors to the energy issues in South Africa, many initiatives have since been implemented. Since the White Paper of 1998, the Government adopted the Energy Efficiency Strategy of South Africa. The National Energy Efficiency Strategy has set an overall national Target Final Energy Demand Reduction of 12% by 2015 (DME, 2005). The Energy Efficiency strategy was careful to set sector targets (for example 10% in the residential sector and 15% in the commercial sector) and potential energy savings as well.

Table 2.1: Sectorial Energy Efficiency Targets

Energy Efficiency Targets	**2005 - 2015**
Industry and Mining	15%
Commercial and Public buildings	15%
Residential	10%
Transport	9%

(Source: DME, 2010:35)

Table 2.1 points out the different sectors identified as high energy and electricity consumers. The DME (2010) and NEES recognize that energy savings need to be unique to an industry and set targets accordingly (refer to Table 2.1). However, these targets have since been argued as being too conservative. Furthermore, not all the sectors and industries have been identified, assessed and allocated an energy target. In South Africa, there's been an increased focus in investing in the building of more power stations, infrastructure development and using alternative sources of energy. However there still remains the existing building stock (in all sectors and industries) that need to use energy more efficiently. Therefore it is important to continue implementing energy efficiency measures in buildings.

2.3.3 Energy Efficiency in buildings

Energy efficiency (EE) can be defined as the improvements in buildings that could result in lower energy consumption (India Ministry of Power, 2008). These improvements – active (technological) or passive (design) - thus assist to provide more services for the same energy

input or the same services for less energy input (IEA, 2011). The energy savings are determined by comparing energy baselines with energy consumed after implementation of EE measures (India Ministry of Power, 2008). The number of buildings that are labelled as "energy-efficient," "sustainable" or "green" has surged over the past decade (Kok *et al.*, 2011). Buildings are the link between the economy, the workforce, daily users and environment (Managan, Araya and Layke, 2011). Buildings are used for shelter, business, tools of investment, multiple facilities, social and cultural symbols. The need for buildings contributes to the high demand of natural resources for their construction, utilization and eventual demolition. Older buildings were not all built to use electricity and other resources of energy efficiently. Unfortunately these older buildings are what make up the largest stock of buildings compounded by new buildings being built. As a result the built environment is the largest user of energy with the consumption of 40% of energy (USGBC, 2008). To mitigate the inefficient use of energy in buildings many energy efficiency initiatives are being implemented. For proper implementation of these initiatives, an extensive set of guidelines and policies are needed.

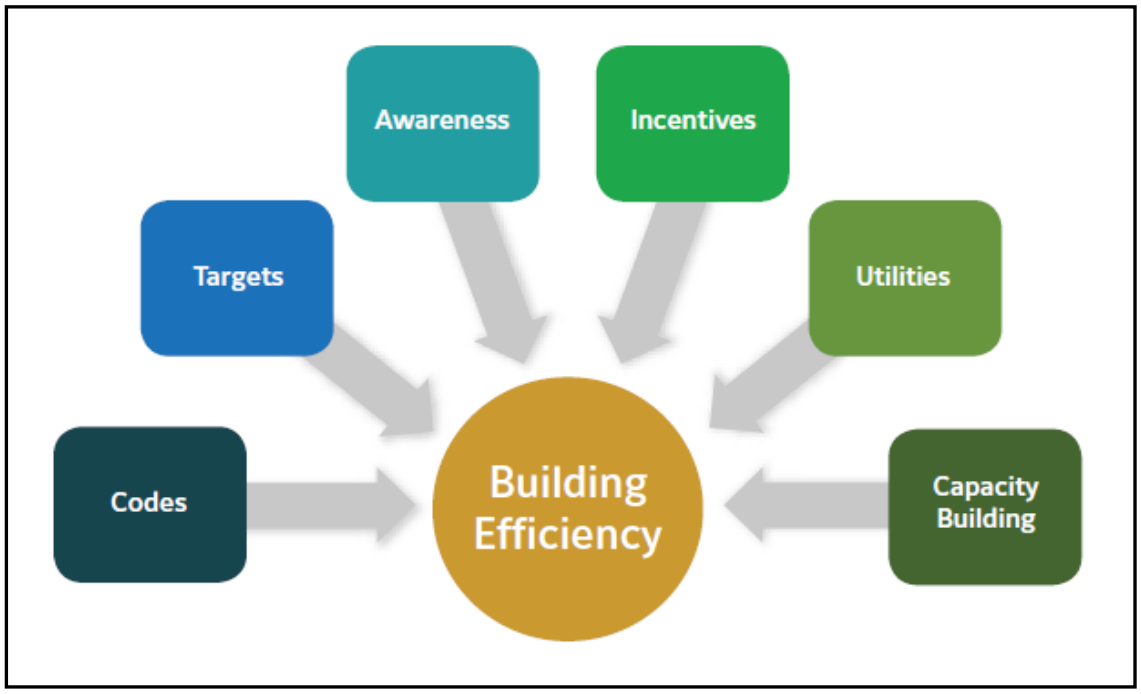


Figure 2.6: Policies can enable energy efficiency transformation
(Source: Adapted from Managan, Araya and Layke, 2011)

As suggested by Managan *et al.* (2011) in Figure 2.6, a holistic approach is needed when making a building more energy efficient. It's imperative to assess the potential building's (existing or to be built) capacity and utilities requirements. With the acquired knowledge energy efficiency targets can be set and the building's designers and users can be made aware and even incentivized to design and use buildings more energy efficiently. However these considerations need to be safely guided by building regulations and codes which should later become policy.

In South Africa, there are two options for energy management: supply side and demand side. Initially, supply side options such as load shedding were used over demand side management (DSM) as a strategy to manage energy (Singh, 2008). The Energy efficiency and Demand Side Management program (EEDSM) is now one of the choices of strategy implemented to meet the national energy demand reduction target (DME, 2010). DSM are activities stimulated by the electricity suppliers (Eskom) that promote resourceful use of electricity from the demand side (The customers) (Calymer, 2006). The DSM programme involves using Energy Service Companies (ESCos) to install energy efficiency technologies and other services (Singh, 2008).Various sectors such as commercial, residential, agricultural, industrial sectors are key focus areas (Singh, 2008; DME, 2005). Instruments used to implement energy efficiency plans include: energy conservation plans, efficiency standards, appliance labelling and energy service companies (DME, 2010; DME, 2005).

Although the White Paper of 1998 paved way for the Energy Strategy of South Africa, energy efficiency regulations were only finalized in the year 2011 (Reynolds, 2012; NBR, 2011). The cheap electricity did not incentivize energy efficiency because of long pay-back periods (DME, 2008) and Government subsidized homes built with no insulation/ceilings (Reynolds, 2012). Current energy efficiency requirements for buildings dictate that all new buildings and extensions comply with the National Buildings Regulations' (NBR) energy usage. This regulation promotes energy saving through:

- better insulation
- more energy efficiency by decreasing vulnerability to air leaks from poorly sealed windows/doors/ceiling
- reduced reliance on electrical energy for heating and cooling (NBR Part X, 2011).

In addition NBR Part X (2011) states that fenestration; roof assembly and orientation in/of buildings should be in accordance with SANS 204 and/or Regulation XA. The above considerations should be designed or recommended by "a competent person that demonstrates an understanding of theoretical annual energy consumption and demand less than or equal to specified values" (NBR Part X, 2011).The NBR XA Energy Usage in Buildings states:

> "*XA1: Buildings shall be designed and constructed so that they are capable of using energy efficiently while fulfilling:*
> *(a) User needs in relation to vertical transport, if any, thermal comfort, lighting and hot water; or*
> *(b) Have a building envelope and services which facilitate the efficient use of energy appropriate to their function and use, internal environment and geographical location.*
>
> *XA2: Hot water heating requirement: at least 50% of the annual average hot water heating requirement shall be provided by means other than electrical resistance heating including but not limited to solar heating, heat pumps, heat recovery from other systems or processes and renewable combustible fuel."*

This updated energy regulation is an essential policy tool. When implemented together with other initiatives like ESCos, campaign awareness, labelling among others (DME, 2010); energy efficiency can be promoted.

2.4 Energy Service Companies (ESCos)

2.4.1 Global view of ESCos

A worldwide assessment of ESCos conducted by Urge-Vorsatz *et al.* (2007) reports that the ESCO concept appeared for the first time in Europe more than 100 years ago (Bertoldi *et al*., 2006). In the United States, ESCos emerged in the 1970s after the oil crisis which led to increasing energy prices (Urge-Vorsatz *et al.*, 2007). ESCos in the United States were supported through Governmental programmes which included DSM programmes aimed at energy saving on the consumer's end (Urge-Vorsatz *et al.*, 2007). It is noted that the ESCos

industry began to gain notoriety and appear in most developed countries during the late 1970s and early 1980s (Vine, 2005). The concept of ESCos has continued to flourish and can also be seen in developing countries such as Kenya, Togo, India and Argentina. In South Africa the majority of ESCos activity became prominent in the late 1990s and early 2000s (Volschenk, 2007). Currently there stands a huge opportunity in non-OECD countries

The concept and application of ESCos differs considerably from country to country and industry. Primarily an energy service company (ESCos) is an entity which has been set up by a public sector organization (with or without private sector participation) that is engaged in developing, installing and financing comprehensive, performance-based projects for the purpose of delivering energy efficiency, energy management, energy savings and/or sustainable energy, whether through a variety of different initiatives or through a particular initiative typically over a 5 to 10 year duration (Bertoldi *et al.*, (2010); Bobker, 2009; Vine, 2005; Singer and Lockhard, 2002; Dayton *et al.*, 1998; Cuday and Dreessen, 1996; Goldman and Dayton, 1996). The services provided and the models of these ESCOs vary from industry to industry and country to country. Usually, the three principal key stakeholders in the energy efficiency and ESCos industry include the end-user, energy auditors and the banks/financial institutions (Kulkarni, 2006). ESCos models can be described and identified into different groupings as per Figure 2.7:

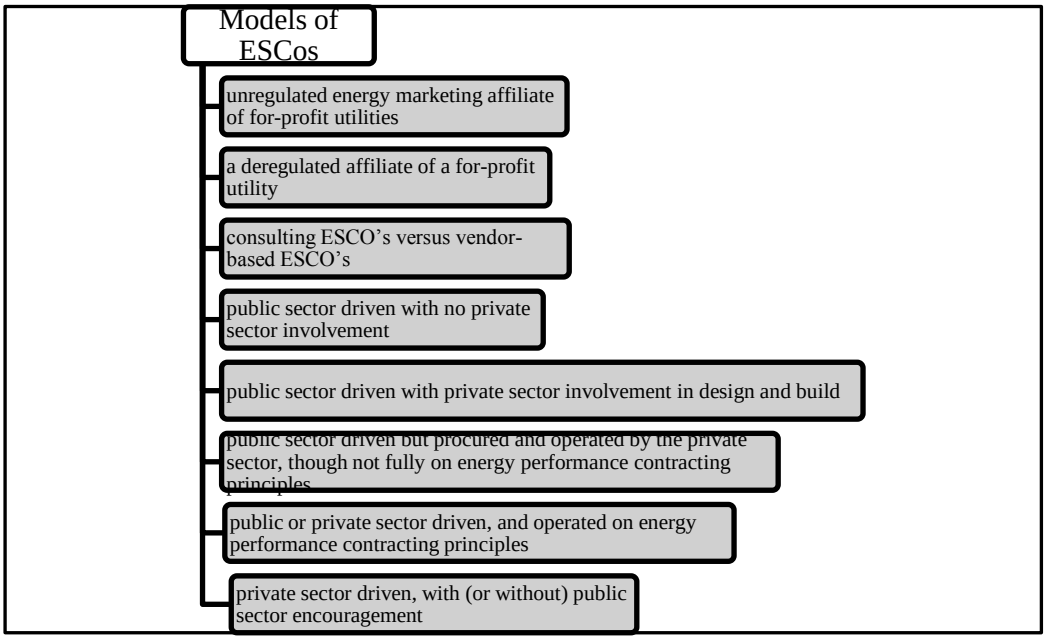


Figure 2.7 Classifications of ESCos

(Source: Adapted from Bertoldi *et al.*, 2010; Brodies LLP *et al.*, 2007)

ESCos are concentrated in the commercial/public sector of most developed countries while developing countries have the highest ESCos concentration in the industrial sector (Ellis, 2010; WEC, 2008). There's a need to expand ESCos activity in the residential, agricultural and transport sectors which remain relatively unexplored (Urge-Vorsatz *et al*. and Metz, 2007).

Table 2.2: Overview of ESCos activity

Country	**Level of Development**	**Market Sector**	**% ESCos Activity**
United States of America	Developed Country	Public	70%
Brazil	Emerging Economy	Industrial Commercial	43%
Bulgaria, Kenya, Egypt, The Philippines, Thailand and Ukraine	Developing	Industrial	70%
India and Mexico	Developing	Industrial Commercial	Increasing activity
Nepal and South Africa	Developing	Residential	Small savings

(Source: Adapted from Urge-Vorsatz *et al.*; Metz, 2007).

2.4.2 South African view of ESCos

In South Africa, ESCOs can generally be identified as public sector driven but procured and managed by the private sector (Eskom, 2010). Additionally, ESCos are operated on energy performance contracting principles (Eskom, 2010). Most ESCOs are employed by Eskom under the DSM programmes. These ESCos are further classified as vendor, utility, contractor and engineering firms (PWC and KFW, 2012). The primary source of business for the local ESCO industry provides financial assistance through its "profitable partnership programme" (Ellis, 2010). Viable energy efficiency projects that are designed to make business and buildings more electricity efficient and reduce electricity consumption are fully funded by Eskom with the beneficiary paying fifty percent (50%) of the capital expenditure of the

project of the life span of the contract (Crossley, 2007). Figure 2.8 below indicates a description of the geographical distribution of ESCOs in South Africa.

