

DIFFUSION OF A QUALITY MANAGEMENT SYSTEM: A CASE STUDY

N.P. Solomon^{1*}, A. Bester¹ & M. Moll¹

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Contact details

* Corresponding author
Solomon@Eskom.co.za

Author affiliations

¹ Cape Peninsula University of
Technology, South Africa

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ABSTRACT

The diffusion of a quality management system (QMS) to improve business performance depends upon the quality management strategy used. The aim of Eskom's QMS strategy was to create a sustainable quality drive throughout the company to improve customer and stakeholder satisfaction. This research project's objective is to determine how the diffusion of a QMS can improve the electricity supply industry in the Western Cape division of the electricity sector in South Africa. A quantitative research methodology was employed in the study. The responses to a survey questionnaire were analysed and conclusions were drawn. The research finding is that diffusion of a QMS improves the electricity industry by positively affecting attitudes towards the challenge of securing a sustainable long-term energy supply; improving processes and practices; engendering a quality culture; and contributing towards continual improvement. At the same time, certain barriers to the implementation of a sustainable QMS were identified.

OPSOMMING

Die verspreiding van 'n kwaliteitbestuurstelsel (KBS) om die maatskappy se prestasie te verbeter hang af van die kwaliteit bestuurstrategie. Die doel van Eskom se KBS strategie was om 'n volhoubare gehalte inisiatief deur die hele maatskappy te skep ten einde die kliënt en belanghebbendes se tevredenheid te verbeter. Die doel van hierdie navorsingsprojek is om te bepaal hoe die verspreiding van 'n KBS die elektrisiteitsvoorsieningsbedryf in die Wes-Kaap afdeling van die elektrisiteit sektor in Suid-Afrika kan verbeter. 'n Kwantitatiewe navorsingsmetodologie is in die studie gebruik. Die resultate van 'n meningsopname vraelys was ontleed en gevolgtrekkings is gemaak. Die navorsing bevinding is dat diffusie van 'n KBS verbeter die elektrisiteitsbedryf deur ingesteldhede positief te beïnvloed teenoor die uitdaging van die verkryging van 'n volhoubare langtermyn energievoorsiening; die verbetering van prosesse en praktyke; die kweek van 'n kwaliteit kultuur; en by te dra tot voortdurende verbetering. Terselfdertyd, word sekere hindernisse tot die implementering van 'n volhoubare KBS geïdentifiseer.

1 INTRODUCTION

The diffusion of a quality management system (QMS) leading to an improvement in business performance is affected by the business's quality management strategy. The aim of Eskom's QMS strategy was to have a sustainable quality drive throughout the company to achieve improved customer and stakeholder satisfaction.

Eskom Holdings' quality management strategy was initially developed with the aim of achieving sustainable and improved business performance [14]. In 2008, a review of the old quality management strategy was initiated due to its focusing on ISO 9001 compliant management systems,

with no other activities to entrench the required culture to sustain quality management and use it as a tool to improve business performance [14].

The QM strategy was therefore reviewed to incorporate actions aimed at integrating quality management into all business processes and activities, and to entrench a quality culture to achieve sustainable performance improvement.

Many departments within Eskom conducted internal audits to ensure their readiness for ISO 9001 QMS certification. An analysis of the internal audit findings revealed a total of 153 findings of fault across the business unit. Twenty-one percent (21%) were critical findings, 36 per cent were significant, 25 per cent observations, and 18 per cent opportunities for improvement. A further analysis of the report reveals that the findings per ISO 9001 clause were as follows: 64 per cent was raised against Clause 4: QMS general requirements and documentation; 35 per cent against Clause 5: Management responsibility; 18 per cent for Clause 6: Resource management; 11 per cent for Clause 7: Product realisation; and 26 per cent for clause 8: Measure analysis and improvement. The internal audit report highlights ISO 9001 QMS diffusion issues that affect the contribution of the QMS to improving business performance [15].

Hence the research question, “How can the diffusion of a QMS bring improvement to the electricity supply industry?”, seeks to determine how the diffusion of a QMS influences the different elements of an organisation. This study gives insight into how the business is affected by the diffusion of a QMS.

The key research objectives of the research study are:

- to assess what effect a QMS has on a sustainable long-term solution to the problem of energy supply;
- to determine what QMS factors contribute to the establishment of world-class processes and practices;
- to determine how a QMS influences quality culture;
- to determine how a QMS facilitates a continual improvement process, and
- to determine what critical success factors aid, and what barriers hinder, the sustainable implementation of a QMS.

2 LITERATURE REVIEW

Long-term business success is dependent on the business’s ability to provide quality products and services. The International Organisation of Standards (ISO) consists of 130 national standard bodies with the general aim of promoting standardisation. ISO aids organisations through its international presence, using ISO 9000 as a quality standard [26].

Fuentes, Benavent, Moreno, Cruz and Pardo del Val [18] maintain that the ISO 9000 standard series makes use of a formalised system to evaluate any organisation’s ability within the business world. Najmi and Kehoe [33] point out that, since its introduction in 1987, the quality standard has sought to demonstrate proof of quality through a world-wide commonly accepted structure.

To elaborate on the diffusion of a quality management system in the electricity supply industry, the following will be discussed in this literature review:

- The effect of a QMS on a sustainable long-term solution for energy supply.
- The contribution of a QMS to the establishment of world-class processes and practices.
- How QMS affects quality culture.
- QMS and the continual improvement process.
- Implementing a QMS.

2.1 The effect of a QMS on establishing a sustainable long-term solution to the question of energy supply

Establishing a sustainable energy supply is a two-fold process: the energy supplier meets the energy consumer’s requirements, and the consumer uses energy efficiently to enable the supplier to satisfy these requirements. Using the ISO 50001 [24] standard allows an organisation to introduce a QMS that provides a sustainable long-term energy supply, and thus to improve its energy performance.

Collins and Steiger [10] observe that the QMS contribution to proper planning for short- and long-term energy solutions occurs when it is decided what level of quality the organisation desires, and a plan is made to attain that level.

