Implementation quality management systems in the electrical distribution contractors in Oman: An exploratory case study

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Abstract The exploratory case study examined Oman's power distribution contractors' quality management systems (QMS). The research sought to understand how electrical distribution contractors see QMS and auditing barriers and facilitators. The survey interviewed Oman's electricity distribution business professionals. Sixteen electrical workers in Oman were interviewed. Interviews highlighted electrical distribution contractors' QMS and audit challenges. Interviews also addressed QMS and auditing success factors. The analysis shows that electricity distribution companies must address safety, quality, and power outages. ISO standards (International Standardization Organization) provide quality management and reduce risks. Quality training and QMS awareness are also stressed by the outcomes. The research found that group meetings can solve implementation issues and foster a collaborative quality management approach. These meetings allow for problem-solving, best practices, and networking. This research may help develop strategies and academic studies to standardize QMS in Oman's electrical distribution business.

Keywords: quality management system (QMS), electrical distribution contractors, auditing procedures, ISO standards, electrical safety, quality training

1. Introduction

QMSs are crucial. To ensure corporate success across sectors. Oman's energy distribution business relies on QMS and audits. This exploratory case study examined Oman's electricity distribution contractors' QMS implementation and audit experiences. Oman's electrical distribution business struggles with quality control and electricity supply (Ammar et al., 2022). As power consumption grows, distribution networks must be stable and secure.

The objective is to investigate the implementation issues of Quality Management Systems for electrical distribution contractors in Oman in order to provide recommendations for enhancing auditing procedures. In addition, deploying the correct execution of the Quality Management System in electrical distribution contracts for Oman-based businesses in accordance with auditing procedures.

This project will improve theoretical and practical knowledge of quality management methods in the electrical sector and enable policymakers, practitioners, and stakeholders sustainably embrace QMS. By tackling these implementation issues, the electrical distribution business in Oman may enhance quality management, customer happiness, and efficiency in delivering reliable and secure electrical services.

RQ 1: What are the perceptions and experiences of electrical distribution contractors in Oman on the barriers of implementing Quality Management Systems and auditing procedures?

RQ 2. What are the perceptions and experiences of electrical distribution contractors in Oman on the facilitators of implementing Quality Management Systems and auditing procedures?

The main limitations the study is limited to group of Electrical Distribution Contractors in Oman. It might or might not be able to be applied in various contexts because the qualitative study does not seek to generate results that can be generalized.

1.1. Literature review

Electrical distribution contractors appreciate QMS. Before starting the specialized study, you must understand QMS in this context. QMS, models, and business success must be defined and understood. Das et al. (2018) proposed a novel strategy for improving distribution network energy efficiency using energy storage systems (ESSs) in the QMS framework.
This study emphasizes the benefits of ESS integration to improve electrical distribution network performance, although it is unclear how it ties to continuing research. Analyzing the study’s methods and limits helps contextualize its findings.

Bozola et al. (2023) advised automakers to implement the new IATF 16949 quality management standard. This research provides insights into how new quality management aspects may be effectively incorporated by electrical distribution contractors in Oman, even when there is no evident relationship. Examine how these standards apply to power distribution. In 2021, Abd Ghani examined the challenges Malaysian construction businesses faced adopting ISO 9001:2015. SEM and a structured survey examined element connections. Malaysian construction companies and Oman electrical distribution contractors may have similar QMS implementation challenges. In connection with quality management systems and reorganize their capacity to adjust unexpected events resulting in better and safe occupational safety and energy auditing in electrical sectors for improving auditing procedures and examining the Implementation protocols of the quality management system in electrical distribution contractors in Oman.

2. Materials and Methods

2.1. Research design

The study was an exploratory case study. To understand quality management systems (QMS) and audits (Ji et al., 2021). A qualitative exploratory case study was utilized to explore QMS features and auditing implementation (Ji et al., 2021). It is vital to include prominent case study researchers like Tambare et al. (2021) and Brooks et al. (2021), who stressed the relevance of this methodological choice and provided a deeper understanding of this research strategy. These notable scholars can help explain the case study approach and its relevance to quality management. This technique allows contractors to discuss their QMS implementation challenges and experiences.