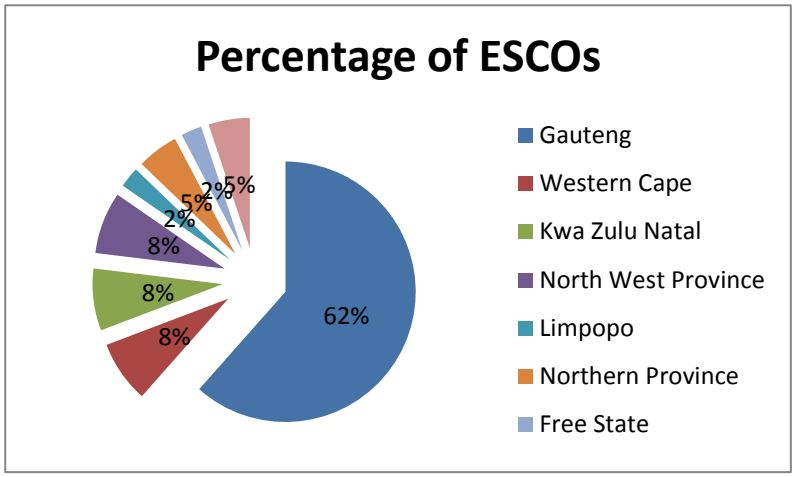


Figure 2.8: Geographic distribution of ESCOs in South Africa
(Source: Adapted from Volschenk, 2007)

Figure 2.8 is representative of the ESCos geographical footprint in South Africa (Volschenk, 2007). Gauteng has the highest number of ESCOs in the country. According to Volschenk (2007), most ESCos are active in the industrial sector rather than the domestic/residential sector. ESCos in the industrial sector contribute less to black empowerment and SMME development than those operating in the domestic and residential sectors (67 out of 104 of the ESCOs in the industrial sector do not contribute to empowerment targets, while 21 out of 36 do drive empowerment in the domestic and residential sectors) (Volschenk, 2007). Nevertheless, ESCOs in South Africa have the potential to provide energy services in the following market sectors: industrial, commercial, domestic, residential, agricultural and transport (Kellermann, 2009)

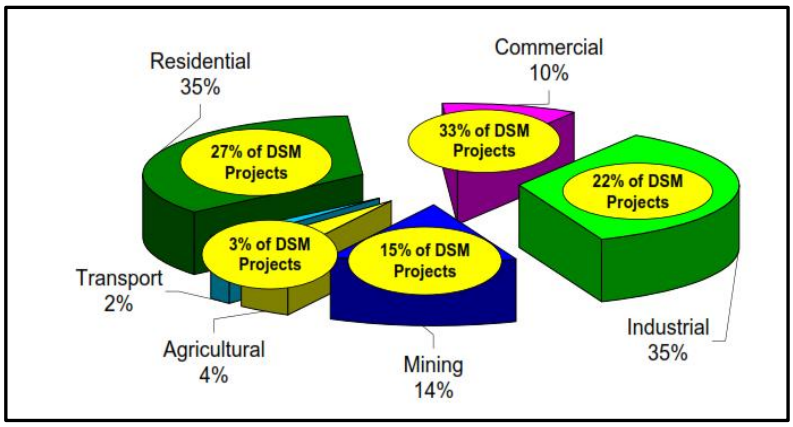


Figure 2.9: DSM projects related to sector size
(Source: Kellermann, 2009; Eskom, 2006)

Table 2.3: Total value of ESCos projects in developing countries

Country	Total value of ESCos projects from 2001
China	$ 49.7 million
Poland	$ 30 million
South Korea	$ 20 million
South Africa	$ 10 million
India	$ 1 million

(Source: Urge-Vorsatz *et al.*, 2007)

Figure 2.9 and Table 2.3 are an indication of market penetration through Eskom's distribution and initial value of DSM projects in the different energy market sectors (Kellermann, 2009; Urge-Vorsatz *et al.*, 2007 and Eskom, 2006). The DSM projects involve the installation of solar water heaters, smart metering, efficient lighting and the improvement of HVACs/compressed air systems (Kellermann, 2009). The draft Energy Efficiency Strategy of South Africa 2012 has since increased energy reduction targets in each market sector and Eskom has continued to issue more projects (Energy Efficiency Strategy, 2012:16).

2.4.2.1 South African view of small and medium ESCos

ESCos in South Africa only formalized in the early 2000s, are relatively small businesses with 62% centralized in Gauteng (Volschenk, 2007). ESCos in South Africa can be classified as large or small and medium-sized enterprises (SMEs). Although there's no consistent national definition; the financial charter classifies SMEs as businesses with a turnover of five hundred thousand rand to fifty million rand (World Bank, 2011). Small to medium ESCos typically have less than 28 staff members while larger ESCos slightly have more (PWC and KFW, 2012). About 45% of existing ESCos are classified as small to medium, employed in Eskom DSM programmes and report working on project sizes ranging from one million rand to fifty million rand (PWC and KFW, 2012). Adeniran and Johnston (2012) affirm with existing research done in South Africa that SMEs are responsible for considerable economic growth, entrepreneurship, job creation and technological progress. The SME can be a good model to address many sectors especially the Energy sector (Bertoldi and Rezesy, 2005).

2.4.3 ESCos services

ESCOs provide energy services that could come in many forms, but in most cases involve delivering conventional energy, renewable energy (RE), energy efficiency (EE), DSM or load management interventions to facilities owned by a client (Urge-Vorsatz *et al*., 2007). ESCOs in South Africa execute DSM projects according to Eskom guidelines and regulations (Eskom, 2007). These energy services involve but are not limited to the following (Ellis, 2010 and Department of Minerals and Energy, 2005):

- site surveys and preliminary evaluation
- energy audit services
- financing mechanisms
- equipment procurement
- installation and commissioning
- operation monitoring and performance guarantees
- measurement, monitoring and verification of the project's energy savings

ESCos also create technology and transfer it; they provide a great opportunity for a reduction in greenhouse gas emissions through energy efficiency and eliminate many barriers of energy

efficiency projects by reducing operating costs (Ellis, 2010; Hansen *et al.* 2009). Adapting lessons learnt from other countries that have used ESCos can be beneficial to the energy problem in South Africa. In Denmark, ESCos have been used as Facilities Managers to renovate buildings and manage energy requirements for public buildings (Jensen *et al.*, 2010). Satchwell *et al.* (2010) reported that ESCos in the US were still able to deliver energy efficiency services during the 2008 economic crisis. In India, ESCos undertake energy projects in public utilities, commercial and private industries (Sridharan, 2005). While in China, ESCos are role players in the innovation of creating energy efficiency products and part take in energy projects (Chen, 2006). Approximately 85% of ESCos in Germany focus on energy improvements but are also involved in construction, municipal and regional utilities (VfW, 2006). The Demand Side Management (DSM) initiative in South Africa enforced by ESCos has since contributed to energy savings in the residential, industrial and commercial markets (Volschenk, 2007).

2.4.4 Barriers for ESCos

As advantageous as ESCos are to the energy sector, many challenges and barriers are faced by both large and SM ESCos. The range of barriers is common in both developing and developed countries. The main barriers comprise of the following but are not limited to:

(1) financial barriers
(2) lack of human resources: skill shortages and energy management capacity
(3) administrative and transactional costs
(4) procurement and legislative rules/limitations
(5) limited knowledge of ESCOs and reliability concerns
(6) lack of demonstrated experience
(7) challenges with the energy performance contracting business model (Limaye, 2013; Ellis, 2010; Hobson 2009; DME, 2008; WEC, 2008; Urge-Vorsatz *et al*., 2007; ESMAP, 2006; Sharma, 2006; Vine, 2005)

Nevertheless, the ESCOs model is a very useful tool to implement energy services in buildings in South Africa and other energy intensive sectors. The nature of the ESCOs' business is technology and performance orientated which is dependent on organizational learning (Olson *et al.*, 2005; Kock and Guillen, 2001). However Limaye (2013) points out that limited capacity and the lack of demonstrated experience of small and medium sized

ESCos further contributes to limited learning. Learning within organizations is essential. Learning enables organizations to select professionals with the right skills and capabilities; this contributes to the organization's competitive advantage. Literature also shows that organizations that learn improve efficiency and performance (Chatterjee, 2010 and Skerlavaj *et al.*, 2007). Learning generates knowledge or "know how" therefore most organizations are dependent on some form of knowledge. ESCOs are therefore required to focus on learning within their organizations then transferring and implementing this learning to achieve energy related targets.

2.5 Learning within the organization

2.5.1 Sources of knowledge

The main sources of knowledge in an ESCos would be the various professionals that operate within the organization. According to Johri and Khare (2013) professionals provide a mix of experience, contextual information, values and expert insight. The sources of knowledge can be from either internal or external sources. Internal sources of knowledge contribute knowledge from internal processes such as: customer contact, sales and marketing to name a few (Johri and Khare, 2013). External sources of knowledge can be other organizations, subsidiaries and suppliers (Johri and Khare, 2013; Foss and Pedersen, 2001). These sources of knowledge are pivotal to continue the provision of information to the organization, in building the organizational knowledge system and gaining competitive advantage.

2.5.2 Organizational Knowledge

Organizational knowledge is knowledge created by individuals that is made available by linking it to the knowledge system of the organization (Nonaka, Van Krogh and Voelpel, 2006). There are various types of knowledge. The two main types of knowledge identified: are explicit and tacit knowledge (Nonaka and Takeuchi, 1995). The other forms of knowledge will be classified in Table 2.4.

Table 2.4: Knowledge classification

Knowledge Classification		
Explicit Knowledge	**Tacit Knowledge**	**Other**
Domain specific	Abstract	Know how
Formal: Highly structured and strategic	Informal	Know why
Declarative and proceduralized	Unstructured	Know what
Elaborated and compiled	Inert	Care why
Conceptual and procedural	Metaknowledge	
	Situated	

(Source: Adapted from King, 2009, Tiwana, 1999; Nonaka, 1995)

Explicit knowledge is formal and recorded information which exists as words, sentences, documents, organized data, computer programmes and other explicit forms (King, 2009; Tiwana, 1999; Nonaka, 1995).While tacit knowledge is referred to as personal knowledge embedded in business processes, personal beliefs, activities, perspectives and relationships (King, 2009; Nonaka, 1995). Tacit knowledge lends itself to the organization's culture, experience and relationships (Nonaka, 1995). These forms of knowledge contribute to the learning in the organization that form part of the organization's knowledge system.

Knowledge is primarily acquired from professionals that learn and share their learning within organizations. The diverse projects undertaken and expertise needed within ESCos guides the required learning within the organization. Professionals' skills, competences and on the job training enables ESCos to provide technical solutions. Therefore, strategically aligning knowledge with an ESCos' project targets achieves performance.

2.5.3 Organizational Learning

Literature on organizational learning can be traced back to the 1960s until its climax in the 1990s. Consequently there's no single definition for organizational learning. For the purposes of this study, figure 2.10 illustrates a simplified version of organizational learning.

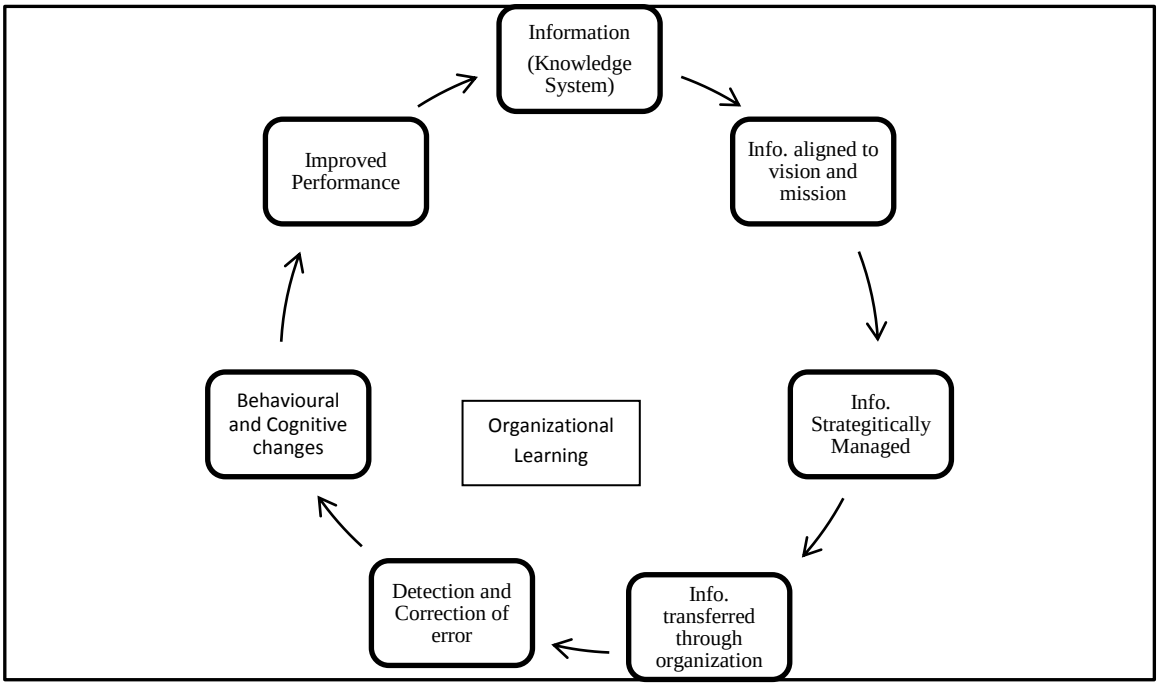


Figure 2.10 The Organizational Learning Cycle

(Source: Author's construction)

Organizational learning will be defined as the strategic management of information which allows transfer of knowledge through the organization (Spector and Davidsen, 2005; Huber, 1991). The acquired organizational knowledge aligns with the organization's mission (Senge, 1990). Through the transfer of knowledge, behavioural and cognitive changes result which impact on organizational performance (Dimovski, 1994). Organizational learning is cyclical thus requiring constant reviewing and adjustments. Learning develops new knowledge that aids change to individual and collective or organizational behavior (Murray and Donegan, 2003; Huber, 1991; Slater and Narver, 1995). This in turn allows the organization to keep redeveloping (Ellström, 2010).

Learning occurs through the individuals, teams/groups and inter/intra organization (Crossa, Lan and White, 1999). However the organization learns as much as its professionals learn and share. Attewell (1992) suggests that learning is transferred when it is embodied in the routines/procedures and practices implemented by the professionals. The transfer of the learning occurs at different levels. Organizational learning occurs at levels differentiated as single-loop, double-loop or triple loop (Argyris and Schön, 1978). Single-loop learning modifies the content of knowledge, processes and actions by entities (individuals, groups or

organizations) according to outcomes (Ellström, 2010 and Argyris and Schön, 1978). These systems within the organization are modified through "detection and correction of error" (Van Grinsven and Visser, 2011). The detection and correction of error refers to the organization correcting the gap between target achievements and actual achievements (Van Grinsven and Visser, 2011, p. 379; Argyris and Scho¨n, 1978; March and Olsen, 1975).

Double-loop learning corrects errors after their detection. Double-loop learning also reviews and corrects the systems within single-loop learning. According to Cope (2003), double-loop learning is responsible for "changing the (mental) frameworks, norms, policies and routines underlying day-to-day actions and routines". Thus double-loop learning allows the organization to assess the systems that led to the initial outcomes at the single-loop learning stage (Argyris and Schön, 1978). Triple-loop learning adapts the changes brought about by double-loop learning into the organization. In addition, triple-loop enables "a change mechanism" for individuals following the feed-back from double-loop learning (Tosey, Visser and Saunders, 2011). Therefore adapting change enables an organization to learn how to learn which is referred to as triple-loop learning (Eilertsen and London, 2012 and Argyris and Schön, 1978).

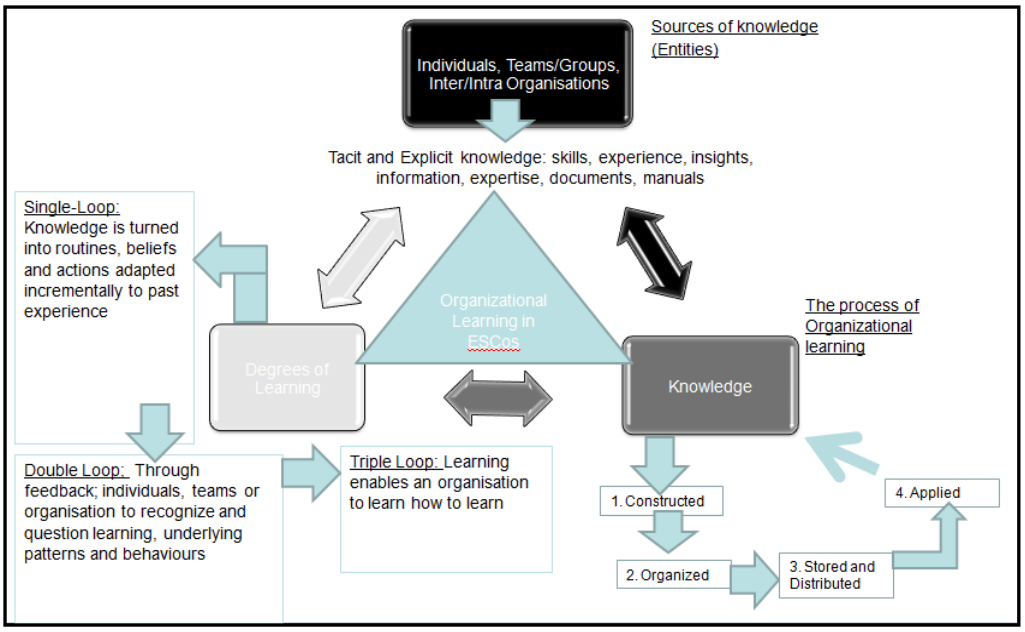


Figure 2.11 The interaction of the components involved in Organizational Learning (Source: Author's construction)

Figure 2.11 illustrates the “components” of organizational learning and how each “component” interacts in the process of learning within an organization. Learning in the organization is dependent on individuals that form part of teams and the organizations. These entities (individuals, teams and organizations) provide different kinds of knowledge to the knowledge system of the organization. The knowledge is then processed and applied where necessary to meet project and organization targets. The degree of learning is important to generate crucial knowledge that leads to improved performance.