A management system's characteristics ensure that all the company's objectives are achieved in a process-related way, and that the performance can be established at any moment in the process. Management systems in general, if used correctly, contribute towards an organisation's performance. Management systems should not be viewed in isolation, because their structures are interlinked. Management standards overlap each other, and might form bases for each other [24, 28].

International Standard ISO 50001 [24] and Paeger-Consulting [35] mention that ISO 50001 EnMS uses the PDCA cycle for continual improvement in the use of energy management practices.

Energy efficiency, energy consumption, and energy use make up the concept of energy performance. Through addressing these elements, an organisation can change its energy performance in many ways, and do so without being restricted to one area of the business. Any change in the use of energy will have an impact on energy performance. This entails certain flexibility in the capacity of any situation to influence the performance [24, 13].

Sustainable energy planning should consider environmental factors and limits and their impact on energy consumption. Energy planning is the process in which an organisation's plans for 'what' and 'how' in terms of energy are improved.

The International Standard ISO 50001 [24] points out that an energy review is necessary, as it evaluates the use of energy to identify areas for improving energy performance. In most cases, an energy review is carried out as an audit or assessment of the energy performance of an organisation.

2.2 QMS contribution to the establishment of world-class processes and practices

The aim of QMS is to improve a business's performance and help it to achieve its business objectives. ISO 9001 is a process essentially designed to establish what the customer desires, and then satisfy those desires [23, 39, 28].

The ISO 9001 [25] standard usefully describes a process as "a set of interrelated activities that uses inputs to deliver outputs". A process thus requires inputs and outputs of a tangible or intangible nature, and typically uses people or material as resources. Gryna, Chua and DeFeo [20] point out that an output can be unintended – such as waste. A process also consists of a customer who expects certain process outputs and assumes the inputs needed for that process. The process performance is measured by gathering process performance data and analysing it to enable corrective or preventative action to occur. All processes should be developed in alignment with the business objectives, and should add value at every step. They should also be assessed for effectiveness and efficiency through an internal or external review process. A process-orientated approach, such as the one suggested by ISO 9001 [25], is a method of strenuous process management to achieve desired business objectives.

Aparecida da Silva, Pelogia Martins Dam and Ines Dallavalle de Padua [1] and Biazzo and Bernardi [4] note that most companies' structures are hierarchal and have different departments or functional units. The units often operate vertically with independently driven outputs. Often these outputs do not share the same overall objective of customer satisfaction. The result of departments or sections working in parallel or in 'silos' means that business objectives are not met. Biazzo [3] and Gryna et al [22] suggest that the process approach is an alternative view of business, through which value is added by introducing a horizontal management entity called a process. This process approach cuts across the business departments or silos and aligns their focus with the main goal of the organisation. Management processes can interact with other processes in the business to form a system where value is added at every step. Businesses that use systems to form networks in order to operate are known to adopt a 'systems approach' to management. In the system, the output of one process is the input into another, creating interlinking throughout the system.

2.3 QMS affects quality culture

In order to become superior in quality, one has to embrace two courses of action: technology and culture. Gryna *et al* [22] and Martin and Joomis [30] define quality culture as “the pattern of human habits, beliefs, values, and behaviour concerning quality. Technology touches the head; culture touches the heart”. Most quality problems can be controlled with proper management, but cultural issues apply to all levels in the business, from top management to the rest of the workforce.

Naicker [32] and Mullins [31] explain that there has been a lot of focus on corporate culture in the 21st century. Many organisations have realised that non-tangible elements, such as corporate culture, affect their company’s performance. The concept of culture includes habits, beliefs, behaviours, and values, and a corporate culture is no different. Management needs to create the right kind of culture for a business to achieve success.

According to Gryna *et al* [22], Cameron and Sine [7] and Cameron [6], quality culture forms an important part of corporate culture. In order to succeed in terms of quality, companies need to satisfy their customers’ needs with their products and services, and develop a culture that puts quality at the heart of everything. Culture change takes years, not months, as quality ultimately depends on trust, not techniques.

2.4 QMS and the continual improvement process

Continual improvement forms a vital aspect of many QMSs, including ISO 9001 (2008). It is key to organisational competitiveness and should have a strong presence in the business. Quality management modules all share the concept of continual improvement in the organisation’s efficiency and effectiveness. Continual improvement promotes the organisation’s ability to adapt to ever-changing conditions to ensure that it remains in business. ISO 9001-type systems use continual improvement as a source of control, although they are partly stimulated by the competitiveness of other organisations [23, 25].

The research of Harrington [23], Bolton and Heap [5], and Nilsson-Witell, Antoni, and Dahlgard [34] has revealed that the concept of *continuous* improvement is commonly confused with *continual* improvement. But ‘continuous improvement’ suggests that improvement happens constantly and can be represented as a straight line moving upwards. Bolton and Heap [5] observe that ‘continual improvement’ is rather a gradual upward trend that is staggered but continues to move up. These staggered upward movements represent periods of improvement brought on by innovation, process improvements, or any other improvement initiative. Continual improvement for ISO 9001 is embedded everywhere in the requirements and recommendations.

2.5 Implementation of a QMS

In many organisations, the introduction of a QMS produces weak results due to ineffective implementation. Many factors are responsible for the ineffective implementation of a QMS, as has been noted by Jang and Lin [27], Magd [29], Feng, Terziovski, and Samson [16], and Sroufe and Curkovic [41].

The research of Park, Kim, Kang and Jung [36] notes that the time when most barriers were encountered was during and after the certification process. Obstacles such as a lack of leadership, lack of management support, lack of training, employees’ inadequate perception of quality, resource constraints, and employees’ resistance to change were all identified as critical to the successful implementation of ISO 9001. Barriers to implementing ISO 9001 include the following:

- Company policy and cultural background.
- ISO 9001 (2008) requirements.
- Quality management system effect.
- Quality management certification body.
- Customer policy.

These barriers reveal the short-sightedness of seeking certification on the basis of sector trend, with no total commitment to the QMS [43, 2, 8].