Case studies, which enabled the use of numerous data sources, including interviews, observations, and documents, were also considered appropriate. Combining data from many sources simplifies triangulation and assures correctness, boosting the study’s validity and reliability. The case study technique was appropriately selected to explore the complex dynamics and challenges of QMS and auditing implementation in the particular setting of electricity distribution contractors in Oman.

2.2. Sampling and participants

Participants met inclusion requirements. Quality management system adoption by Omani electrical sector personnel was required. Purposive sampling was used to choose people who might give relevant study data. Participants from the Oman Electrical Sector were recruited. Participants without enough electrical expertise will be disqualified. Table 1 lists chosen participants.

<table>
<thead>
<tr>
<th>S. No</th>
<th>Participants</th>
<th>Designation</th>
<th>Field Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>TK</td>
<td>Manager and Owner UL Commerce Consultancy Oman</td>
<td>34 years</td>
</tr>
<tr>
<td>2.</td>
<td>BOB</td>
<td>Consultant at Robert Enterprises</td>
<td>40 years</td>
</tr>
<tr>
<td>3.</td>
<td>ABUS</td>
<td>Quality Manager</td>
<td>20 years</td>
</tr>
<tr>
<td>4.</td>
<td>AM</td>
<td>CEO Electrical Company</td>
<td>Five years</td>
</tr>
<tr>
<td>5.</td>
<td>OW</td>
<td>QHSE Team lead</td>
<td>14 years</td>
</tr>
<tr>
<td>6.</td>
<td>AJ</td>
<td>Electrical Engineer</td>
<td>Ten years</td>
</tr>
<tr>
<td>7.</td>
<td>AR</td>
<td>Regional Manager</td>
<td>25 years</td>
</tr>
<tr>
<td>8.</td>
<td>SM</td>
<td>Operation Engineer</td>
<td>19 years</td>
</tr>
<tr>
<td>9.</td>
<td>HH</td>
<td>Senior Manager- Business and Asset Planning</td>
<td>30 years</td>
</tr>
<tr>
<td>10.</td>
<td>HB</td>
<td>QHSE Head Section</td>
<td>18 years</td>
</tr>
<tr>
<td>11.</td>
<td>HR</td>
<td>Quality, Health and Safety</td>
<td>Seven years</td>
</tr>
<tr>
<td>12.</td>
<td>AM</td>
<td>QHSE Acting Manager</td>
<td>12 years</td>
</tr>
<tr>
<td>13.</td>
<td>ATH</td>
<td>Electrical Supervisor</td>
<td>Ten years</td>
</tr>
<tr>
<td>14.</td>
<td>AMAR</td>
<td>Senior Operation Manager</td>
<td>15 years</td>
</tr>
<tr>
<td>15.</td>
<td>AQ</td>
<td>Senior Manager Energy Procurement</td>
<td>20 years</td>
</tr>
<tr>
<td>16.</td>
<td>SH</td>
<td>GM- Oman Engineering Investment Company</td>
<td>15 years</td>
</tr>
</tbody>
</table>

Sixteen participants were selected based on data saturation (Mwita, 2022), the point at which new information becomes repetitious and redundant. Saturation ensures that the research fully understands implementation problems.

2.3. Data collection

Semi-structured interviews with selected persons were the main data source. The interview procedure comprised open-ended questions and prompts to obtain detailed QMS implementation issues from electrical distribution contractors.
Before data collection, ethics were addressed, including informed permission. This study was approved by the Ethics Committee of Cyprus International University. Participants were informed about the research, its aims, voluntary participation, and anonymity. Participants provided written informed consent for participation. Audio-recorded interviews ensured accuracy throughout the analysis. Verbatim transcription transcribed the recorded interviews.