2.5.3 Organizational learning processes

The organizational learning process is a constant interaction between the sources of knowledge (entities), knowledge and the degree of learning within an organization. This process is especially dependent on top management’s interactions and interventions. Figure 2.12 illustrates the relationship between the crucial elements involved in the process of organizational learning.

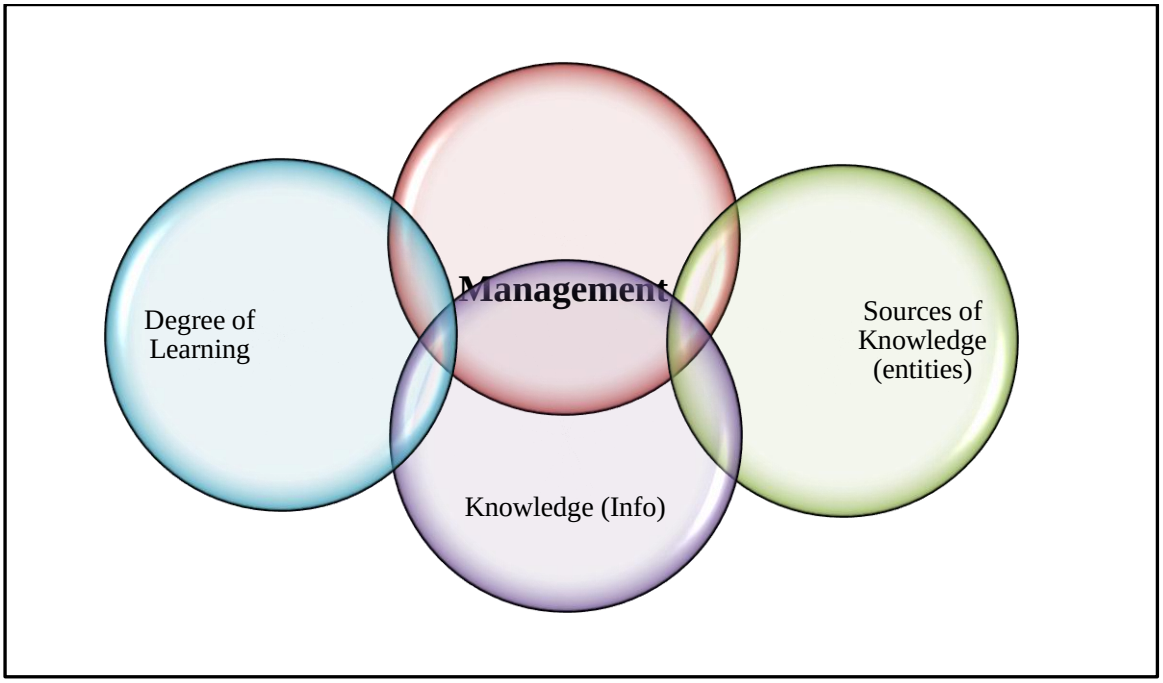


Figure 2.12 The interaction of the constituents involved in the organizational learning process (Source: Author’s construction)

According to Lima and Filion (2011), the process of organizational learning in SME organizations is dependent on their strategic management. When an organization determines and understands its organizational targets and mission, it can facilitate its organizational learning process effectively. Furthermore, strategically managing activities and decisions guides the organization to the right opportunities that can be effectively performed (Lima and Filion, 2011).

The learning process comprises of knowledge acquisition, information interpretation, information distribution and organizational memory (Huber, 1991). Within these learning processes are sub-processes that knowledge passes through namely: construction, organization, storage, distribution and application (Holzner and Marx, 1979). These sub-processes can be thought of as a chain for learning. If any link within this chain fails then the learning process is negatively affected (Holzner and Marx, 1979). Figure 2.13 illustrates how acquired knowledge is synthesized and then applied to appropriate situations to yield required results.

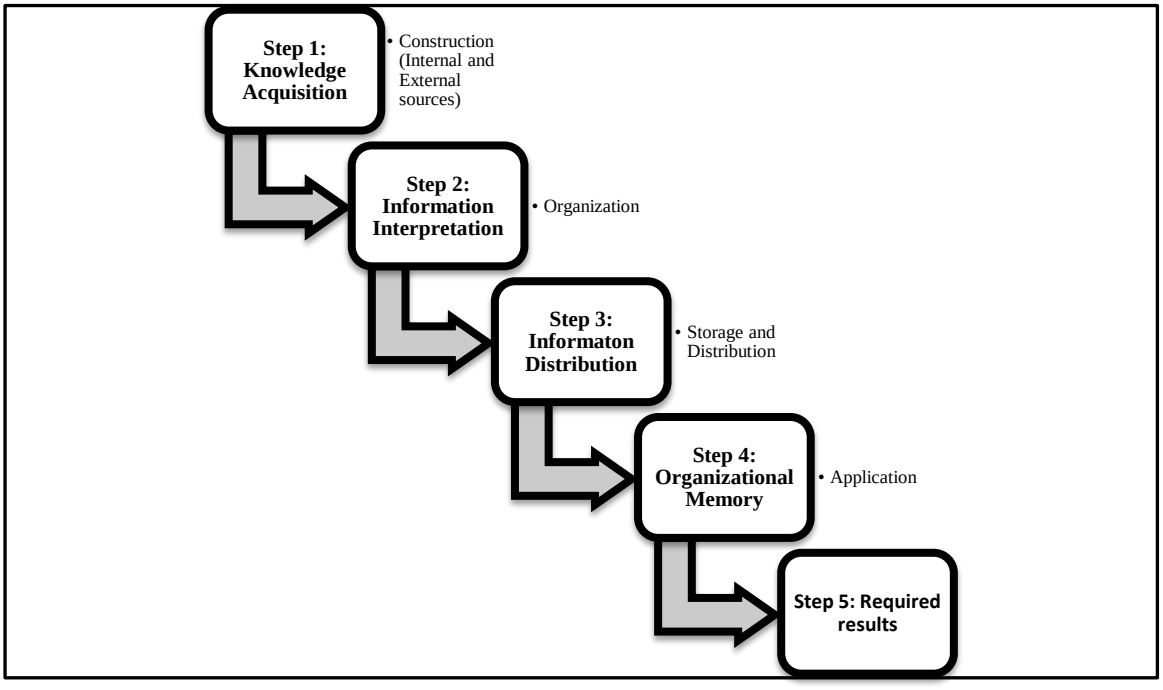


Figure 2.13 The process of organizational learning
(Source: Adapted from Huber, 1991; Holzner and Marx, 1979)

Figure 2.13 shows how the learning process requires individuals to constantly compare previously received information with newly received information (Orange *et al.,* 2000; Huber, 1991; Holzner and Marx, 1979). Learning is essential to generate and update the knowledge in the organization (Lines *et al.,* 2011). Knowledge is acquired from internal (individuals and teams) and external (inter-organization) environments (Lines *et al.,* 2011). Thereafter the knowledge must be contextualized and integrated into the organization's knowledge system (Orange *et al*., 2000). It is important to further assimilate this knowledge in order to solve problems or provide solutions effectively (Orange *et al*., 2000). Contributions to the organization's memory require "continuous testing of experience" and the integration of new and old knowledge (Senge, 1990).

2.5.4 Organizational learning strategies and practices

To achieve a successful learning process, an organization must want to learn and strive to keep redeveloping. Additionally, the organization must implement strategies and practices that enable learning. The organization must evaluate its learning needs in relation to its visions and missions (Senge, 1990). In that way; there is an alignment between the professionals and the professionals' learning needs in relation to the organization's vision and mission.

ESCos organizations (SME and Large) do recognize and appreciate the benefits of learning. Furthermore, some ESCos do promote learning but do not have formalized practices and/or strategies. Formalized practices and strategies assist in the management of knowledge generated from learning and experience. When the iterative learning process is managed, the organization is able to develop resources and capabilities that contribute to organizational performance (Opoku and Fortune, 2011).

Learning by experience reduces costs (Arrow, 1962) however updating and generating knowledge (Lines *et al.,* 2011) is equally critical. Organizations such as ESCOs in technology and learning-dependent industries need to tie their learning strategies directly to their targets, visions and missions (Ellström, 2010; Ebrahim, 2005; Senge, 1990 and Levitt and March, 1988). Various learning practices can be employed in both SME and large organizations without huge cost implications. It is important to start with setting goals in relation to the organization's targets and the knowledge system (King, 2009). Individual and collective

learning also known as "encouraging self-organization' should be promoted and align strongly with the set goals (Mitleton-Kelly, 2003).

Information Systems and Technology (IST) are highly recommended as a tool for monitoring and evaluating organizational learning (Lima and Filion, 2011). IST systematically manages tactical and operational information useful for strategic planning, learning and managing (Coffman and Beer, 2011; Lines *et al.*, 2011). IST can be used to construct a knowledge management system such as a documenting system (King, 2009). The knowledge management system (KMS) allows the organization to access, store, share and review its knowledge so it improves knowledge practices and organizational performance (King, 2009). Furthermore, IST provides a communication platform vital for communication and feedback (Ebrahim, 2005; Mitleton-Kelly, 2003). Apart from IST systems and KMS, it is important to create a "metrics system" that can gauge and evaluate learning (Mitleton-Kelly, 2003). The metric system can be set against the IST, individuals, the KMS and organizational goals and targets.

2.5.4 Factors that influence organizational learning in small and medium ESCos

The learning process within an organization together with the strategies and practices used for learning are influenced by various factors. According to Hitt *et al.* (2000) there is either internal or external factors that affect learning in organizations. Factors such as organizational structure, size (internal factors) or industry, competition (external factors) are some of the factors (Hitt *et al.*, 2000). Learning in ESCos is enhanced or impeded by several determinants. Ellström (2010) categorizes the determinants of organizational learning as (1) subjective and cultural factors, (2) structural factors and (3) leadership and political factors.

Subjective and cultural determinants include the "softer systems" of the organization. Subjective factors include perceptions by individuals about learning (Ebrahim, 2005) and perceptions about learning from failure (Smillie and Hailey, 2001). What is more is perceptions can be closely tied to factors such as job roles and incentives (Ebrahim, 2005). When job roles/descriptions include incentives for professionals that learn (attend workshops and training) performance is encouraged (Garvin, 1993). Such factors exist in an organization with a strong learning culture and environment (Rebelo and Gomes, 2008). Organizational cultures can be further classified as: group, developmental, hierarchal or rational (Skerlavaj *et*

al., 2007). Nevertheless, it is recommended that the organizational culture be adaptable as it is critically required for transformation (Skerlavaj *et al.*, 2007). Firms that have developed a strong learning culture are good at creating, acquiring and transferring knowledge, as well as modifying behaviour to reflect new knowledge and insight (Huber, 1991; Garvin, 1993).

Structural factors of organizational learning examine the organizational strategy, size, structure type, human resources employed, communication and reporting structures (Ellström, 2010; Rebelo and Gomes, 2008; Ebrahim, 2005). Lastly the leadership directly influences the management of the groups of experts in relation to the local and global market, competition and technology. The leadership also makes the important decisions regarding the knowledge base necessary for the organization's capabilities and performance (Ellström, 2010 and Gherardi and Nicolini, 2001).

The factors that determine organizational learning are instrumental in promoting learning within any organization. For ESCos organizations to meet their energy service targets efficiently and achieve intended performance, focus on the factors that promote organizational learning is important. Berthoin-Antal *et al*. (2003) asserts that ESCos that set strategies and norms for organizational learning that can be easily implemented will lead to positive results for the organization, its performance and members. Organizational learning has been studied and adapted to various fields. Studies have showed outcomes of organizational learning behaviours may include changes in values and assumptions (Argyris and Schön, 1978), skills (Fiol and Lyles, 1985), systems and structures (Levitt and March, 1988), core competencies (Prahalad and Hamel, 1990), organizational innovativeness and competitiveness (Nason, 1994), corporate success and employee satisfaction (Bontis et al, 2002).

2.5.5 Performance of small and medium ESCos

Organizational performance is "a far wider concept than just profit or some other financial performance measure" (Skerlavaf *et. al*. 2007 and Yeo, 2003). Organisational learning within ESCos is important in providing competitive advantage and improving organizational performance for energy efficiency projects in buildings (Rebelo and Gomes, 2008 and Yeo, 2003). The importance of improving organizational performance in ESCos will positively address the energy reduction target of the Energy Strategy in South Africa.

Organizational performance in ESCos has to be evaluated, analysed then measured to effectively reach energy targets/goals (Popova and Sharpanskykh, 2010). The use of qualitative (efficiency, effectiveness and equity) and quantitative (profit, number of clients, costs) indicators are performance information that can be used to "measure" performance (Popova and Sharpanskykh, 2010; Askim *et al.*, 2007). The evaluation of performance can be achieved through benchmarking using efficiency data gathered before and after learning (Hucama, 2011). This information must be carefully monitored to obtain data based information on organizational adaptability, success rates in key job and organizational strengths and weakness (Hucama, 2011). This information is useful for management to make decisions on how to improve performance. Behavioural and cognitive changes are other important indicators to also consider when evaluating organizational performance (Hernaus, 2008). The purpose of behavioural changes is to achieve goals, which can mean many different things—ranging from productivity increases to higher efficiency achievements and overall performance improvement (Skerlavaf *et al*. 2006).