Gotzamani [20], and Gotzamani and Tsiotras [21] observes that change in any organisation is never easy. For any change to be successful, the need to change should first be recognised. The

organisation needs to have a complete view of its current state, including its strengths, weaknesses and limitations, the desired future state, and the obstacles associated with the transition stage. The important obstacles to consider during the transition stage are:

- Change of culture.
- Adoption of ‘paper certificates’.
- Management commitment.
- Unrealistic requirements.

3 RESEARCH DESIGN AND METHODOLOGY

The research design and methodology used for this study has three sections: a research theory section that explains to the reader which strategies are available, an application section that explains how these theories are applied, and an account of the particular strategy selected for this research that is based on the theory and application.

The criteria employed in introducing and comparing research strategies used to explain and justify the strategy chosen for this study are as follows:

- **Design classification:** This research falls within the quantitative arena. This method requires the use of both numerical and textual data for its analysis, and has a low degree of control over the research environment.
- **Key research questions:** Key research questions to be addressed in this research are of a descriptive and explanatory nature.
- **Application:** A typical application would occur in a company or other organisation.
- **Mode of observation:** The data is derived from the organisation’s personnel in the form of interviews or responses to a questionnaire.
- **Analysis:** The data analysis includes survey data and descriptive and inferential statistics. For visual representation, charts and graphs are used.
- **Strengths:** Its strength lies in the potential to obtain in-depth insight into the diffusion situation through the collection of rich data.
- **Limitation:** The main limitation might stem from the quality of the data, which might not always satisfy the model being used.
- **Sources of error:** In this type of study, these include sampling error, questionnaire error, high non-response, data capture error, respondent effect, and fieldwork error.

Based on the criteria used to benchmark the various research strategies, and on the particular requirements of this study, the most appropriate research approach is a case study using a questionnaire [40, 42].

4 DIFFUSION OF A QMS: DATA COLLECTION, ANALYSIS, AND INTERPRETATION OF THE RESULTS

Research data can be collected using a variety of methods. Researchers choose their method according to their research paradigm and the type of data it typically produces. This chapter will elaborate on the following:

- Data collection.
- Data validity and reliability.
- Data analysis.

4.1 Data collection

The framework used that leads to the selection of the particular data collection method for this research is that the theory of various data collection methods and their application will be explored. Based on the theory and application of these data collection methods, the most appropriate method for this research was a questionnaire.

4.2 Data validity and reliability

Robson [38] and Easterby-Smith, Thorpe and Lowe [12] remind us that the credibility of research findings has always been an issue in research. The question, ‘How do I know?’, sums up the meaning of credibility when used in the research environment.

Reliability testing was conducted using Cronbach’s alpha test and SPSS software on almost all the data gathered. Cronbach’s alpha test was not conducted on the responses addressing the first research objective, ‘To assess what effect a QMS has on a sustainable long term solution for energy supply’, because of the low sample value of 12.

The Cronbach’s alpha coefficient summary is provided in Table 1.

Table 1: Summarised Cronbach’s alpha test for research

Research question	Cronbach’s alpha	Internal consistency
Questions 6 - 10	0.659	Questionable
Questions 11 - 15	0.699	Questionable
Questions 16 - 20	0.695	Questionable
Questions 21 - 25	0.619	Questionable

The reliability test was conducted on the data gathered for each research objective. The result of the initial Cronbach’s alpha test for questions 6-10 was 0.427, which meant that internal consistency was unacceptable. After removing question 8, as shown in Annexure E, the alpha coefficient increased to 0.659, which indicated that the measuring instrument, though questionable, was still usable.

The remaining research questions all yielded questionable but still usable instruments.

4.3 Data analysis

De Vos [11] and Given [19] describes data analysis as “the process of bringing order, structure and meaning to the mass of collection data”. This study aims to determine whether the diffusion of a quality management system can improve the electricity supply industry by answering the following research questions:

- What effect does a QMS have on a sustainable long-term solution for energy supply?
- How does a QMS contribute to the establishment of world-class processes and practices?
- How does a QMS influence quality culture?
- How does a QMS ensure a continual improvement process?
- What factors affect a sustainable QMS implementation?

The data used for the analysis was obtained through the completed questionnaires. This analysis was conducted in two steps: data preparation, which consists of organising and cleaning the data to be used for the analysis; and descriptive statistics, which provide a holistic description of the collected information using SPSS.

4.4 Analysis

4.4.1 Descriptive statistics to assess what effect a QMS has on a sustainable long term solution to the problem of energy supply.

Table 2 illustrates that the standard deviations for questions 1-5 were low, except for question 5. This indicates there was noteworthy disagreement associated with question/statement 5. The most common answer to all the questions was Agree (2), as indicated by the mode of questions 1-5. Using the coefficient of variation (CV) indicates there was a high variation of answers with respect to question 5.

Table 2: Descriptive statistics: Questions 1-5

1. QMS (ISO 9001:2008) effect on a sustainable long-term solution for energy supply.							
Question		N	Mean	Median	Mode	Std. Deviation	(CV)
		Valid					
1	The quality policy introduced by the QMS (ISO 9001:2008) supports Eskom’s sustainable drive.	6	1.83	2.00	2	0.408	22%
2	The Eskom energy management programmes support the pillars of sustainability (social, environmental, and economic).	6	2.17	2.00	2	0.408	19%
3	The QMS (ISO 9001:2008) performance does impact the Eskom energy improvement programmes.	6	2.33	2.00	2	0.516	22%
4	The energy improvement programmes use continual improvement principles.	6	2.00	2.00	2	0.632	32%
5	The QMS (ISO 9001:2008) does support the monitoring of energy improvement initiatives.	6	2.33	2.00	2	1.033	44%

4.4.2 Descriptive statistics to determine what QMS factors contribute to the establishment of world-class processes and practices.