2.4. Data analysis

We utilized thematic analysis to detect patterns in participant responses and Dedoose for coding and topic creation. Research topics and theoretical models shaped codes, categories, and themes throughout the analysis. The theoretical model also provided a foundation for understanding QMS implementation challenges. Due to this model's effect on thematic categories, the inquiry focused on QMS implementation and Oman's electrical distribution contractors' challenges.

The coded data segments were carefully analyzed and categorized into overarching themes based on participants' replies to uncover recurrent patterns, topics, and categories relevant to QMS implementation challenges. Each topic was analyzed in relation to the research questions and theoretical model to ensure that the results were founded on facts and theory. To improve outcomes' dependability and validity, quality control was utilized throughout the study.

Interviews, Dedoose coding, and theme analysis are viable tools for studying Oman's electrical distribution contractors' QMS implementation issues. This strategy helps explain the issues and possible remedies.

3. Results

The results chapter presents Oman's electricity sector participant interview findings. This chapter summarizes the interview analysis of QMS implementation issues among electrical distribution contractors. The data show what variables affect QMS adoption in this industry and what contractors face.

3.1. QMS challenges

TK emphasizes that even a little aspect, like a link, may impact the network's quality and reliability. Quality management is essential to solving these issues and preventing widespread failures (Please see Supplementary Material).

3.1.1. Lack of government investment

AJ said in the interview, "There is no legal recommendation from APSR (Authority Of Public Service Regulator) or some other legal authority to adopt the quality management system in the electrical sector." The allegation implies that regulatory organizations, such as the Authority of Public Service Regulator (APSR) or other judicial entities, do not require the electrical sector to apply a Quality Management Procedure (QMS). The absence of legislative guidelines for QMS implementation in the electrical industry may affect enterprises' commitment to quality management practices. In the absence of regulatory pressure, organizations may regard QMS adoption as an optional step to ensure consistent quality and operational excellence.

3.1.2. Substandard quality standards

"Because the product is very high, then the supplier will make sure it's going to perform, and if there's a failure of transmission, the supplier will face a big penalty," AR said. Mr AJ says the Authority of Public Service Regulator (APSR) and other legal bodies do not require the electricity business to establish a quality management system (Please see Supplementary Material). The electrical business seems to have no clear legislative standards for quality management systems, unlike other industries.

3.2. Auditing challenges

3.2.1. Outsourcing and lack of knowledge

HB said, "I think it's all to do with the investment...some companies may decide not to implement because of cost...having to adopt the general... audit controls...while you have it, you know, geographic location is different." The participant said investment, economic issues, and location influence the electrical industry's QMS decision. The responder said that QMS implementation costs, including basic audit controls, may deter certain organizations (Please see Supplementary Material).

3.2.2. Impact of substandard systems

Mr HR's remark is intriguing: "Failures of equipment and substandard systems can damage our business and our customer's faith in us." Informed decision-making and internal knowledge are essential for trustworthy and successful operations. Risk and equipment failure should be considered when installing a QMS in the electrical business, according to
participants. The reply stresses that equipment failure and poor quality are key problems in QMS implementation (Please see Supplementary Material).

3.3. Theme 3: Quality management standards: ISO accreditation

QMS effectiveness requires ISO certification. BOB says, "The systems themselves have progressed quickly... ISO certified... In every management system, installation, monitoring, and ongoing improvement lag. ISO standards enable effective quality management operations in organizations.

"Oman’s electrical centre had companies." OW's interview answer matches ISO 9001, a global QMS standard. ISO 9001 standards emphasize customer satisfaction, innovation, and regulatory compliance. It helps companies identify and meet consumer demands, streamline procedures, and increase performance (Please see Supplementary Material).

3.4. Quality management and productivity

The research stressed ISO 9001’s role in process improvement and operational excellence. BOB says, "If you raise the quality management system by 100%, you’re probably going to boost productivity by 100%... It’s hard to quantify but proportionate. "Investment is needed to develop systems, examine international best practices, and implement."