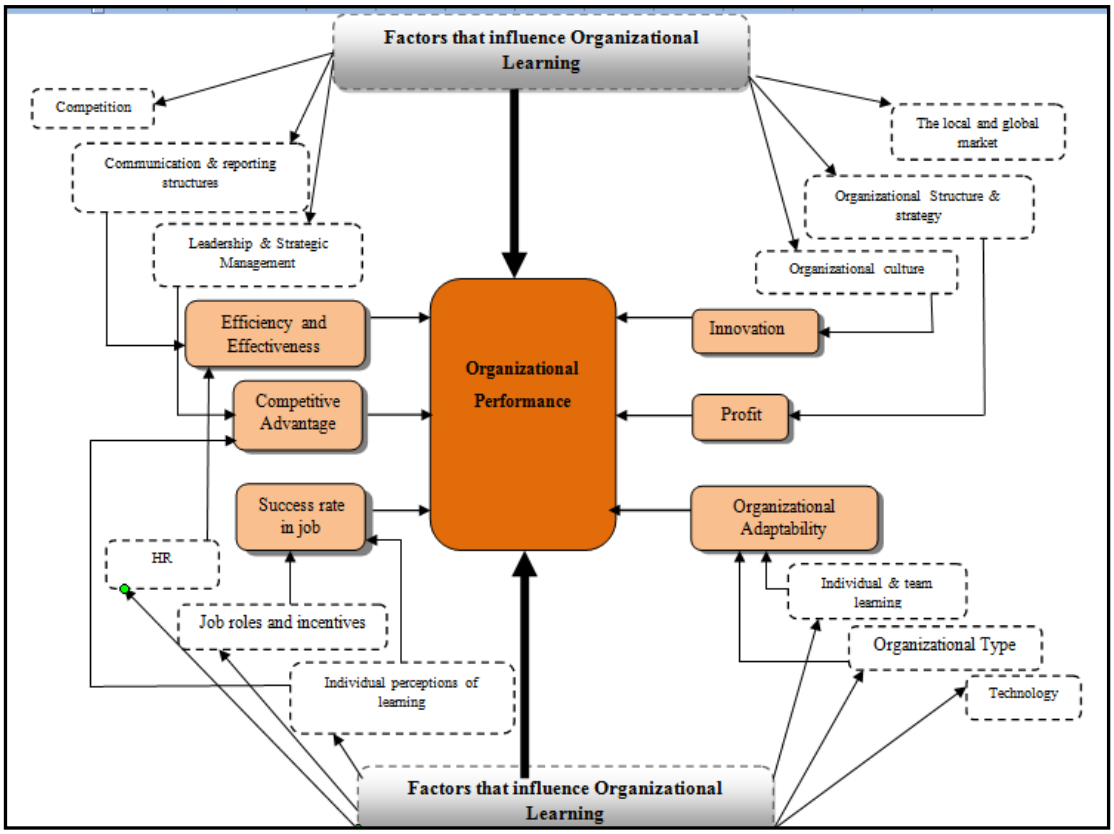


Figure 2.14 Impact of Organizational Learning factors on Organizational Performance (Source: Author's construction)

Figure 2.14 explains the performance indicators and factors that influence the organizational learning. The above factors and indicators are not an exhaustive list nor are the impacts each factor has on the performance indicators. For example, the leadership of an ESCos are responsible for strategically planning and managing learning and other resources to achieve competitive advantage. However how the leadership strategically plans and manages learning and other resources can impact on profits and efficiency as well. The above framework demonstrates that if certain factors that promote learning are present in ESCos, these factors impact positively on the ESCos' performance. ESCos should identify performance indicators and improve them within their organizations if they are to be effective vehicles that promote energy efficiency projects (Goldman and Dayton, 1996). Hence the effectiveness of ESCos like any organisation is dependent on adequate learning within the organisation.

2.5.6 Good practice for Organizational Learning

Organizations should focus on learning strategically (Lima and Filion, 2011). Learning should be aligned to goals. A learning framework must be developed and this framework must make use of suitable and adaptable learning practices. Individual and team learning should continue to be promoted through existing practices like training sessions, workshops, short courses to name a few. In other words, learning within organizations needs to be retained, documented and shared in the organization. Orange *et. al.* (2000) suggest knowledge shared tacitly should be converted to explicit information. ESCos can use post project reports, evaluations, milestone reports and technical reports etc. This information must be integrated into the organization. Making use of technology to create knowledge centres like intranet, extranet and libraries provide access to information gathered like practices, innovations and experiences (Orange *et. al.*, 2000).

Lastly these systems should be evaluated on an outcome measurement basis (Ebrahim, 2005). It is important that ESCos regularly undertake performance evaluation methods in relation to their learning strategies and practices (Popova and Sharpanskykh, 2011). There should be automated methods and staff dedicated to monitoring learning and performance (Popova and Sharpanskykh, 2011).

2.6 Conclusion

From the literature reviewed, the energy landscape in South Africa is still in need of vast improvements. While Eskom focuses on building new power stations and establishing a stable electricity supply, there is continued advocacy for energy efficiency measures (Dames, 2012 and Eskom, 2010). In spite of this, there is no definite indication that the national Final Energy Demand Reduction target of 12% and the sectorial energy efficiency targets that need to be met by 2015 have been met. Frequent power cuts and outages continue post the 2008 electricity blackouts (Vanheukelom, 2013). Furthermore, due to various barriers there is still a lag in the implementation of energy efficiency measures in South Africa (Von Alvensleben, 2013).

Small and medium ESCos tasked with implementing energy efficiency measures are faced with various challenges. ESCos face challenges with their organizational learning that has an impact on their organizational performance towards energy efficiency projects. ESCos' organizational learning needs to comprise of a link between strategic management, the right sources of knowledge, defined learning processes, valuable knowledge generated and how this knowledge is stored and shared. The above elements need to be translated into the organization's procedures. These procedures then need to be evaluated and formally incorporated into the organization by establishing a learning strategy that relates to the performance strategy.

The next chapter outlines the methodology used to conduct the study. The research methodology verifies the findings from the literature reviewed and the findings in the field. Various energy professionals in ESCos were interviewed to evaluate organizational learning, learning processes, strategies and practices. The interviews were conducted to also obtain insight into energy targets/goals, performance indicators and how organizational learning was linked to the organizational performance. Government and company (such as statutory, strategy and policy documents) were reviewed to establish practices in the field concerning organizational learning. The findings were analyzed and presented in Chapters 4, 5 and 6.

CHAPTER 3: RESEARCH METHODOLOGY

3.0 Introduction

This chapter describes the adopted research methodology and its substantiation. The first section describes the research questions and its derivatives. The second, third and fourth sections deal with the research design and approach. The subsequent sections discuss the data collection methods and the validity and reliability of the methods. Lastly, the chapter concludes with the limitations and ethical considerations for the study

3.1 Study rationale and research questions

The study was conducted in 2013. The study reviewed a total of four cases. The respective cases were small and medium sized ESCos that are situated around Gauteng. The study was guided by the main question "How does organizational learning within SM ESCos impact on the organizational performance of energy efficiency building projects in South Africa?" To aid the answering of the main question, sub questions were generated.

The first and second sub-questions are "How does organizational learning occur in SM ESCos undertaking energy efficiency building projects?" and "How do internal and external factors influence organizational learning in SM ESCos undertaking energy efficiency building projects?". The first sub-question identified indicators of learning and how learning occurs in SM ESCos. While the second sub-question identified the factors that influence effective learning practices in SM ESCos.

The third and fourth sub-questions are "How are SM ESCos undertaking energy efficiency building projects in South Africa performing?" and "How do the organizational learning practices facilitate performance in SM ESCos undertaking energy efficiency building projects in South Africa?". These two questions determined the level of performance and investigated the various organization learning practices within small and medium ESCos in South Africa.

3.2 Research Framework

The study's research framework was guided by the "research onion" below. To conduct the research, the following aspects were considered: the research paradigm/philosophy, research approaches, research strategy and research instruments (refer to Figure 3.1; Saunders, 2012). The description of the methods of design, sample selection, data collecting, analysis and other research measures were discussed below. This chapter further substantiates the selected research framework.

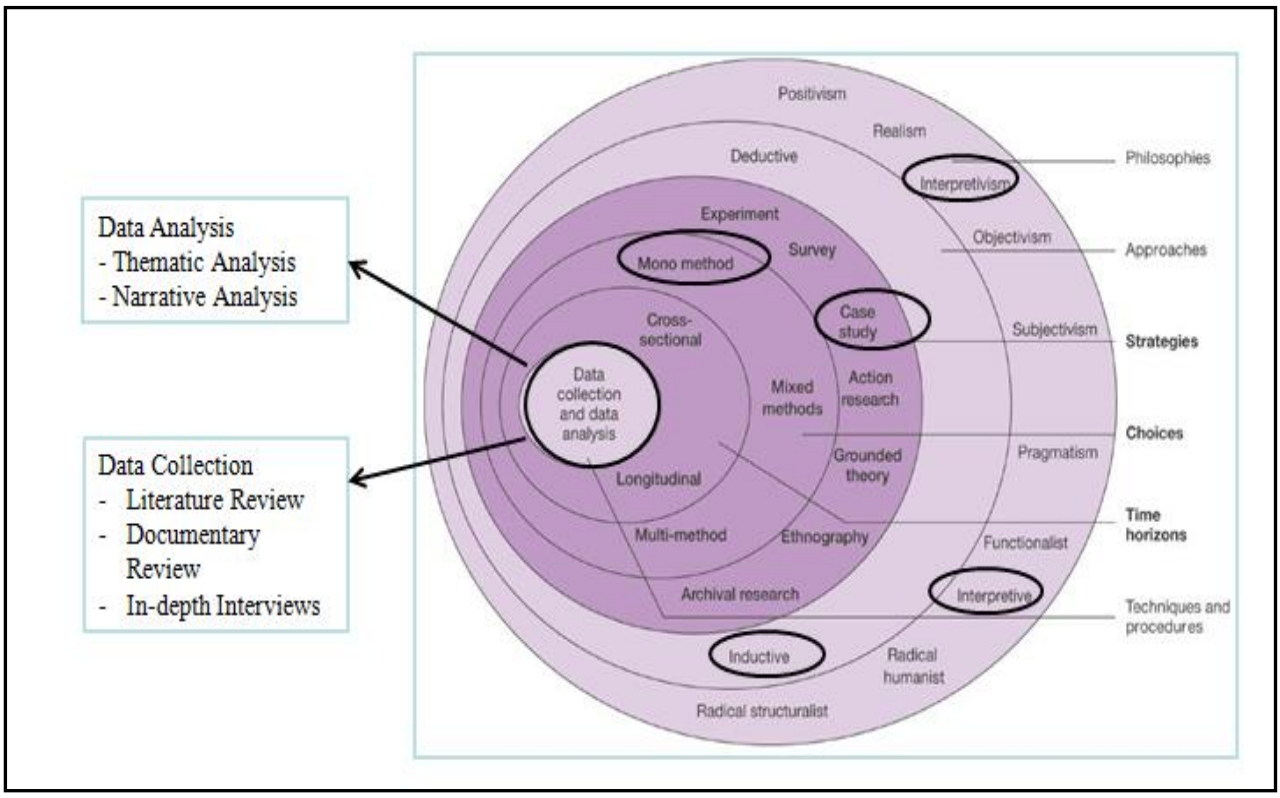


Figure 3.1: Research Onion on the description, explanation and justification of methods of research methodology
(Source: Saunders, 2012:)

3.3 Research paradigm

A research paradigm is defined as the underlying assumptions and intellectual structure/s upon which research and development in a field of inquiry is based (Kuhn, 1970). Paradigms examine social phenomena which particular understandings of these phenomena can be

gained and explanations attempted (Saunders *et al.*, 2012). This study employed the interpretivist paradigm and utilized qualitative methods. The interpretivist paradigm was selected as it obtained a deeper understanding from individuals within the situation studied (Saunders, Lewis and Thornhill, 2012). Complementing the paradigm were qualitative methods that enabled areas of the research to be described, interpreted, verified and evaluated (Leedy and Ormod, 2010; Peshkin, 1993). Using the multiple case study method aided the study obtain insight and multiple perspectives into the processes of organizational learning within SM ESCos in South Africa. The case study approach provided an understanding of similarities and differences in the organizational learning of different SM ESCos. The use of multiple cases yielded more robust conclusions (Yin, 1994; Robson, 1993).

There are two main methodological choices widely used namely quantitative and qualitative. Trochim and Donnelly (2008) differentiates the quantitative choice as a method concerned with numeric data; whereas the qualitative method is non-numeric data concerned with words and images amongst others. Newman and Ridenour (1998) affirm that the qualitative, naturalistic approach is used when observing and interpreting reality with the aim of developing a theory that will explain what was experienced. The quantitative approach is used when one begins with a theory (or hypothesis) and tests to prove or disprove the hypothesis. However, both are concerned with reliability and study designs, and approaches are similar (Taylor, 2005). For the purposes of this study, the qualitative methodology choice was selected and qualitative techniques utilized. The study expanded on the theoretical framework from existing literature. Thereafter the concepts in context and processes of organizational learning in SM ESCos were examined and interpreted. Based on the findings and interpretations, theory was built on and a suggested best practice model recommended.

The nature of research can be exploratory, descriptive, explanatory, exploratory or a combination of these (Saunders *et al.*, 2012). The study used descriptive research. Descriptive research describes situations and events. The researcher is required to observe and then describe what was observed in order to answer questions of what, where, when and how (Babbie, 2005). The study explored and described the SM ESCos as an organisation. In particular, the study gained insight into what the processes of organizational learning within these SM ESCos were. The study also determined how SM ESCos transfer their organisational learning for energy efficiency building projects and the impact this learning has on their performance.

In addition, there are two main research approaches pertaining to theories which are traditionally employed, namely: deduction and induction. The study used the inductive research logic. Inductive research starts with theory often developed from reading academic literature and then designing a strategy to test the theory (Saunders *et al.*, 2012). The concepts of organizational learning, learning processes and factors that affect organisational learning are generally well defined however not well described in relation to their application in SM ESCos in South Africa. The use of an inductive approach was most suitable. The obtained from the field by way of in-depth interview are categorized into themes and patterns to ultimately suggest a best practice and build on organisational theory.

3.4 Research methodology

The methodological approach selected for this research is the multiple case study research design. According to Leedy and Ormrod (2010) and Yin (2003), the case study is an empirical inquiry that studies a poorly understood or little known situation in-depth. The multiple cases approach requires looking at two or more cases to make comparisons or build theory (Leedy and Ormrod, 2010). The research allowed for literal replication in the 4 cases it assessed. A general explanation model was generated to fit each case even though the cases varied in detail (Yin, 1994). The case study approach was suitable because processes of organisational learning in SM ESCos in South Africa are relatively unknown. Four SM ESCos organizations that undertake DSM programmes for energy efficiency projects in buildings were identified. The study subsequently found out how the different components within the organisation impacted on the processes of organizational learning. The processes of organizational learning were then reviewed to understand how they affected the organizational performance of ESCos.

The advantage of case studies according to Yin (2003) is that a phenomenon can be studied without affecting the study subject, cases can be compared and contrasted and multiple perspectives are provided yielding robust conclusions. However case studies can also be prone to lack a systematic reporting of evidence and taking long periods of time (Yin, 1994). The study used the case study approach because it was effective in representing the SM ESCo organization and the processes of learning.

3.5 Population and Sample

3.5.1 Sampling Plan

DeFusco *et al.* (2011) defines a sampling plan as the set of rules used to select a sample versus a whole census. The concept of sampling has been introduced with a view to making the research findings economical and accurate (Singh, 2010). There are two main sampling techniques, probability and non-probability. Probability sampling is associated with survey research strategies where there's a need to make inferences from the sample about a population to answer the research question and to meet the research objectives (Saunders *et al*., 2012). Non-probability sampling provides a range of alternative technique to select samples, the majority including an element of subjective judgement (Saunders *et al*., 2012). Since this study requires in-depth knowledge, is subjective and interpretive in nature, the non-probability sampling technique was selected. The use of purposive sampling, specifically homogeneous sampling was selected because this study used cases that required detailed information. The homogenous population considered for this study included technical professionals, support staff and professionals in management positions. With regards to this homogenous population, the professionals were sourced from SM ESCos and ESCos that provided energy services for the DSM program.