Table 3 illustrates the standard deviations for questions 6-10, which were low, except for question 8, indicating a strong disagreement with question/statement 8. The disagreement was confirmed by looking at the uni-variate graph in Figure 2. The most common answer to all the questions was ‘Agree’ (2), as indicated by the mode of response to questions 6-10 – excluding question 8, which was ‘Disagree’ (4). Using the coefficient of variation (CV) for this section illustrates a high variation of answers with respect to question 8.

Table 3: Descriptive statistics: Questions 6-10

2. QMS (ISO 9001:2008) contribution to the establishment of world-class processes and practices.							
Question		N	Mean	Median	Mode	Std. Deviation	(CV)
		Valid					
6	Process improvement is directly related to the quality management system (ISO 9001:2008).	21	2.10	2.00	2	0.889	44%
7	QMS (ISO 9001:2008) process and systems approach leads to an improvement of processes in Eskom.	21	2.05	2.00	2	0.590	43%
8	All Eskom staff have been trained on the Eskom processes (process control manuals).	21	3.24	4.00	4	1.261	68%
9	QMS (ISO 9001:2008) does provide us with tools to improve processes.	21	2.29	2.00	2	0.845	48%
10	Eskom has adopted the process and systems approach introduced by the QMS (ISO 9001:2008).	21	1.90	2.00	2	0.625	40%

4.4.3 Descriptive statistics for research objective 3

Table 4 illustrates that the standard deviations for questions 11-15 were low, except for question 15, which indicates a strong disagreement with question/statement 15. The disagreement was confirmed by looking at the uni-variate graph in Figure 3. The most common answer to all the questions was ‘Agree’ (2), as indicated by the mode of questions 12-13, but excluding question 15, which was ‘Disagree’ (4), and question 11, which was ‘Strongly agree’ (1). The coefficient of variation (CV) indicates there was a high variation of answers with respect to all questions.

Table 4: Descriptive statistics: Questions 11-15

3. The effect of QMS (ISO 9001:2008) on quality culture.							
Question		N	Mean	Median	Mode	Std. Deviation	(CV)
		Valid					
11	A quality culture is when quality is embedded in every part of the business.	21	1.52	1.00	1	0.750	49%
12	Eskom does have a quality culture.	21	2.19	2.00	2	0.928	42%
13	Open and honest communication is part of Eskom's culture.	21	2.48	2.00	2	0.981	39%
15	Eskom does learn from past mistakes.	21	2.76	3.00	4	1.221	44%

4.4.4 Descriptive statistics for research objective 4

Table 5 shows that the standard deviations for questions 16-20 were low, except for questions 17, 19, and 20. This indicates a strong disagreement with statements 17, 19, and 20. The disagreement was confirmed by looking at the uni-variate graph – see Figure 5. The most common answer to all the questions was ‘Agree’ (2), as indicated by the mode of questions 16-20 – excluding question 18, which was ‘Undecided’ (3). Using the coefficient of variation (CV) indicates that there was a high variation of answers with respect to all questions.

Table 5: Descriptive statistics: Questions 16-20

4. QMS effect on continual improvement process in an organisation.							
Question		N	Mean	Median	Mode	Std. Deviation	(CV)
		Valid					
16	Eskom's quality policy promotes continual improvement.	74	1.89	2.00	2	0.732	39%
17	Continual improvement introduced by QMS (ISO 9001:2008) is practised within Eskom.	74	2.78	3.00	2	1.076	39%
18	Continual improvement practised in Eskom is based on the PDCA cycle.	74	2.42	3.00	3	0.702	29%
19	Monitoring, measuring, and analyses are performed on all continual improvement processes.	74	2.96	3.00	2	1.152	39%
20	Top management is committed to continual improvement.	74	2.39	2.00	2	1.004	42%

4.4.5 Descriptive statistics for research objective 5

Table 6 shows how the standard deviations for questions 21-25 indicated that there was some disagreement with all the questions/statements. The disagreement was confirmed by looking at the uni-variate graph – see Figure 6. The most common answer to all the questions was ‘Disagree’ (4), as indicated by the mode of questions 21-25, but excluding questions 21 and 22, where it was ‘Agree’ (2).

Table 6: Descriptive statistics: Question 21-25

5. Barriers that affect a sustainable QMS implementation.							
Question		N	Mean	Median	Mode	Std. Deviation	(CV)
		Valid					
21	The implementation of ISO 9001:2008 is sustainable.	74	2.47	2.00	2	1.063	43%
22	Senior management is strongly involved with the ISO 9001:2008 drive.	74	2.64	2.00	2	1.067	40%

23	Sufficient quality training was given to staff during the ISO 9001:2008 implementation.	74	3.24	3.50	4	1.132	35%
24	All employees do fully understand the concept of quality.	74	3.51	4.00	4	0.983	28%
25	Eskom staff do fully understand the ISO 9001:2008 requirements.	74	3.50	4.00	4	1.010	29%

4.5 Uni-variate graphs

4.5.1 Graph for objective 'QMS (ISO 9001:2008) effect on a sustainable long-term solution for energy supply'

The designation of the respondents who answered the research questionnaire 'QMS (ISO 9001:2008) effect on a sustainable long-term solution for energy supply' is employees who work in the sustainable energy management environment. The result of the questionnaire is illustrated in Figure 1.