3.5. Significance of data quality

Data quality was stressed in audits and continuing improvement. They said that improving data quality may greatly enhance these methods and that fixing data quality issues is easy. It’s the most crucial enhancement idea. In his interview answer, Mr BOB said, "One thing that springs to mind there is data quality... the audits and the continuous improvement measures... would be substantially enhanced... and it's quite straightforward to repair... That's my #1 pick." The literature emphasizes data quality in quality management systems (QMS).

3.5.1. Strategic communication of policy

"Back improving the quality balance system," suggests Mr HR. Quality auditing requires top management and suitable rules. Communicating policy. Monitoring, assessing performance, then using it.” In the interview answer, the participant emphasizes proper rules, top management engagement, and quality balance system improvement. The participant’s emphasis on building a quality balancing system shows a willingness to balance and improve quality management in the organization. This recommends a systematic approach to balance quality-related responsibilities, including auditing, policy communication, performance monitoring, and review (Please see Supplementary Material).

3.5.2. Importance of leadership

Shareholders and directors must drive it. It may be strategic." In his interview answer, Mr AM stresses the need for sector owners to understand quality and invest heavily in the future. He claims that developing a solid quality management system (QMS) is a strategic option and that shareholders and directors should promote this shift. Mr AM stressed the importance of leadership commitment and responsibility in promoting industry excellence. Owners must understand quality management’s impact on the company's performance, reputation, and longevity (Please see Supplementary Material).

Regular meetings improve quality management in electricity distribution organizations, according to OW. "Regular meetings can help discuss quality policy and objectives. These workshops allow employees to discover how their work meets quality goals and ask questions. The seminars also allow personnel to share ideas and learn from one another, fostering a culture of collaboration and growth.

4. Discussion

The interview emphasizes distribution network quality and the impact of poor connections on system breakthroughs. This supports studies showing that robust connections are essential for reliable electricity distribution (Ryall, 2012).

This research illuminates various aspects of the electrical industry QMS. These remarks relate to implementation, standards, output, and development. This discussion will address these concerns using relevant literature.

4.1. Theme 3: Quality management standards: ISO accreditation

Technical training is crucial to QMS deployment. It helps workers understand and follow ISO standards like ISO 9001 that apply to QMSs. Technical training helps personnel understand the electrical industry's quality assurance requirements and processes (Kayhan, 2006).

4.2. Accuracy and reliability of data
A successful Quality Management System (QMS) provides rigorous audits, data-driven choices, and continuous improvement using accurate and trustworthy data. Data-driven insights aid decision-making, goal-setting, and resource allocation, and QMS audits need accurate data. Reliable data helps firms assess performance, identify issues, and make QMS improvements to boost productivity and customer satisfaction.

4.3. Need for government investment and compulsory QMS implementation

No legislative suggestions for QMS adoption in the electrical sector were found, which may indicate a regulatory framework inadequacy. The earlier study suggests that a lack of regulatory standards may hinder QMS adoption (Wang et al., 2015). Even without regulations, organizations may enhance operations and competitiveness by implementing QMS. Suppliers fear significant fines and are urged to maintain high standards to avoid financial losses and brand damage.

4.4. Accuracy and reliability of data

Interview replies emphasize the financial investment required to build a QMS, including audit controls. Asghar et al. (2019) found that implementing a QMS requires resource allocation and control systems. Financial concerns and regional disparities show the need for QMS implementation methodologies tailored to organizational context and resource availability. Risk, equipment malfunction, and poor craftsmanship may damage a company's image. This supports past studies linking quality, reputation, and risk management (Srivastava et al., 2022). A solid QMS reduces equipment failure and protects a company's reputation.