3.5.2 Population: Case Sites

The case sites were SM ESCOs operating in the Gauteng area. Four ESCos ranging from small to medium sized were identified by snowballing. The use of more than one case gave a multiple perspective that provided richer conclusions. In addition, the multiple case studies allowed for the various data sources to be triangulated so as to increase the reliability. The study conducted 11 semi-structured interviews in four small and medium ESCos as indicated in Table 3.2. Energy professionals in management, support staff, technicians and practicing professionals who were junior, intermediate and senior skilled were interviewed individually.

Table 3.2 Respondents schedule

ESCo	**Description of respondent**	**Number of Respondents**
Company A	Management (P-A1) Support staff (P-A2) Technician (P-A3) Professionals (senior, intermediate, junior) (P-A4)	1 1 1
Company B	Management (P-B1) Support staff (P-B2) Technician (P-B3) Professionals (senior, intermediate, junior) (P-B4)	1 1 2
Company C	Management/Support staff (P-C1) Technician (P-C2) Professionals (senior, intermediate, junior) (P-C3)	1 1
Company D	Management (P-D1) Support staff/Technician (P-D2) Professionals (senior, intermediate, junior) (P-D3)	1 1

The respondents schedule (Table 3.2) indicates that a total of 11 professionals in management, technical and administrative roles were interviewed. The criterion used to select the respondents includes:

i. Experience in engineering, management, business administration and a financial background.
ii. The professionals should have served the ESCos for at least two years.
iii. The professionals were skilled in both the hard and soft services of the Energy industry.

iv. Their educational background was ideally in the Engineering, Management and Financial professions. The professionals from the Engineering profession have superior training in technical, managerial and financial activities.

The interviews were set up by appointment. The appointments were made through email and telephone. Then a personal visit was made to the place of employment of the professionals. The face-to-face interviews were conducted individually and took 20 to 40 minutes each.

3.6 The Research Instrument

The study collected data using literature review and documentary review. Semi-structured interviews were used to solicit data from respective professionals working within small and medium ESCos. These instruments are discussed below.

3.6.1 Semi-structured interview

Interviews range from highly formalized and structured to semi-structured to informal and unstructured conversations (Saunders *et al*., 2012). Interviews are one-on-one discussions intended to gather information on specific topics (Harrell and Bradley, 2009). The semi-structured interview is "constructed around a core of standard questions and may expand on any questions in order to explore a given response to a greater depth" (Mitchell and Jolley, 2010).

Saunders *et al.,* (2012) asserts that interviews assist in gathering valid and reliable data relevant to the research questions and objectives. The semi-structured interview allows for the depth of information to be improved, good response rates and the researcher can guide the interview where additional information is required (Walsh and Wigens, 2003). However semi-structured interviews are prone to excess information that isn't useful, interviews are lengthy and comparing responses between respondents maybe difficult (Walsh and Wigens, 2003). The use of semi-structured interviews was used to obtain unique information on the organizational learning from the opinions, views and experiences of the professionals. Due to the number of interviews that needed to be conducted, using the semi-structured interview kept the interview on topical trajectories while allowing some measure of open-endedness.

3.6.2 Literature Review

Literature reviews are systematic reviews of information. Literature reviews provide academic solutions that develop a qualitative appraisal of articles (Jesson, Matheson and Lacey, 2011). A literature review is the most valid and reliable research instrument. The data collected is peer reviewed, updated and holds an accurate account. The literature review involved the exploring of extensive literature on decision making, processes, practices and strategies regarding organisational learning for energy efficiency projects in buildings by ESCos. The literature review was also a guide to selecting the relevant documents for the documentary review and what kind of questions to probe during interviews.

3.6.3 Documentary Review

To obtain information from the respective SM ESCos, a combination of interviews and documentary reviews were adopted. Professionals in management were able to provide their internal visions and missions. This document highlighted their policies and strategies and was able to provide insight into their organisational learning processes and its effectiveness on DSM programmes. Eskom and government documents were assessed online from their websites. This assisted in gaining a clearer understanding of current Energy Strategies and the DSM programmes. Other documents analysed were project based archival documents and government policies.

3.6.4 Data Collection

The data for this study was collected with the above discussed research instruments. Data was collected from primary and secondary sources. Primary data sources included interviews, electronic databases, Government and company documents. The secondary data sources constructed the theoretical framework and the interview questions. The sources were mainly peer reviewed journals, narrative reports and academic books.

The semi-structured interview managed to capture information that the literature was unable to capture. Furthermore, the interviews were fairly open ended to elicit crucial information from the respondents (Polit and Beck, 2008). The face to face interview assisted in observing

the non-verbal communication in which case clarity was sought. The interview consisted of 10 strategic questions asked over 20 to 40 minutes.

3.7 Analysis

According to Polit and Beck (2008), "the purpose of data analysis is to organize, structure, and elicit meaning from research data". The case study analysis involves organising case details, categorizing the data, interpretation, pattern identification then synthesis and generalizations (Creswell, 1999; Stake, 1995).

Analysis of the data began with the transcription of the audio footage. The data collected from the respondents and data collected from the documents was analyzed and categorized into themes. After the themes were categorized per case, a cross-case synthesis was done for comparative basis and high quality (Yin, 2003). Thereafter, the descriptive and narrative analysis of the theoretical framework, responses and documents was presented. The descriptive analysis described the ESCos organization and the way the organization learns and undertakes energy efficiency building projects. The narrative analysis involved exploring the experiences and the interpretations of the professionals' use of organizational learning in improving performance in energy efficiency building projects.

3.8 Validity and Reliability

This study strategically used several data collection tools to meet the required reliability, construct validity, internal validity and external validity. To reduce bias, the researcher verified the respondents' statements during the interviews. The transcribed data were made available and validated by the documentary review of the Energy Service Companies (ESCOs). Using these tools ensured the reliability of the information collected and presented was accurate. To achieve construct validity the study employed different peer reviewed sources of data though journals, academic books, narrative reports, statutory and archival documents to corroborate the facts, experiences and interpretations of the professionals interviewed. The sources of data were constantly revisited and referred to. To eliminate distortion there was concerted effort by the researcher to understand the opinions of the professionals and truthfully report them. All the findings were triangulated to ensure that acceptable validity and reliability was obtained. Finally both constructs namely

organizational performance and organizational learning were continuously examined, so the most relevant items of each construct was determined.

3.9 Limitations

This study was not immune to limitations. Firstly, because of the time limit, the sample size only consisted of 4 cases of SME energy service companies. These 4 cases yielded 11 interviews. This was due to a limited number of ESCos actively participating in the energy industry as they face many business challenges. Nevertheless, the interviews were strategically held with professionals that influenced the processes of organizational learning. A number of insights were obtained from the sample size.

To generalize the results across all SME energy service companies, more interviews among participants and different professions could have been included. Secondly, the study was designed to evaluate organizational learning as the main variable and organizational performance as the dependent variable, other interesting findings emerged. Also, not all variables were significant on the theoretical framework since organizational learning is broad.

3.10 Ethical Consideration

The study recognized that the University of the Witwatersrand has ethical considerations regarding research. Also there are various codes of conduct that regulate the researcher's behaviour. In preparation for the research, the researcher became familiar with the University's research ethical requirements. After the researcher submitted the proposal, the researcher applied and obtained their ethical clearance from the University of the Witwatersrand's Research Ethics Committee. This research commenced after ethical clearance from the University was obtained. Part of the ethical issues and considerations regarded were the objects of research and issues of access. This study involved human participants and visiting data archives. Since data was collected from different sets of people, both physical and cognitive access was needed. The researcher sourced different Energy Service Companies (ESCos) from the Eskom website and through recommended professional contacts. The website was accessible on the internet to anyone. Permission to conduct the interviews was sought through telephone and email. As part of the Research Ethics

Committee guidelines, the researcher adhered to the University's and the Energy Service companies policies on non-disclosure of information and confidentiality.

CHAPTER 4: DATA ANALYSIS

4.1 Introduction

About 62% of ESCos in South Africa are concentrated in the Gauteng Province (Volschenk, 2007). The study proposed to look at three to five cases of Energy Service Companies, only four cases were reviewed in this study. The motivation for selecting the four ESCos was to have an acceptable level of comparison. The ESCos were generally small and medium sized with some difference in their organizational structure. Due to the low number of active ESCos in the industry, the number of interviews is still a sufficient scope of measurement which assures the adequacy of data. The difference in organizational structure, learning indicators, KPIs, learning practices and strategies offers a platform to suggest improvements.

4.2 Protocol of Interview

The researcher used the snow bowling approach to select the study samples. Permission was obtained as and when the new research participant/s' details evolved. An existing contact from ESKOM assisted in identifying the information of potential participants. Also, ESCOs' information (phone numbers and websites) were obtained from the South African Association of Energy Services Companies (SAAEs) and Eskom website. The ESCos website was visited to obtain information such as "services provided and size" for suitability to participate in the study. Thereafter, the researcher contacted the ESCos telephonically and confirmed services and size of ESCos. There was verbal as well as email permission obtained. Appointments were then arranged and confirmed mainly by email.

4.3 Analysis

This section summarizes the findings from the semi-structured interviews. The influences based on the participants' responses were represented in statement format to support the study findings. The results are classified and represented under the followings topics: vision and missions, management issues/organizational structure, project configuration and the knowledge system, factors, organizational learning and processes, learning practices and strategies, learning indicators, KPIs and challenges. The analysis of findings is discussed below.

4.4 Vision and missions

The interviews showed that all the ESCos interviewed had visions and missions for their organizations. Each organization outlines the business' vision i.e. B-BBEEE, business status, past projects and core services among others as seen in Table 4.1. While only Organization A and B were able to clearly outline their missions i.e. workforce, values, work experience and work culture/beliefs, organization D and C do not have clearly outlined missions. All four organizations have active websites with company profiles that outline their visions and missions.

Table 4.1 Findings: summary of Vision and Mission

	ESCos A	**ESCos B**	**ESCos C**	**ESCos D**
Visions				
B-BBEEE	√	√	√	√
Business Status	√	√	√	√
Past Projects	√	√	√	√
Core Services	√	√	√	√
Missions				
Workforce	√	√		
Values	√	√		
Work Experience	√	√	√	√
Work culture/beliefs	√	√		
Learning	-	-	-	-

4.5 Management issues/Organizational structure

Each organization had some form of organizational structure. Most organizational structures were described by the respondents as "flat". This description was representative of the hierarchal structure which was found across all four cases. Below are Figures 4.1 to 4.4, the structures give a diagrammatic description of each organizational structure.