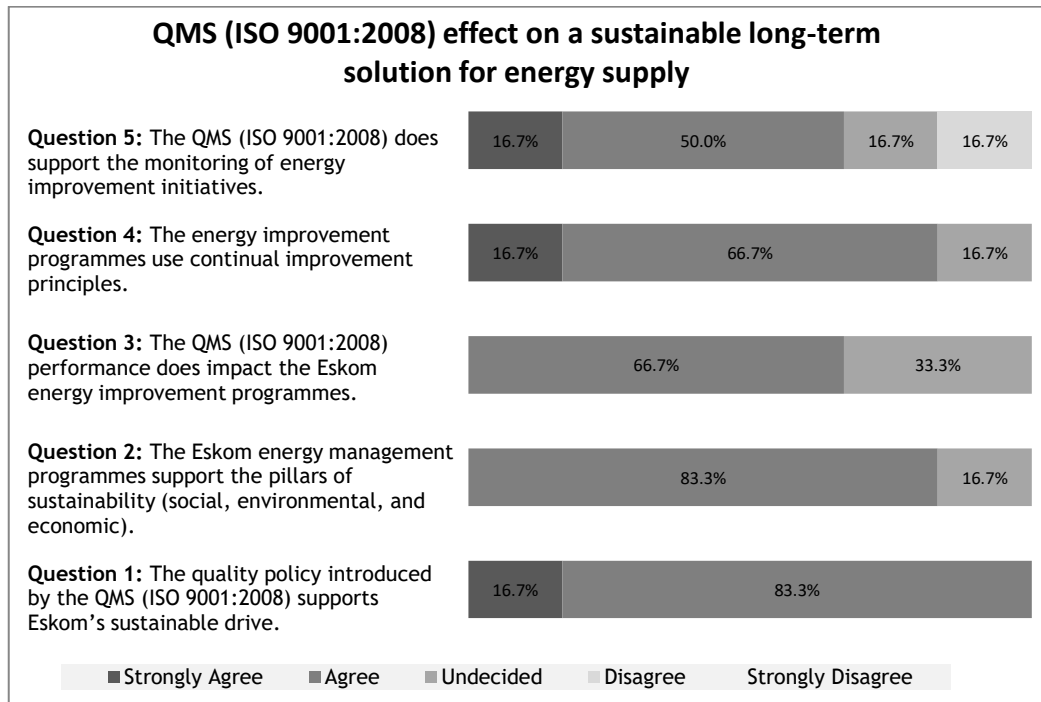


Figure 1: QMS (ISO 9001:2008) effect on a sustainable long-term solution for energy supply.

Most of the respondents agreed or strongly agreed with the five statements:

- The quality policy introduced by the QMS (ISO 9001:2008) supports Eskom's drive for sustainability (100 per cent agree to strongly agree).
- Eskom energy management programmes support the pillars of sustainability (social, environmental, and economic) (83.3 per cent agree).
- The QMS (ISO 9001:2008) performance does affect the Eskom energy improvement programmes (66.7 per cent agree to strongly agree).
- The energy improvement programmes use the continual improvement principle introduced by the QMS (ISO 9001:2008) (83.3 per cent agree to strongly agree).
- The QMS (ISO 9001:2008) does support the monitoring of energy improvement initiatives (66.7 per cent agree to strongly agree).

4.5.2 Graph for questionnaire 'QMS (ISO 9001:2008) effect on a sustainable long-term solution for energy supply'

The respondents who answered the research questionnaire 'QMS (ISO 9001:2008) contribution to the establishment of world-class processes and practices' are employees appointed as quality management system directors in their respective sections. The results of the questionnaire are illustrated in Figure 2.

QMS (ISO 9001:2008) contribution to the establishment of world-class processes and practices.

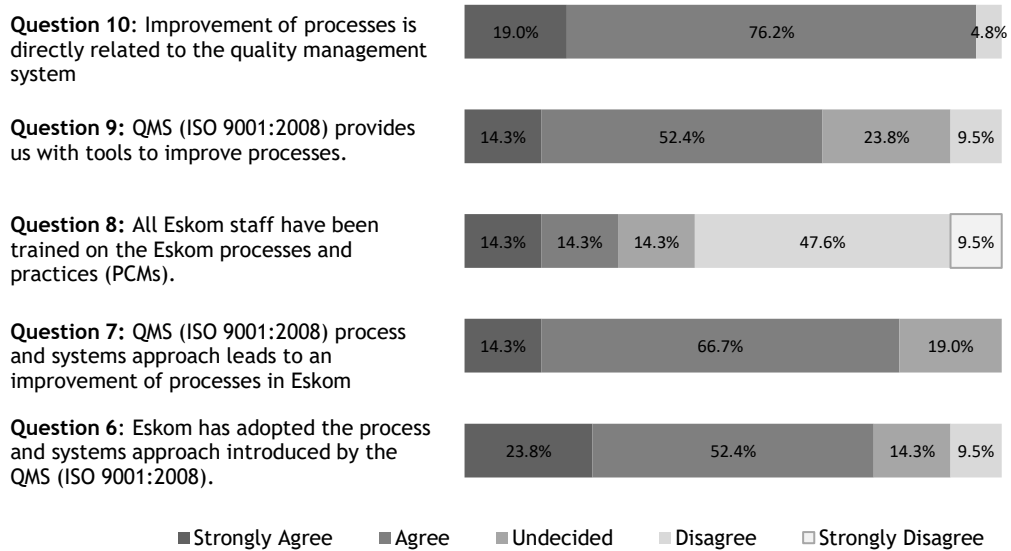


Figure 2: QMS (ISO 9001:2008) contribution to the establishment of world-class processes and practices.

Most of the respondents agreed or strongly agreed with the five statements:

- Eskom has adopted the process and systems approach introduced by the QMS (95.2 per cent agree to strongly agree).
- The QMS (ISO 9001:2008) process and systems approach leads to an improvement of processes in Eskom (81 per cent agree to strongly agree).
- Process improvement is directly related to the quality management system (76.2 per cent agree to strongly agree).
- QMS (ISO 9001:2008) does provide us with tools to improve processes (66.7 per cent agree to strongly agree).

4.5.3 Graph for questionnaire ‘The effect of QMS (ISO 9001:2008) on quality culture’

The designation of the respondents who answered the research questionnaire ‘The effect of QMS (ISO 9001:2008) on quality culture’ are employees appointed as the quality management system managers in their respective sections. The results of the questionnaire are illustrated in Figure 4.