The conversation reveals how QMS's rapid expansion and ISO certification mirror the electrical industry's growth. According to the research (Kayhan, 2006), QMS adoption is often hindered by delays in implementation and improvement. Firms must focus on certification and QMS monitoring and improvement for long-term benefits. As stated in the eighth paragraph, ISO 9001 provides a framework for QMS in the electrical sector. Standards promote quality and organizational transformation, according to a wide body of research (Andrade et al., 2017; Willar, 2012).

4.5. Connection between quality and production

Production increases QMS effectiveness, according to the findings. Previous studies show that QMS improves productivity, even when accurate measurements are challenging (Lekan et al., 2022). A well-designed QMS may improve operational efficiency, cut error rates, and simplify operations, boosting productivity.

4.6. Audit and continuous improvement

The results emphasize QMS audits, continual improvement, and data quality procedures. This aligns with research (Brooks et al., 2021; Leong et al., 2014) that emphasizes data-driven decision-making, rigorous auditing, and improvement culture for QMS adoption. Continuous improvement, auditing, and data quality in QMS adoption were also highlighted.

4.7. Leadership and engaging staff

Leadership, policy communication, and employee participation are crucial to improving the quality balancing system. Regular meetings helped discuss quality policies and goals and engage and educate employees. Strong leadership, effective communication, and staff engagement are needed to create a quality-focused culture.

5. Conclusions

The interviews and additional literature study reveal the electrical industry's QMS implementation challenges. The interviews included quality management, regulatory frameworks, supplier responsibility, investment, risk management, international standards, productivity development, data quality, leadership participation, and employee engagement. Interview excerpts discussed distribution network connection quality, QMS adoption cost, absence of regulatory guidelines, and regional implementation variances. These concerns demonstrate the need for proactive quality management and robust QMS to sustain dependable electrical operations.

The researcher's findings reveal QMS implementation challenges and best practices in the electrical sector. The outcomes emphasize proactive quality control, worldwide standards, QMS investment, risk management, and continual improvement.

6. Limitations & Recommendations for Future Studies

6.1. Study limitations

It is important to recognize a number of limitations that affect the scope and generalizability of our findings. These restrictions must be regarded in light of the significance and potential contributions of the study:

1. Limited Sample Size for the Study:
The present study has a limited sample of 16 participants selected for the interview. This restriction may limit the range of experiences and points of view that can be recorded. Future research could examine whether cross-national comparative research is feasible in order to better understand the implications of these findings.

2. Geographic Specificity:
   The study’s limited geographic scope, which is Oman. The results are limited in their direct relevance to other regions since they are contextualized within the special conditions and dynamics of the Omani electrical distribution contracting industry. Future Research could examine whether the longevity of quality management methods is better understood by longitudinal research tracing the development of QMS adoption within electrical distribution contracting companies. It may be beneficial to look at how organizational culture, resource allocation, and performance indicators have changed over time.

3. Qualitative Research Timeframe:
   This methodological trait may cause the research to take longer than first planned, which may be difficult to manage, the researchers should carefully evaluate their time frames and methods for gathering and analyzing data. It’s vital to strike a balance between the demand for in-depth insights and effective research management.

6.2. Theoretical recommendations
   The research focused on electrical distribution contractors in Oman, but future studies could examine QMS implementation in other industries and regions to better understand the challenges and best practices.

6.3. Practical recommendations
   The conclusion summarizes the study results and emphasizes proactive quality control, worldwide standards, QMS investment, risk management, and continuous development. Addressing these issues and implementing a good QMS may help electrical companies enhance their operations, reputation, and competitiveness.
   1. Legally mandate electrical QMS implementation.
   2. Reward QMS-adopting companies.
   3. Provide industry-specific QMS implementation advice with sector specialists.
   4. Develop comprehensive QMS implementation training.
   5. Hold practical QMS workshops.
   6. Encourage continuing learning and development to keep skills current.

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Ethical considerations
   This study was approved by the Ethics Committee of Cyprus International University. Participants were informed about the research, its aims, voluntary participation, and anonymity. Participants provided written informed consent for participation.

Conflict of Interest
   The authors declare no conflicts of interest.

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