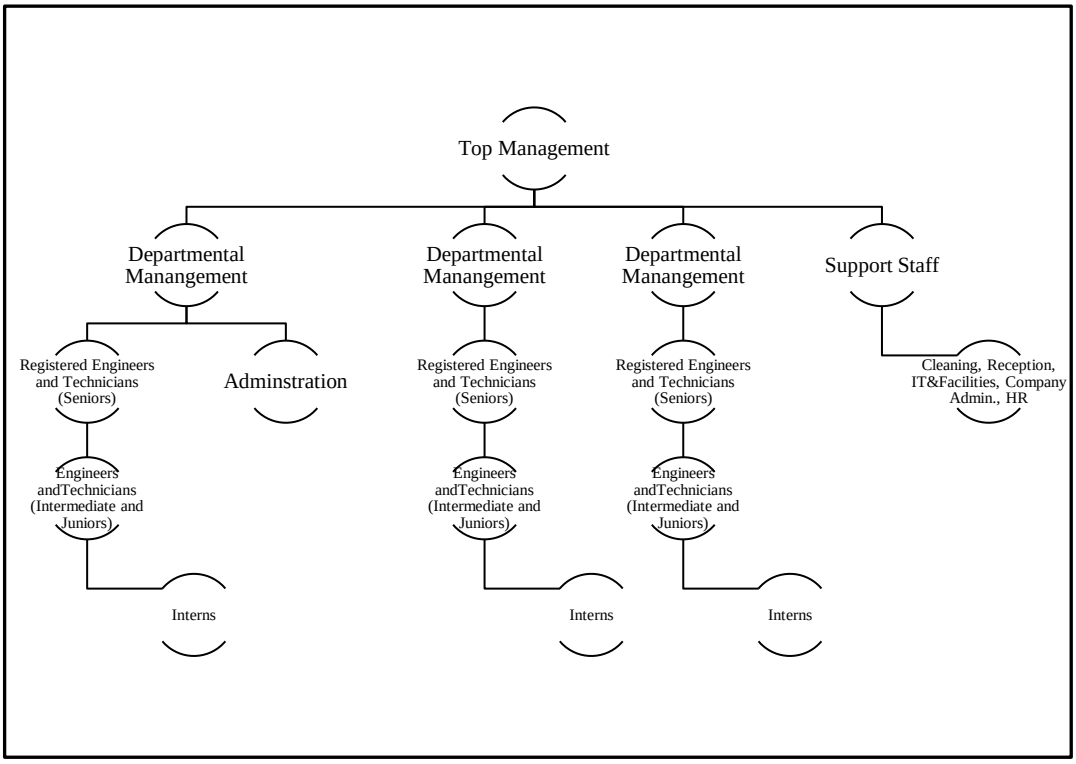


Figure 4.1 Findings: organizational structure of ESCo A

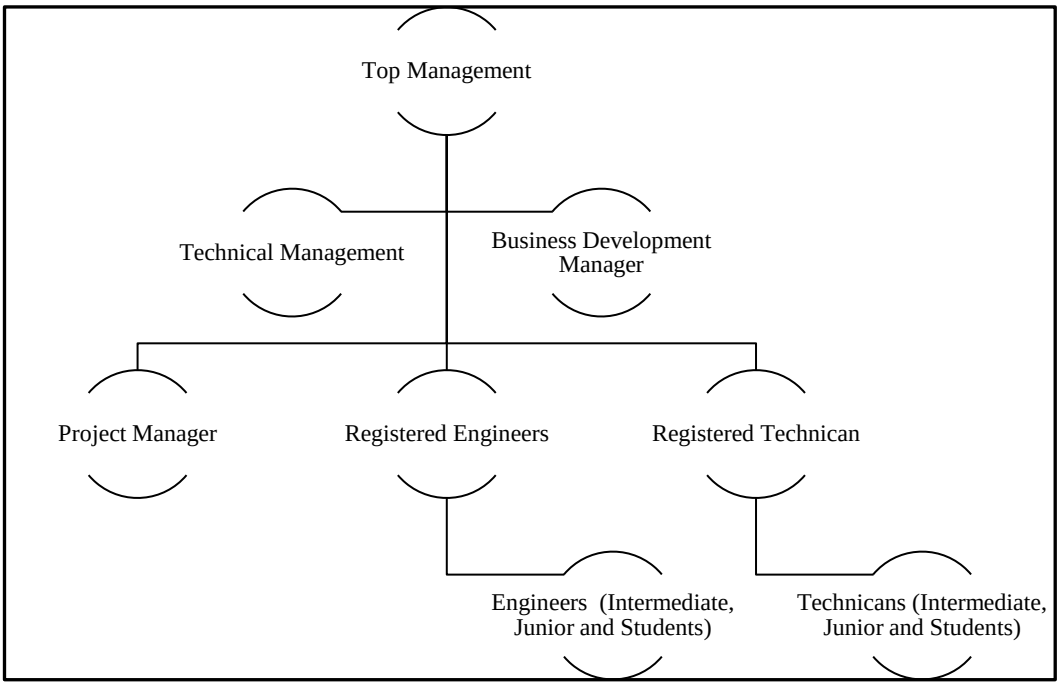


Figure 4.2 Findings: organizational structure of ESCo B

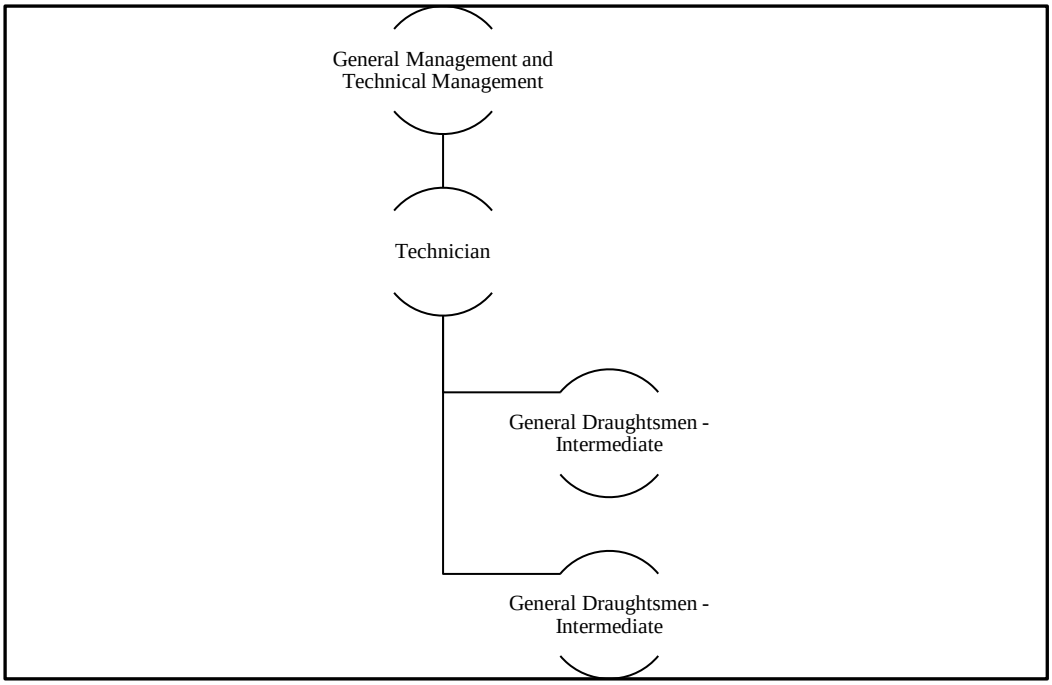


Figure 4.3 Findings: organizational of structure ESCo C

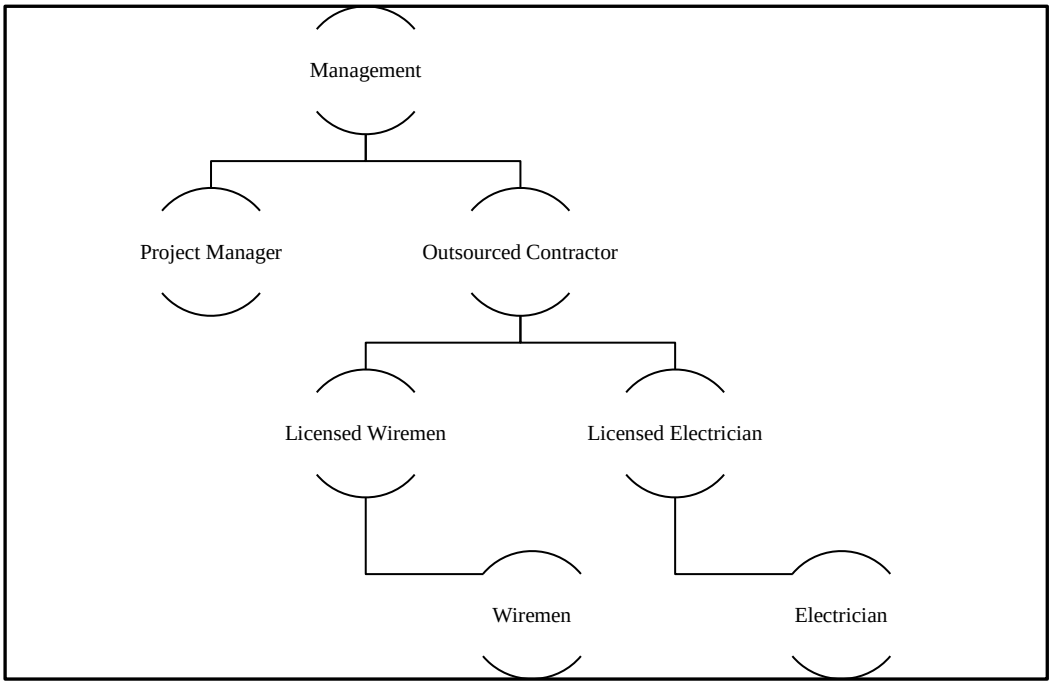


Figure 4.4 Findings: organizational of structure ESCo D

In each organization; top management is directly in charge of decision making and specifically the decision making for learning. Although the organizational structures highlight the various communication channels, most of the organizations insisted the individuals actively communicate their learning needs. It was however noted that the top management in

all four ESCos actively participate in the learning process of ESCos. Top management was directly involved in the human resource and teaching from experience. In *ESCos C* there was little focus on organizational learning, the technical manager still overlooked and instructed most learning required. While *ESCos B and D* monitored the professionals and then decided which areas were more learning was required. *ESCos A* allows the professionals to "direct" their learning needs as long as the learning fits into the organizations' core service areas.

4.6 Project configuration and the knowledge system

All four ESCos are active participants in the South African energy landscape. A variety of their energy services are provided for government/public and private projects. Some of the energy services are listed below in Table 4.2.

Table 4.2 Findings: summary of Energy Services

	ESCos A	**ESCos B**	**ESCos C**	**ESCos D**
DSM Projects				
Lighting			√	√
Heat Pumps				√
Metering		√		√
Energy Savings	√	√		√
Energy Optimization				
Energy training		√		
M&V		√		
Energy Management		√		
Energy Auditing		√		√
Manufacturing				
EE technology			√	
Lighting			√	
EE installations			√	
Turnkey Solutions	√	√		√
Other Services				
Project Management	√	√	√	√
Feasibility Studies	√			
Funding facilitation	√			
RE	√			
Engineering designs	√			

ESCos A has a staff ranging from engineering students to registered professionals. Their organization has professionals with a high level of technical skills ranging from project management, soft and hard engineering and information technology. Both tacit and explicit knowledge were used for the project but also within the running of the ESCos. Professional P-A2 and P-A4 were able to account on how they individually processed information from experience, past projects and learning acquired from training. Both professionals confirmed that they used both tacit and explicit knowledge to assimilate and apply to projects.

ESCos C and D have staff with legal, engineering and apprenticeship skills. Both organizations use more tacit than explicit knowledge. ESCo D outsources its high level technical skill if needed while ESCo C operates more on repetitive and intermediate level knowledge. Both ESCos C and D did not perceive that it was necessary to account for knowledge and other learning processes. Nevertheless, ESCos D acknowledged that some transfer of knowledge was followed usually between the acquiring and assimilation stage.

ESCos B has a wealth of knowledge ranging from engineering, business, information technology, project management and finances. The organization derives this wealth of knowledge from professionals, academia, experience and other external sources. However professional P-B1 acknowledged that there was a geographical challenge that affected their learning process. The technical director of the firm is in a different province thus harnessing his skills and having him overlook all the learning processes in the organization is challenging. The learning process is somewhat disrupted by this shortcoming. However P-B2 was confident their "learning turnaround strategy" would change this while professional P-B4 was confident they acquired, assimilated, applied, shared and stored all knowledge successfully.

4.7 Organizational learning and processes

All the professionals in the participating ESCos acknowledged the importance of learning. This was indicated by the extensive years of experience, the varying degrees and diverse expertise. It was also clear that learning was important and promoted in various ways. Most learning were formalized learning (i.e. qualifications obtained from a tertiary education), experience based and on-the-job-training. However, none of the ESCos' organizational learning was formally aligned to their visions and missions although professionals opined that

that learning was part of the organization's mission. At least three of the four ESCos had some sort of learning process. Those learning processes adopted are discussed below.

ESCos C had an unclear learning process. The professionals in management perceive experience and on-the-job-training were the only sufficient learning practices. However, respondents P-C1 and P-C2 suggest repetitive learning was what would best describe their learning process.

ESCos A, B and D provide various energy services and require diverse skills. However all three ESCos rely heavily on their repetitive learning, experience, individual/team learning, mentorship and on-the-job-teaching. *ESCos A and B* acquire and use both tacit and explicit knowledge readily available from professionals within the firm or similar projects executed. Where additional information is required, senior professionals are asked to share this knowledge. In *ESCos D,* mostly explicit knowledge is used. The knowledge is assimilated and applied to projects. Professional P-D1 mentioned that the learning is shared in the technical project close-out report that is compiled and documented. *ESCos A* also compiles a project report and technical project close-out report. Professionals in *ESCos A* briefly discuss the technical issues of projects at a bi-weekly project meeting or weekly if the project was particularly challenging. The technical project close-out report is then documented into the project library. *ESCos B* undergoes a similar learning process as *ESCos A and D*. However, *ESCos B's* new learning strategy requires each project team to provide an extensive evaluation of each project which includes: explicitly sharing and documenting each benefit and challenge, then identifying the lessons learned. This evaluation is attached to the technical close-out report. A feedback session provides further scrutiny on what was learned and what action can be taken. What follows is documentation of this information into the "content library" of ESCos D.

4.8 Factors

The professionals were able to identify similar factors that mostly encouraged organizational learning rather than impeded it. The factors were identified as indicated in Table 4.3:

Table 4.3 Findings: summary of factors that affect organizational learning

	ESCos A	ESCos B	ESCos C	ESCos D
Internal Factors				
Company Culture	√	√	-	-
Leadership	√	√	-	-
Individual Attitude	√	-	√	
Professionalism	√	√	√	√
Organizational Structure	√	√	-	-
Communication	√	√	√	-
Performance	-	-	-	-
Innovation	√	-	-	-
External Factors				
Local and Global Market	√	√	√	√
Technology	-	√	-	√
Competition	√	√	√	√
Job Requirements	-	√	-	-
Politics	-	-	√	-

4.9 Learning practices and strategies

Most of the learning practices were similar across the four ESCos. The learning practices are good and commonly practiced in industry. It was however noted that all four ESCos did not have a formalized learning strategy/strategies. Furthermore, there was no formal link between the learning practices and learning strategy. There was also no formal link between the organizational performance to the learning practices and strategies. The learning practices are identified in Table 4.4:

Table 4.4 Findings: summary of learning practices

	ESCos A	**ESCos B**	**ESCos C**	**ESCos D**
Learning Practices				
External workshops	√	√	-	√
Internal workshop	√	√	-	√
Mentorship	√	√	√	√
On-the-job training/field training	√	√	√	√
Technical/Training training	√	√	√	√
Experiential learning	√	√	√	√
Individual learning	√	√	-	√
Team/Group learning	√	√	√	√
Lessons learned	√	√	√	-
Meetings	√	√	-	√
Experimental learning	-	-	-	-
Learning Strategies				
Business strategy versus learning strategy	x	x	x	x
Continuous learning strategy and learning practices	x	x	x	x
Organizational development versus learning strategy	x	x	x	x
Organization learning versus organizational performance strategy	x	x	x	x
Organization learning benchmarking	x	x	x	x

All four ESCos employed some learning practice within their organization. Only *ESCos B* is in the process of finalizing an actual learning strategy that will be incorporated into the company policies. Nevertheless there were similar kinds of learning practices across the four ESCos. All the ESCos positively indicated that experience based, mentoring and on-the-job training are the best ways to learn. Most ESCos made sure their employees were sent to key training sessions. The training sessions were either selected on behalf of or were individually selected by the professionals.

ESCos A sends their employees to external training sessions but also have a weekly in house team building session. Professionals P-A1 and P-A4 mentioned that they equally try to have post project review or briefing sessions. *ESCos A* also has some form of knowledge management system they refer to as "a project library" that is accessible to all professionals.

ESCos D's management perceive on-the-job training and informal training sessions were the most effective learning practices. However, the professionals in *ESCos C and D* both attend external training sessions.

ESCos B was slightly different. Professionals in *ESCos B* attend external training sessions but conduct internal training sessions to other professionals from industry. Furthermore, they conduct workshops and also invite other professionals to conduct in house workshops to their professionals (inter-and-intra organizational learning). ESCos B holds regular project meetings and generally encourages continuous learning. All learning is now formally documented and kept in a "content library" that's managed by the business development manager P-B2.

4.10 Learning indicators

All four ESCos have no formal method of identifying learning indicators. Professional P-A1 and P-B4 however indicated that professionals are encouraged to set learning goals aligned to their career goals. Whereas a technician P-A3 was of the opinion an indicator used to identify the need for learning was from informal assessments. Senior engineer P-A4 suggested that identifying the need for learning needed to be reviewed during the monitoring of a project and how the project goals were achieved.

4.11 Organizational performance and learning

The study did not obtain financial performance information due to the sensitivity of the company's financial information. The non-financial performance information was what was focused on. All four ESCos did mention that there was a steady increase in the number of projects. However, most of these projects are private as opposed to public projects. The professionals in top management (from all four ESCos) complained that obtaining DSM projects from Eskom was hampered by numerous technical requirements and other

bureaucracies. *ESCos A, B and C* indicated that their project sizes and complexities were steadily increasing. While *ESCos D* indicated that mostly the quantity of production had increased in their projects. *ESCos A and C* noted that project failures had significantly decreased. Overall, *ESCos A, B and C* suggested learning contributed somehow to the improved performance of their employees, the quality of their employees work and the completion of projects.

Only two out of the four ESCos had some form of KPIs. Professionals P-D1 and P-D2 mentioned that their only KPI were more related to finance than learning. The KPI implemented is a monetary bonus based on time and project completion. Professional P-B4 from the project management department of ESCo B mentioned using project outcomes as a KPI. The professionals in management in ESCos A, B and C commented that they recognize that there is a need to develop KPIs related to organizational learning.

4.12 Challenges

Overall there were many common challenges regarding learning and the adoption of learning processes. Three out of the four ESCos mentioned that the learning and existing learning processes in their organization were somehow effective and contributed to their performance. However, there was still room for improvement. It was further noted that none of the organizations had KPIs in relation to their organizational learning.

Table 4.5 Findings: summary of organizational learning challenges

Organizational Learning Challenges				
	ESCOs A	ESCos B	ESCos C	ESCos D
Time consuming	√	√	√	√
Financial constraints	√	√	√	√
Not prioritized: lack of top management's support		√	√	√
Behavioral resistance: professionals not wanting to learn	√	√		√
Lack of KPIs related to the organizational learning	√	√	√	√
Learning is ill-defined and not well integrated into the organization	√	√		√
No structure to support learning: lack of a formal learning strategy	√	√	√	√
Geographical constraints that affect the transferring of knowledge : divided project team	√	√		

Almost all the professionals observe that although learning was important, it is a time consuming exercise that is not well prioritized. However, some professionals are resistant to learning. Both management and professionals acknowledged that promoting learning is financially demanding. There's a large opportunity cost and profitability for learning. The professionals also recognized that complex projects had an impact on learning and learning processes as financial gain was valued over knowledge transfer and mentorship. Compounding the challenge of learning on complex projects is the new technology and the accompanying "new" learning. The most difficult challenge however is that not all learning is integrated, assimilated and stored into the organization.