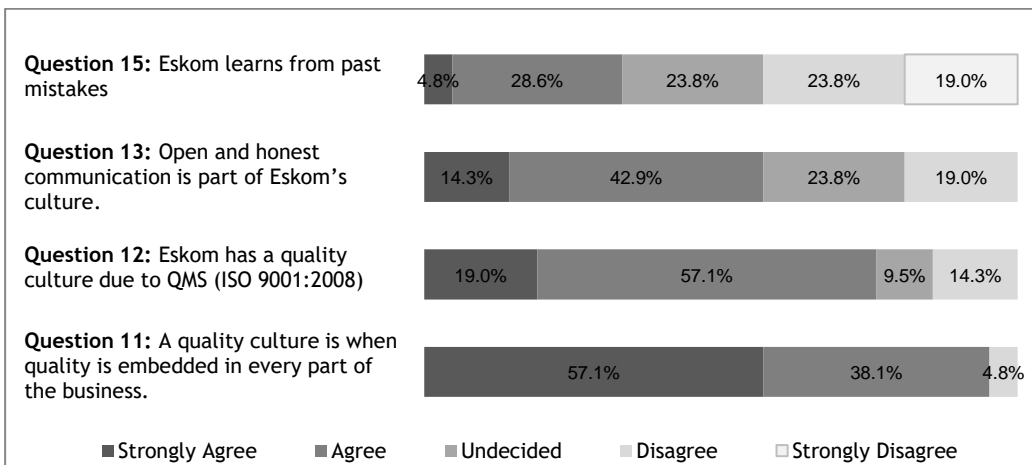


Figure 3: The effect of QMS (ISO 9001:2008) on quality culture.

Most of the respondents agreed or strongly agreed with the four statements:

- A quality culture is when quality is embedded in every part of the business (95.2 per cent agree or strongly agree).
- Eskom has a quality culture due to QMS (ISO 9001:2008) (76.1 per cent agree or strongly agree).
- Open and honest communication is part of Eskom’s culture (57.2 per cent agree or strongly agree).
- Eskom learns from past mistakes (42.8 per cent disagree or strongly disagree).

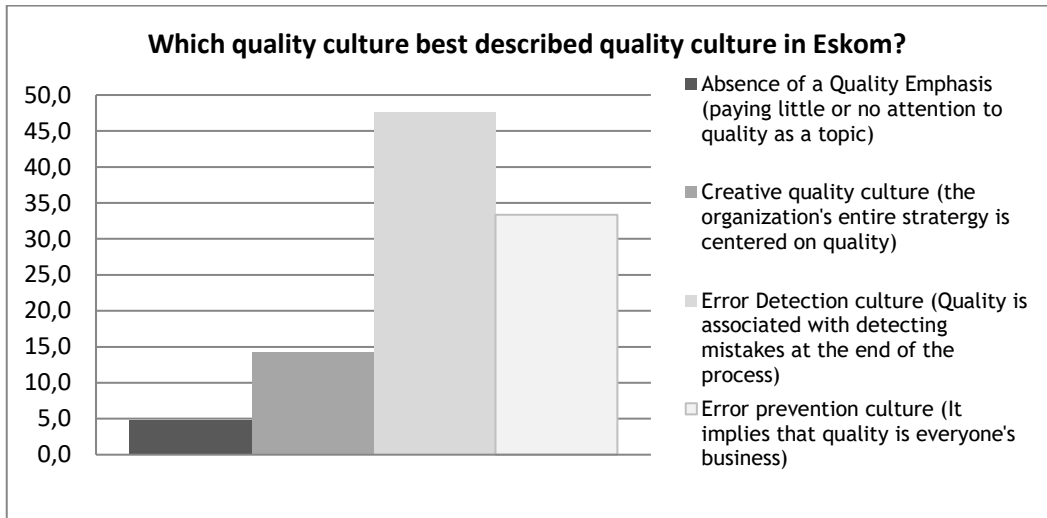


Figure 4: Which quality culture best described quality culture in Eskom?

Regarding the question, ‘Which quality culture best describes quality culture in Eskom?’, Figure 4 illustrates that most respondents identified ‘Error detection culture’ (quality is associated with detecting mistakes at the end of the process) as the quality culture in Eskom.

4.5.4 Graph for questionnaire ‘QMS effect on continual improvement process in an organisation’

The respondents who answered the research questionnaire ‘QMS effect on continual improvement process in an organisation’ are employees appointed as the quality management system directors in their respective sections (22 per cent) and the quality management representatives/document controllers (78 per cent), as shown in Table 5. The results of the questionnaire are illustrated in Figure 5.

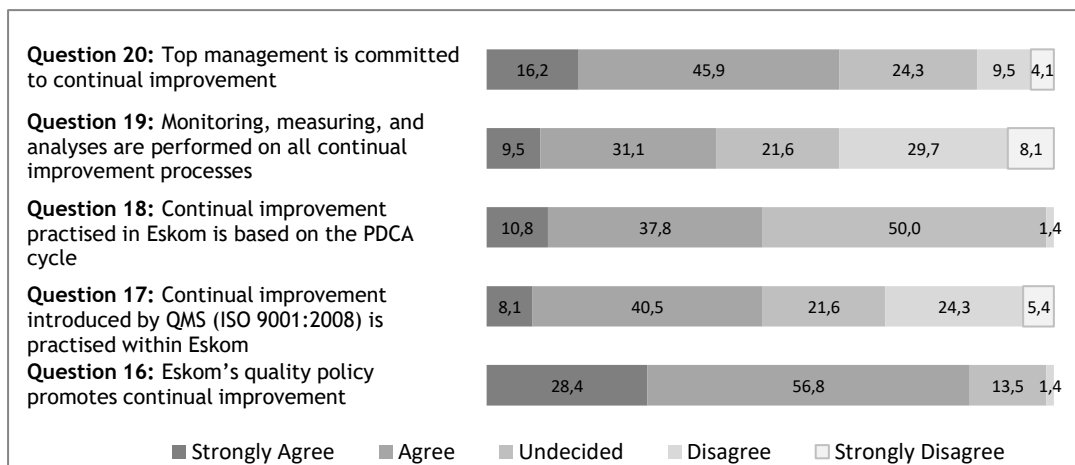


Figure 5: QMS effect on continual improvement process in an organisation.