4.13 Summary of findings

Eleven professionals from four Energy Service Companies around Gauteng were interviewed. Of the eleven professionals, four were in managerial positions; one was part of support staff while the remaining six made up the technicians and engineers. There were some minor differences in the characteristics of the ESCos. The findings found that there are learning practices in place and that learning was occurring within these organizations. However learning processes are not directly linked to the organizations' business and learning strategies which should be tied to the vision and missions. In addition, the extent of learning is not adequately linked to any learning indicators and key performance indicators. Thus, although learning may occur, the organization is unable to review the effectiveness of its learning on the performance towards energy efficiency projects. The next chapter will proceed to analyse the findings from chapter 4.

CHAPTER 5: DISCUSSION

5.1 Introduction

This chapter discusses the findings in Chapter 4. The main sections are thematically structured into: vision and missions, management issues/organizational structure, project configuration and the knowledge system, factors, organizational learning and processes, learning practices and strategies, learning indicators, KPIs, organizational performance and learning. This chapter analyzes and explains the emerging themes revealed in Chapter 4. It further offers prescriptive suggestions.

5.2 Visions and Missions

In this section, information about the management, visions and missions of the four ESCos that provide energy services is provided through Figure 5.1.

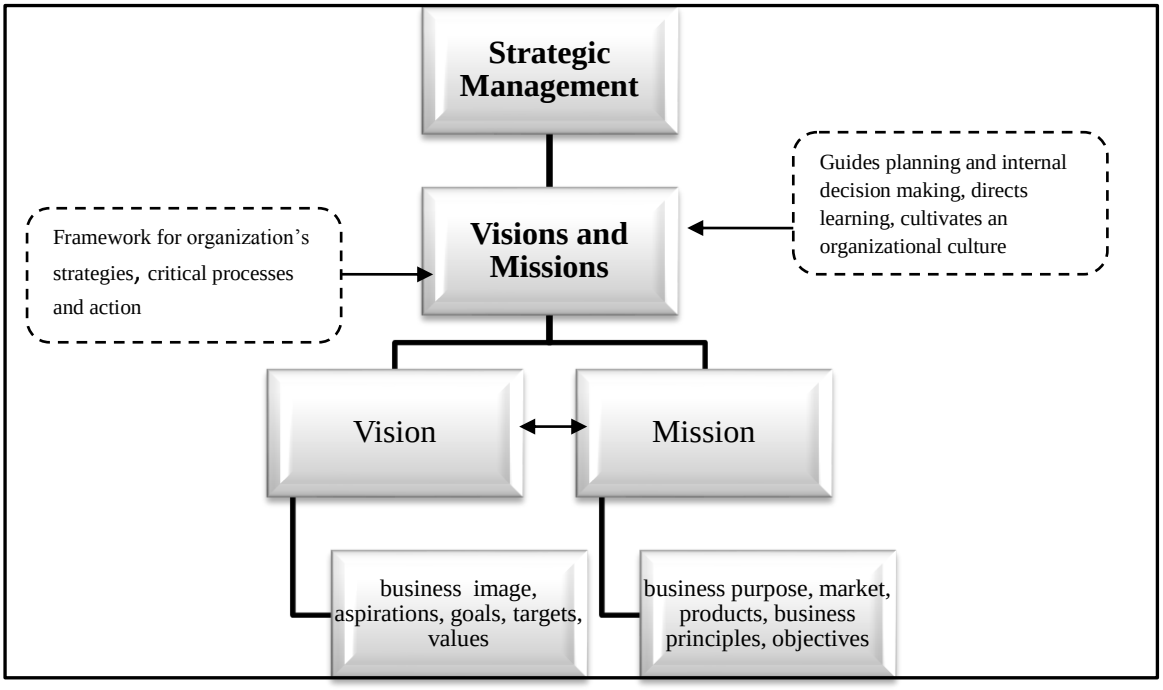


Figure 5.1 The link between strategic management to the vision and mission (Author's construction)

According to Senge (1990), organizational learning should align with the organization's missions. It was clear that all four ESCos had defined visions. But, only two of the four ESCos had defined missions. The visions ideally direct an organization while the missions are linked to how the visions will be achieved. Three of the four ESCos did not clearly outline how learning is linked to the organization's mission. This shows the lack of top management's commitments towards learning. The ESCos would benefit from linking their missions to the strategic planning, learning and managing of the organization (Coffman and Beer, 2011 and Lines *et. al.*, 2011). ESCos B is however in the process of aligning certain professionals' learning and performance goals to the organization's visions and missions. If ESCos are to continue redeveloping, it is important that they consider enforcing a learning strategy into their missions.

5.3 Management issues/Organizational structure

Management actively makes decisions and participates in the issues of business. Specifically, management took the tactical business issues more seriously than the operational business issues. This is to say financial gain (tactical issue) was viewed more important than the learning and the organizational performance (operational issue). ESCos C and D's management did not consider learning to be as important as financial gain. The management in ESCos A acknowledged the importance of learning but opined that learning should be individually driven. Management in ESCos B acknowledges that financial gain overrides learning but that the organization needs to reconsider their attitude to learning. There is clearly a misalignment between learning and strategic management by top management. Also management does not highly prioritize organizational learning. Ellström (2010) and Gherardi and Nicolini (2001) advise that management strategically stimulate and mobilize learning within the organization.

There were defined organizational structures in all four ESCos. The hierarchical structure highlighted the multiple layers of technical leadership and orderly channels in which learning could be monitored and transferred. However, ESCos A, B and D suggest that the technical team leaders' duties were firstly to meet their project targets not necessarily to transfer learning. Also although professionals were sent out in teams, the onus was on the individuals to choose what to learn versus a holistic view on what the organization would learn. Mentorship was thought of as "an after business" affair rather than a priority. Although team

sessions were held, the sessions were semi-compulsory and not all the tacit knowledge was converted to explicit knowledge accessible to everyone. Often than not, most teams ended up divided after projects and team members assigned elsewhere forming new teams. Thus learning is difficult to promote because of the poor link between technical staff, learning requirements and strategic management. In three of the four structures, there was no key role/s dedicated to deal with organizational learning. The ESCos need to consider a key role that will systematically deal with the challenges arising from learning. Furthermore the key role needs to ensure learning is collaborated and integrated into the organization. This information should then be relayed to top management for their strategic management purposes.

5.4 Project configuration and the knowledge system

The nature of projects handled in the different energy service companies range from easy to very complex. The Professionals acknowledged that there was a need to tap into the knowledge system constantly. Both tacit and explicit knowledge were used. Figure 5.2 depicts the relationship between a project, the entities of knowledge and the knowledge system.

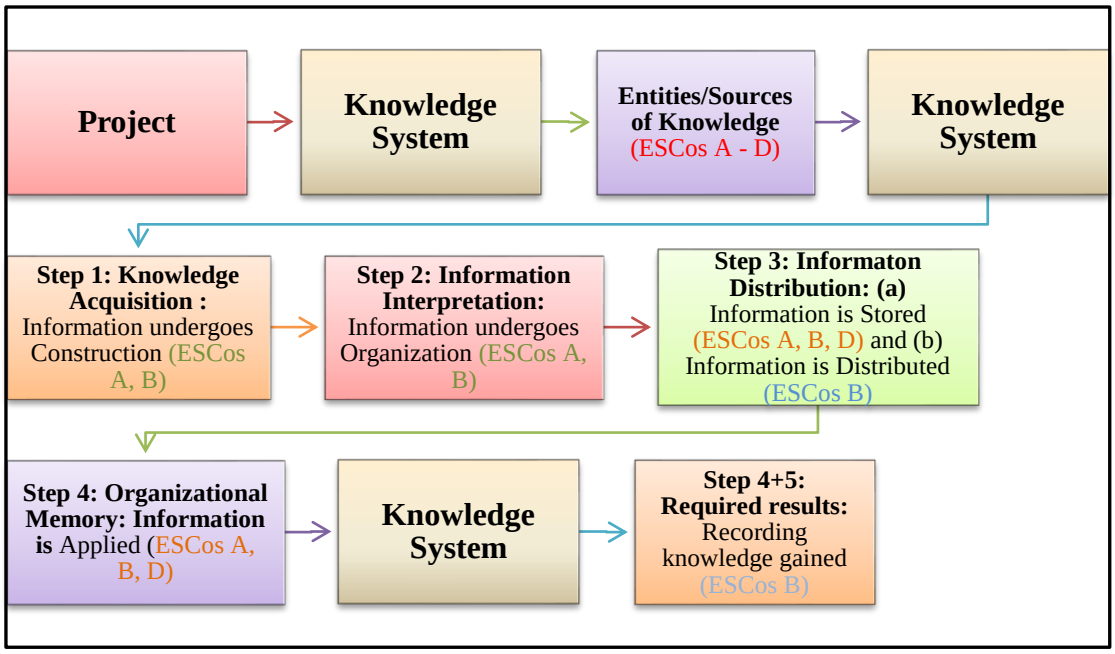


Figure 5.2 Summary of project configuration and the knowledge system of ESCos (A-D) (Source: Adapted from Huber, 1991)

Figure 5.2 also depicts the shortcomings and the specific process each ESCo could ideally fix. Huber (1991) suggests all information go through the refining process of: knowledge acquisition, information interpretation, information distribution and organizational memory. However most knowledge the professionals used and stored was their tacit knowledge i.e. the informal "know how" or experience. Most tacit knowledge gained previously and newly gained was not converted to explicit knowledge.

All the ESCos were able to provide information at the initial stage of the project and obtain results at the end of the project. However the knowledge process in between was not apparent for all ESCos. According to Orange *et al.* (2000), the learning and knowledge process requires individuals to constantly compare previously received information with newly received information. In so doing, knowledge is generated and updated in the organization (Lines *et al.*, 2011). Also, the ESCos need to assimilate and store this knowledge; these processes enable problems to be solved or solutions to be provided more effectively (Orange *et al*., 2000).

5.5 Factors that affect organizational learning

In this section, the various internal and external factors that affect individual, team/group and inter-organizational learning in the ESCos are examined (refer to Figure 5.3)

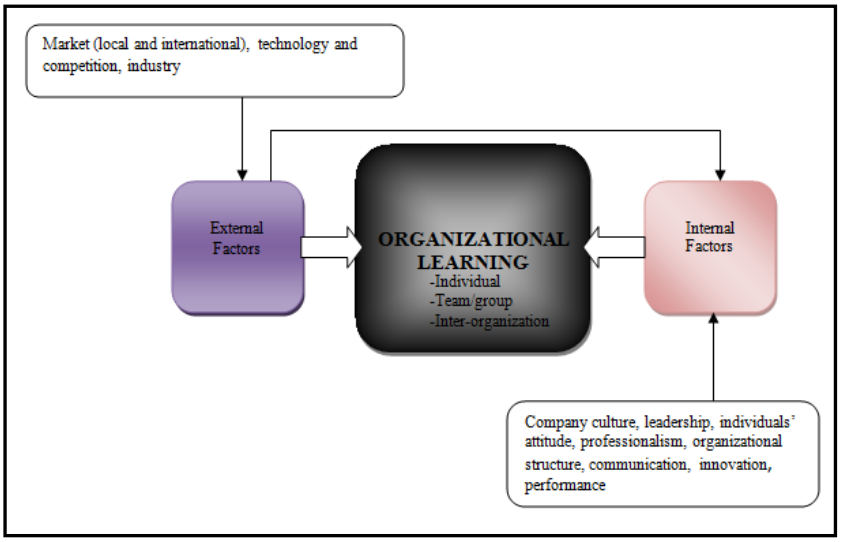


Figure 5.3 Summary of internal and external factors that affect organizational learning in ESCos (A-D)

(Author's construction)

Most of the factors identified contributed to enable learning (refer to figure 5.3). The external factors contributed more towards the need for the organization to learn while the internal factors contributed towards individual learning. The external factors such as the market, technology and competition were drivers across all the ESCos, as learning translated to higher financial benefit. The technical professionals felt keeping abreast with current knowledge and technology in their fields allowed them to contribute positively to their organization. This notion is supported by Porter (1990) and Senge (1990) who state that enhancing the human asset achieves competitive advantage. In line with the external factors, if ESCos continue to promote learning, they adapt better to change, broaden competitive advantage, capabilities and efficiency to ensure overall improved performance (Lines *et. al.*, 2011; Porter, 1990; Senge, 1990).

When analysing the internal factors that facilitated organizational learning, it emerged that learning is "an individual benefit" as opposed to learning being ultimately for the organization. Professionals generally had a positive attitude that was inclined to want to learn. In addition, there was a hierarchical structure in all the ESCos there was generally an open door approach towards learning. Professionals in supervisory functions noted that not all professionals understood why they needed to learn and thus even though learning occurred there was no guarantee it was applied.

Most professionals observe that those in leadership had created a culture of learning. This was definitely the case in ESCos A and B. Leadership did believe it was important to continue encouraging continuous learning. However in three ESCOs; leadership/management has not been able to fully communicate and align organizational learning with the ESCos' visions, missions, strategies and organisational performance. According to Senge (1990), leadership/management's approach to organizational learning should be systematical and integrative. Gephart *et al.,* (1996) state that the influence of supportive and strategic management/leadership creates an organizational structure that promotes a learning culture. This structure considers a multiplicity of aspects namely: communication, delegation, responsibility and control (Grossi *et al*., 2007).

5.6 Organizational learning and processes

This study had set out to generally determine among other things how much learning was occurring, to what extent and how this had an impact on organizational performance. The extents varied among the ESCos. There was no clear way of determining the link of organizational learning to organizational performance.

ESCos C and D have very set routines which are repetitive. Any deviation from these existing routines seldomly occurs. Also management acknowledged that as long as the routines generated financial gain there was no need to change. In this case only single-loop learning is attained as they only operate within static routines and beliefs. Professional P-D1 from ESCos D spoke of diversifying and becoming experts in their field but did not consider how organizational learning would directly provide these capabilities. ESCos C and D's management generally need to consider their strategic management to accommodate learning for the various benefits.

Both ESCos A and B have more formalized learning and knowledge processes that have led to routines. Also, both these ESCos have systems that question and review these processes. The post project reports provide insight into the various processes. In the case of ESCos A, they undergo single- and double-loop. They also go through a "shallow" process of feedback but lose most of the valuable learning that is discussed informally. ESCos A needs to insist on turning its tacit information into explicit information. This could be incorporated into a learning strategy that enforces this into everyday business activities. ESCos B goes through a similar double-loop learning process of post project review. However they are in the process of adapting a strategy that requires a post project review, an evaluation of the review and an extensive recommendation on what was learnt and what could be improved thereafter. This will allow ESCos B to learn how to learn (triple loop learning). ESCos B approach towards learning would be quite beneficial to ESCos A.

5.7 Learning practices and strategies

Based on the interviews, it was clear the ESCos are aware of the importance of continuous learning. This was evident by the array of learning practices provided namely: training sessions, team sessions, project review sessions, in-house workshops, course or out-house

workshops and presentations, among others. All these are useful and develop the individuals in the organization. However, it is unclear how the learning practices are linked to the organization's learning strategy.

There's need for top management to develop a learning strategy. The use of a learning strategy/strategies will be to provide clear objectives on how to link learning to the organization's learning goals, project targets and performance (refer to figure 5.4). McGill *et al. (*1993) insists it is important that individuals or teams actively participate in policy making and eventually adopt an effective learning strategy. The objective of the strategy would be make best use of available resources and ensure learning is not a stand-alone activity but an integral component of the business affairs. Figure 5.4 illustrates a learning strategy that can be adopted. Learning should carefully align with the business strategy of an ESCos. It will equally be important to then monitor and gauge learning and its impact on performance.