Most of the respondents agreed or strongly agreed with the statements:

- Eskom’s quality policy promotes continual improvement (85.2 per cent agree or strongly agree).
- Top management is committed to continual improvement (62.1 per cent agree or strongly agree).
- Continual improvement introduced by the QMS (ISO 9001:2008) is practised within Eskom (48.9 per cent agree to strongly agree).
- Monitoring, measuring, and analyses are performed on all continual improvement processes (40.6 per cent agree to strongly agree).

Half of the respondents were undecided about the statement ‘Continual improvement practised in Eskom is based on the PDCA cycle’ (50 per cent undecided).

4.5.5 Graph for questionnaire ‘Barriers that affect a sustainable QMS implementation’

The respondents who answered the research questionnaire ‘QMS effect on continual improvement process in an organisation’ are the employees appointed as the quality management system directors in their respective sections and the quality management representatives/document controllers. The result of the questionnaire is illustrated in Figure 6.

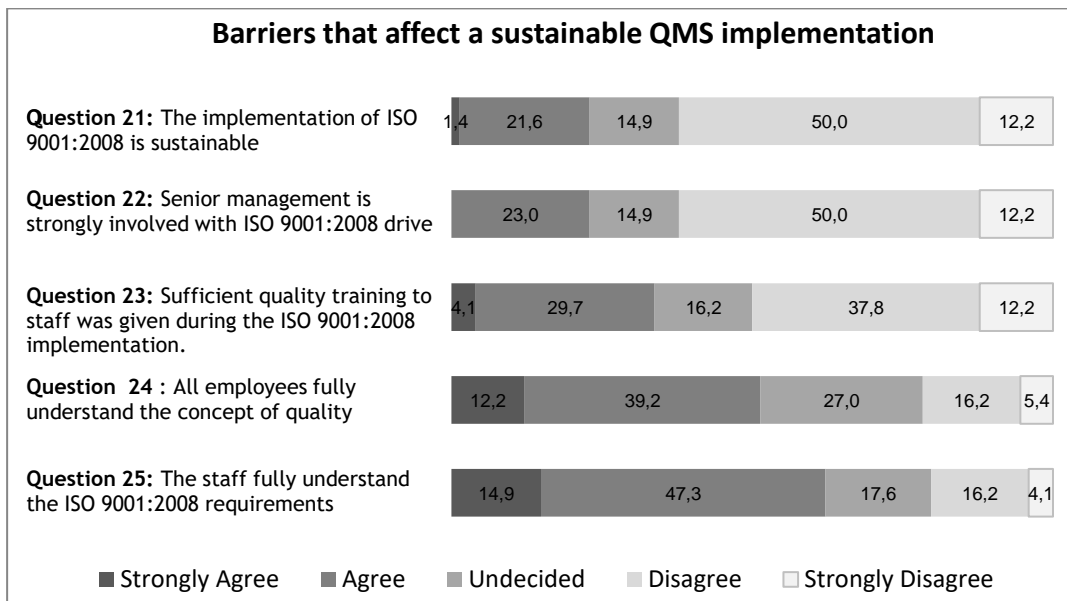


Figure 6: Barriers that affect a sustainable QMS implementation.

Most of the respondents agreed or strongly agreed with the statements:

- The implementation of ISO 9001:2008 is sustainable (62.2 per cent agree to strongly agree).
- Senior management is strongly involved with the ISO 9001:2008 drive (54.1 per cent agree to strongly agree).

Half or more of the respondents disagreed or strongly disagreed with the following statements:

- Eskom staff does fully understand the ISO 9001:2008 requirements (62.2 per cent disagree to strongly disagree).
- All employees do fully understand the concept of quality (62.2 per cent disagree to strongly disagree).
- Sufficient quality training to staff was given during the ISO 9001:2008 implementation (50 per cent disagree to strongly disagree).

5 CONCLUSION

5.1 Research questions answered using the data analysis

The research questions were answered using the research data analysis performed in the previous section. Descriptive statistics helped to develop the answers to these questions. Below is a detailed answer to each question, based on the analysis data.

5.1.1 *Research question: 'What effect does a QMS have on a sustainable long-term solution to the problem of energy supply?'*

The quality policy introduced by the QMS (ISO 9001:2008) supports Eskom's sustainability drive and does impact the Eskom energy improvement programmes. The energy improvement programmes use the continual improvement principle introduced by the QMS (ISO 9001:2008), including monitoring and measuring.

5.1.2 *Research question: 'How does a QMS contribute to the establishment of world-class processes and practices?'*

Eskom has adopted the process and systems approach introduced by the QMS, which leads to an improvement of processes in Eskom. The tools to improve processes do exist; however, staff have not been trained in the Eskom processes (process control manuals).

5.1.3 *Research question: 'How does a QMS influence quality culture?'*

Eskom has a quality culture due to QMS (ISO 9001:2008), which includes open and honest communication. Eskom does not learn from past mistakes, and has an error detection culture (quality is associated with detecting mistakes at the end of the process).

5.1.4 *Research question: 'How does a QMS ensure a continual improvement process?'*

Eskom's quality policy promotes continual improvement, and top management is committed to continual improvement. Continual improvement, which includes monitoring, measuring, and analysis, introduced by QMS (ISO 9001:2008), is practised within Eskom. It is undecided whether continual improvement as practised in Eskom is based on the PDCA cycle.

5.1.5 *Research question: 'What factors affect a sustainable QMS implementation?'*

The factors that affect a sustainable QMS implementation are: senior management involvement, full understanding of the ISO 9001:2008 requirements, and full understanding of the concept of quality and quality training.

5.2 Research questions answered using the literature

The research questions were answered using the literature review performed in Chapter 3. This literature review was done by reviewing journal articles, international standards, textbooks, and online articles. A literature review was performed for each research question, which led to developing the answers to these questions. Below is a detailed answer for each question, based on the literature.