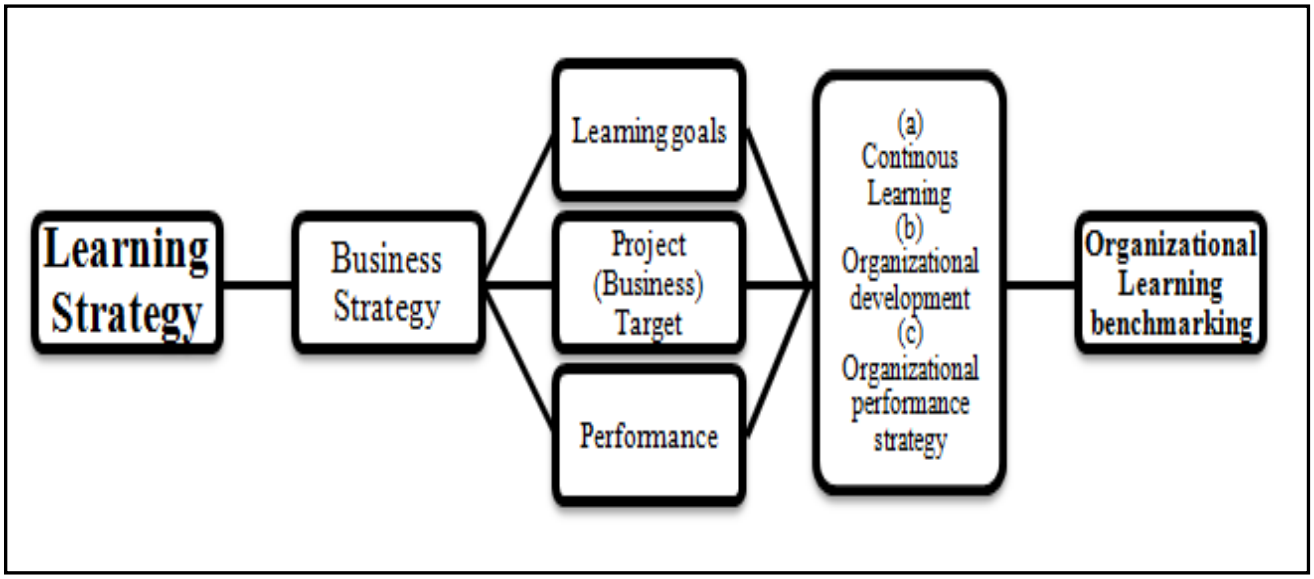


Figure 5.4 Concept of a Learning strategy
(Author's construction)

5.8 Organizational performance and learning

The ESCos were able to account for performance in terms of financial standing. It was indicated by the professionals that their organizations had completed more projects. The completion of the projects was one of the widely mentioned indicators. Only two out of the

four ESCos had some vague key performance indicators (KPIs). The KPIs were more financially reflective than they were non-financially reflective (for example effectiveness, product quality, workforce development etc). Overall top management agreed that there was a lack of formal performance evaluation that was specifically related to organizational learning.

It is necessary to understand and link learning and performance (refer to figure 5.5), the impact of one on the other yields valuable information. This information would be useful for strategic management to understand where continuous learning is needed such that the organization keeps developing and performing. Regardless of the financial investment in learning, it is in vain without any clear indication of how this learning contributes to the organization's learning goals, project targets and performance. Hernaus (2008) suggests goal-setting in relation to behavioural and cognitive changes are important indicators to consider when evaluating organizational performance. Also the transfer of knowledge is linked directly to behavioural and cognitive changes that lead to outcomes that impact on performance (Ellström, 2010 and Dimovski, 1994).

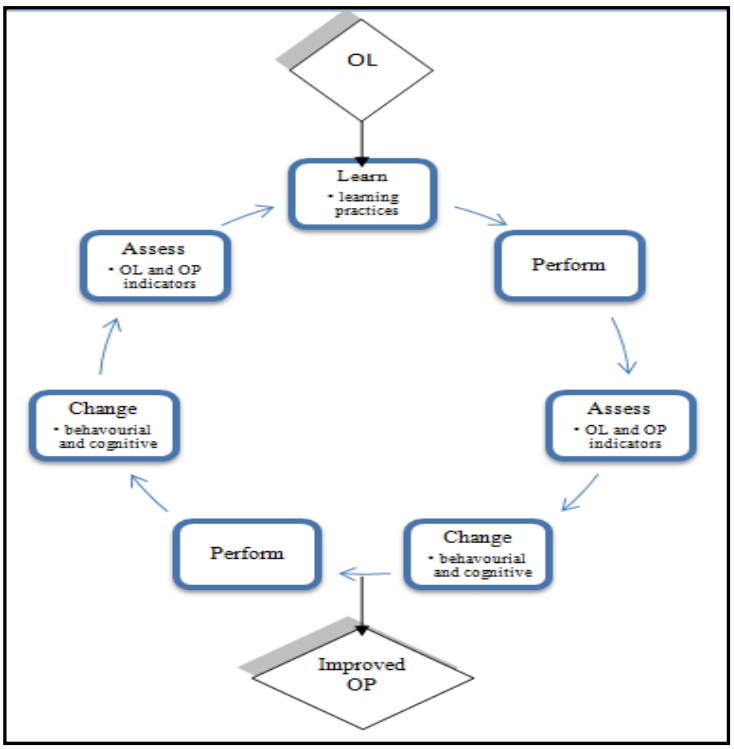


Figure 5.5 The cyclical impact of organizational learning on organizational performance (Author's construction)

5.9 Conclusion

This chapter highlights that in practice, SM ESCos do not have a clear method/s used to link organizational learning and organizational performance. This is highlighted by the lack of KPIs for both performance linked learning. The focal issue that emerged was ESCos did not have a clear learning strategy. A learning strategy is necessary to direct the organization's learning to the organization's goals, project targets and performance. Although learning occurs in ESCos, the findings suggest organizational learning becomes ineffective if it is not strategically managed.

It is important for ESCos to consider having a key role that will systematically collaborate and integrate learning into the organization. This information should then be relayed to top management for strategic management purposes. There's need to develop a learning strategy/strategies that provide clear objectives on how learning will link to the organization's learning goals, project targets and performance. This strategy/strategies should relate to learning indicators and KPIs. If ESCos are able to evaluate their performance, they are able to assess their performance for Energy Efficiency projects while increasing organizational capabilities and gaining competitive advantage. Chapter 6 will provide final conclusions of the findings, analysis and recommendations of the study.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The research was driven by the evident energy challenges in South Africa. It was of interest to review the initiatives the Government of South Africa has implemented to alleviate these energy challenges. The specific initiative reviewed was the use of Energy Service Companies. The motivation for this research was to understand the organizational learning within SM ESCos undertaking energy efficiency projects for buildings in South Africa. Furthermore, how the organizational learning impacts the performance of these ESCos. This research was necessary as SM ESCos are responsible for implementing energy efficiency measures in buildings which contributes to alleviating the energy challenges in South Africa. However, these SMEs face many challenges that hamper their performance.

The main objective of the study was to investigate how effective organizational learning practices in SM ESCos can lead to better performance in implementing energy efficiency building projects. To achieve this objective, the research was guided by the main question:

> *"How does organizational learning within small and medium ESCos impact on the organizational performance of Energy Efficiency building projects in South Africa?'*

To adequately answer the main question, strategic role players in the ESCos were targeted and interviewed. The interview questions were able to determine: (1) how learning occurred in the organization, (2) internal and external factors that influence organizational learning, (3) how ESCos undertake projects and (4) practices that facilitate learning and learning related performance. The concluding result is ESCos need to implement learning strategies that align with their organization's learning goals, project targets and performance.

6.2 Conclusions

6.2.1 Learning in SM ESCos

Learning is principal to the effectiveness and capabilities of ESCos'. Therefore, one of the study's objectives was to understand how learning occurred. Learning occurred through

various means namely: continuous individual learning, team learning and experience based learning. It emerged that although ESCos are clearly vested in learning, their learning is not clearly and objectively linked to the organization and performance. Furthermore, management does not prioritize organizational learning.

6.2.2 Internal and external factors that influence organizational learning in SM ESCos

The study sought to understand what influences the need for SM ESCos to focus and invest in learning. The study revealed that an organizational structure and culture that encourages individual/team learning possesses and manages quality information from superior professionals. This in turn improves the organization's performance. Furthermore, these ESCos are better positioned to deal with competition, the market and innovation. This significantly contributes to the ESCos competitive advantage, performance, adaptability and organizational effectiveness.

6.2.3 The performance of SM ESCos undertaking energy efficiency building projects

Professionals in the ESCos were able to acknowledge that both financial and non-financial performance information were important performance indicators. It emerged that learning contributed to improved project approaches and delivery. However; existing practices, learning processes and knowledge processes are not evaluated or monitored within the SM ESCos. Furthermore, there are no indicators used for learning and learning linked performance. This could be fixed by ensuring there's a key role/s dedicated to organizational learning. However, most of the ESCos did not have this key role.

6.2.4 The learning practices that facilitate learning and learning related performance in SM EScos

All the ESCos had some learning practices. However the learning practices are not linked to any strategy/strategies. This results in the misalignment between learning and strategic management. So regardless of the financial investment in learning, it is in vain without any clear indication of how this learning contributes to the organization's learning goals, project targets, performance and visions and missions. To develop effective learning practices which

lead to improved performance, ESCos need to consider formulating a learning strategy that aligns their learning to the organization's needs.

6.3 Shortcomings

The study could serve as a pilot study. The study had initially envisaged observing at least three to five cases of small and medium sized ESCOs. These cases should have included at least fifteen to twenty interviews but only four cases with eleven interviews were conducted.

6.4 Recommendations

The main recommendations are that ESCos should consider having a key role that systematically collaborates and integrates learning into the organization. This information should then be relayed to top management for strategic management purposes. There is a need to develop a learning strategy/strategies that provide clear objectives on how learning will link to the organization's learning goals, project targets and performance. This strategy/strategies should relate to learning indicators and KPIs. However, other factors like financial constraints to the SM ESCos and the lack of skills for this key role could affect these recommendations.

6.5 Future research

This study was an overview of the organizational learning in SM ESCos and the impact it has on the performance for energy efficiency project. The study could benefit from a larger sample group and a more in depth study conducted over a longer period of time. Future studies could look at inter-organizational learning separately and a comparative study of inter- and intra- organizational learning and the impact that has on performance.

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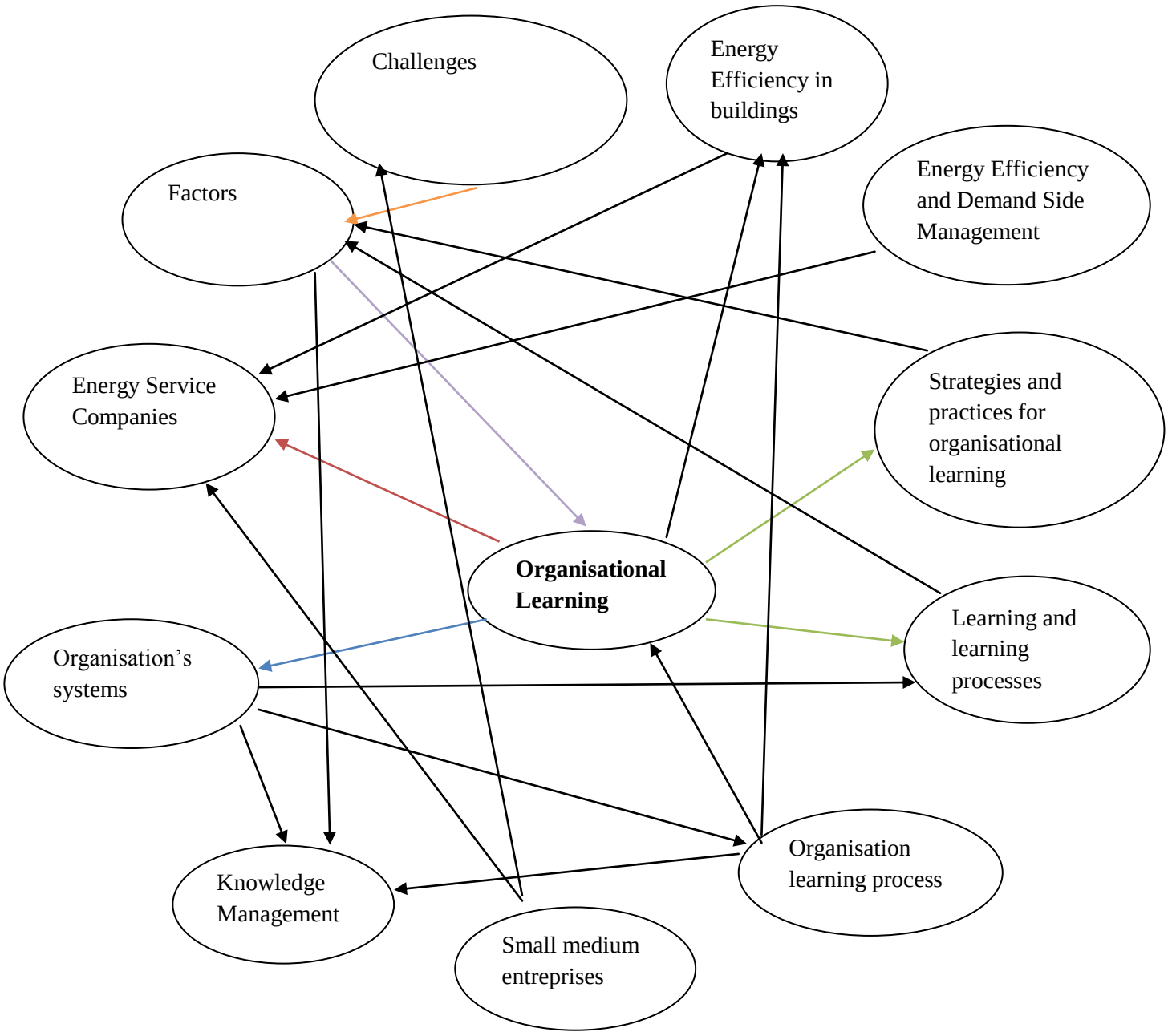
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Appendices

Annexure A: Logical Diagram



Annexure A: Interview Questions

1. What is the company's vision and mission?
2. What is the nature of your organisational structure?
3. What kind of projects does your organisation undertake?
   Probe: different entities, level of technical skill required, type of knowledge, how knowledge is process i.e from acquisition to utilization, past projects
4. What does organisational learning mean to your organisation?
   Probe: definitions, identify if they learn and/or promote learning, how important they think organisational learning is
5. How does your vision and mission align with the organisational learning?
   Probe: guidelines followed when setting strategies for learning, the decision making process, who is in charge of knowledge management
6. What internal and external factors tend to facilitate organizational learning?
   Probe: what actual factors (e.g internal politics, competition, culture, management participation) and how do they affect O/L
7. What are the organisation's practices and procedures for learning?
   Probe: processes, obtain a description of practices e.g intranet, lessons learned, newsletters, training sessions
8. What do you use as indicators of learning?
9. What do you use as indicators of performance?
   Probe: levels of performance (some form of comparision), what has contributed to better performance, determine if performance evaluations are implemented in relation to the effectiveness of organisational learning (how often they occur)
10. What challenges has the organisation faced regarding adoption of learning processes?
    Probe: how effective is your organisational learning and the processes?