5.2.1 *Research question: 'What effect does a QMS have on a sustainable long-term solution to the problem of energy supply?'*

International Standard ISO 50001 [24] and Eccleston, March and Cohen [11] highlight that using the ISO 50001 standard allows an organisation to infuse a QMS with a sustainable long-term solution for energy supply, while improving the organisation's energy performance at the same time.

Collins and Steiger [10] state that a QMS contributes to proper planning for short- and long-term energy solutions when it is decided what level of quality the organisation desires, and a plan is formulated to attain that level.

Sustainable energy planning considers environmental factors and limits and their impact on energy consumption. There is a growing international trend for organisations to adopt targets to reduce greenhouse gases for more sustainable energy production. Thus, to produce a sustainable energy plan, one should look at the bigger picture of future energy needs [24].

According to International Standard ISO 50001, an energy review is necessary, as it evaluates the use of energy, which leads to identifying areas where energy performance can be improved.

5.2.2 Research question: ‘How does a QMS contribute to the establishment of world-class processes and practices?’

The reference to processes in the ISO 9001 (2008) standard is strong and clear. Sub-clause 0.2, Process approach: “The application of a system of processes within an organization, together with the identification and interactions of these processes, and their management to produce the desired outcome, can be referred to as the process approach” [25].

It is good practice on the part of organisations to define the number and type of processes in the business. It is common for processes that form part of the QMS to exist in the organisation as well [26].

Biazzo [3] and Gryna [22] suggest that the process approach is an alternative view of business, such that value is added by introducing a horizontal management entity called a process. Businesses that use systems to form networks to operate are known to adopt a ‘systems approach’ to management. In this system, the output of one process is the input into another, thus creating interlinking throughout the system.

5.2.3 Research question: ‘How does a QMS influence quality culture?’

Collins and Porras [9] and Mullins [31] maintain that an organisational culture exists when an organisation is distinguished by a shared meaning among its members.

Mullins [31] and Naicker [32] found that the notion of culture enables one to account for variations among organisations and managers. There is nothing incidental about social qualities, and there is a relationship between an association’s society and its executive activities.

Naicker [32] emphasises that corporate culture is one of the most important qualities of a successful company. In order to succeed in terms of quality, a company needs to satisfy the customer’s need with its products and services, and develop a culture that puts quality at the heart of everything. A culture change takes years, not months, as quality requires trust rather than techniques.

5.2.4 Research question: ‘How does a QMS ensure a continual improvement process?’

The quality management modules all share the concept of continual improvement aimed at improving the organisation’s efficiency and effectiveness [25, 34]. The continual improvement concept helps with building quality into the process of production, and provides a way to prevent the stagnation of systems after they have been implemented [17, 37].

Foster [17] and Plura [37] explain that continual improvement is not just about using a set of tools and techniques, or of organising departments that focus on improvement and on training people. Improvement occurs after a change in the organisation. Continual improvement needs to focus on issues such as leadership and communication, regardless of the level of the organisation.

5.2.5 Research question: ‘What factors affect a sustainable QMS implementation?’

The research of Park et al [36] notes that most obstacles were experienced during and after the certification process. Issues such as a lack of leadership, lack of management support, lack of training, employees’ inadequate perception of quality, resource constraints, and employees’ resistance to change were all identified as critical barriers to the successful implementation of ISO 9001 (2008).

To summarise, to be obstructed by these barriers is indicative of a short-sighted motivation for seeking certification. It suggests that the standard itself is expected to produce something more; that there is an absence of total commitment to the QMS; and that the quest for certification is based merely on sector trend [43, 2, 8].

5.3 Recommendations

The following conclusions are reached and recommendations made on the basis of the data analysis.

- **Conclusion 1:** Regarding the research question: ‘The effect of QMS (ISO 9001, 2008) on a sustainable long-term solution for energy supply’, it is accepted that a QMS does improve the chances of a sustainable long-term solution to the question of energy supply. However, the link between the sustainability drive and quality policy needs to be strengthened, as 16.7 per cent of respondents disagreed with that statement.

- **Recommendation 1:** Senior management must lead the quality policy and sustainability drive. It is recommended that training and awareness programmes be used to highlight the link between the quality policy and sustainability drive.
- **Conclusion 2:** There is a general acceptance that the QMS has a positive effect on processes and serves as a way to improve business. However, 57.1 per cent of staff is of the opinion that there was insufficient training.
- **Recommendation 2:** Training all staff on processes is vital to the performance of the business. It is the foundation of a QMS and should be a continuous activity. Process training and the PDCA concept should be part of everyone's work activities.
- **Conclusion 3:** The positive effect of a QMS on quality culture in the business is duly acknowledged. The area of concern here is that quality is not embedded in every part of the business. This is confirmed by the majority of respondents describing Eskom's quality culture as an 'error detection culture' (i.e., that quality is associated with detecting mistakes at the end of the process).
- **Recommendation 3:** Management needs to lead the drive to include quality in every activity in the business. This can be achieved by including quality considerations in any type of training programme in the business. The importance of quality and business culture needs to be emphasised because, if the culture is strong, there is less need for formalised standards, processes, rules, etc. Incentivising good quality application - and not only quality itself - can increase the diffusion of quality in the business.
- **Conclusion 4:** It is generally accepted that the QMS leads to continual improvement in the business. However, 50.7 per cent of respondents disagree or strongly disagree that continual improvement is practised in Eskom.
- **Recommendation 4:** The non-conformance process is a vital part of continual improvement. Management needs to lead this process to ensure continual improvement in the business. Credible business decisions can be made on the basis of existence of non-conformance in Eskom.
- **Conclusion 5:** The barriers that affect sustainable QMS implementation in Eskom stem from the impression that insufficient quality training was given, which has led to employees not understanding the QMS and the quality concept.
- **Recommendation 5:** Continual quality training and the application of quality in every part of the Eskom organisation will ensure that employees achieve a better understanding of quality concepts and the role of the QMS.

The successful diffusion of a QMS is dependent on a few essential elements, such as management's commitment to the QMS to drive the current work culture towards a quality culture. QMS training is essential to empower employees to understand and adopt the quality way of life.

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