

**Sudan University of Science & Technology**  
**College of Postgraduate Studies**  
**Quality Centre**

**Thesis on:**

**The Implementation of Quality Systems in the Sudan  
and the role of TQM in Performance Improvement**

**A study of National Electricity Corporation (NEC)  
and Azza Air Transport Company cases**

**تطبيق نظم الجودة فى السودان ودور إدارة الجودة الشاملة  
فى تحسين الأداء**

**دراسة حاليّ الهيئة القومية للكهرباء وشركة عزة للنقل الجوى**

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**Submitted by:** Eng. Altayeb Sid Ahmed Alawad Abu Zeyd

**Supervisor:** Dr. Salma Yahya Mohamed

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# *Forward*

*Quality is the art of designing things in a frame of satisfaction status.*

*Total Quality is everybody's responsibility towards everybody's required Quality.*

*Al Tayeb*

# Acknowledgment and Gratitude

Beforehand and Afterwards - Praise, gratitude for Allah the most esteemed, Who enabled me to interpret my belief and ethics to practical work of Quality related.

Then, *all acknowledgements and gratitudes* to:

- Sudan University of Science and Technology that cared about quality culture and established the Quality Centre for Postgraduate Studies.
- The Sudanese Standards and Metrology Organization for supporting the researchers and scientific research.

And, *special appraisal and appreciation* to my supervisor, **Dr. Salma**, for her:

- Smart thoughts, effective brainstorming, and valuable advices that benefited me conceptually and practically during the research.
- Total Quality characteristics “Just-In-Time response” without delaying or frustrating her students, namely, the researchers.

And *I could say*: “She knows how to put the dots on the letters”

*Altayeb*

# Dedication

## **I would like to dedicate this work to:**

- My father's soul as an ongoing charity.
- My mother who is very careful to do what she views as a duty for her sons and others.
- My brothers who have continually encouraged, motivated, and supported me throughout my educational life.
- All Quality interested parties who are:
  - Searching for Quality learning, information, and systems.
  - Desiring to shift from the traditional systems to modern ones.
  - Interested in improving, developing, and reaching the total quality and excellence levels.
  - Planning to achieve the highest quality index for their products in a global market competition.

## Abstract

This research is about implementing Quality Systems in the Sudan and the role of TQM as a comprehensive approach to improve organizational performance.

The research began with a comprehensive background on Quality, focusing on Total Quality Management (TQM), which is not well understood for many people, particularly, in the Sudan. Then, it defined TQM as a comprehensive management approach for improving performance, since there is a critical problem of unsatisfactory organizational performance, which is considered as a common problem for many organizations, particularly, in the Sudan.

The research *main objectives* include; an evaluation of quality systems implementation in the Sudan with a special focus on TQM, introduction of a comprehensive approach for enhancing organizational performance, introduction of a comprehensive approach to define, understand, benefit from, and differentiate TQM from other quality management systems such as ISO 9000; and finally, to encourage organizations' managers to adopt TQM as a strategy.

The research used the statistical, analytic, and descriptive *approach* to investigate and identify the status of quality systems implementations in the Sudan and the role of TQM in performance improvement. Relative TQM tools and engineering software and techniques had been applied for data collection, analysis, assessment, and to introduce the feasible improvement efforts. Initially, a general survey on a hundred Sudanese organizations was conducted. That was followed by an interview with each leader or quality manager of such organization. Then, two detailed case studies were also considered; the National Electric Corporation (NEC), and Azza Air Transport Company, respectively. And that was followed by questionnaire.

This research consists of five chapters. The first is an introductory chapter that describes the research framework. The second comprised a review of the literature and studies on Quality systems and Total Quality Management (TQM). The third chapter introduced the methodology,

assessment of quality systems related to the two targeted organizations. The fourth chapter contained the analysis and discussion of results, where assessment and improvement for those systems were considered. Finally, the fifth chapter showed the conclusion and recommendations; where the appendixes are attached at the end of it.

The research came out with certain results. The most important of these is that the implementation of quality systems in the Sudan is weak but increasing chronically, there is no TQM system implemented yet, the majority of the implemented quality systems are ISO9000 Quality Management Systems (QMS) with ineffective implementation.

Accordingly, the research ended up by giving 12 recommendations for achieving high quality organizational performance.

تناول هذا البحث تطبيق نظم الجودة في السودان ودور إدارة الجودة الشاملة كمنهج لتحسين الأداء المؤسسى.

بدأ البحث بتقديم خلفية تاريخية شاملة عن الجودة مركزاً على إدارة الجودة الشاملة والتي يجهلها الكثير خاصة في السودان. بعد ذلك عرّف البحث إدارة الجودة الشاملة كمنهج شامل للإدارة لتحسين الأداء حيث توجد مشكلة حرجة متمثلة في الأداء المؤسسى غير المرضى، والذي يعتبر مشكلة شائعة في كثير من المؤسسات، وبالتحديد السودانية.

**أهداف البحث** الأساسية هي؛ تقييم تطبيق نظم الجودة في السودان خاصة إدارة الجودة الشاملة، تقديم منهج شامل لترقية الأداء المؤسسى، تقديم منهج شامل لتعريف، فهم، الاستفادة من، وتمييز إدارة الجودة الشاملة من النظم الأخرى مثل نظام إدارة الجودة (ISO9000)، تشجيع مديري المؤسسات لتبنى إدارة الجودة الشاملة كاستراتيجية.

استخدم البحث **المنهج** الاحصائى، التحليلى، والوصفى لتشخيص وتوضيح حالة تطبيق نظم الجودة في السودان ودور إدارة الجودة الشاملة في تحسين الأداء. حيث استخدمت التقنيات البرمجية الهندسية لجمع البيانات، تحليلها، تقييم نتائجها، وبذل جهود التحسين الممكنة. مبدئياً تم القيام بمسح عام لمائة مؤسسة سودانية عن طريق المقابلات، بعده تم القيام بدراساتى حالة بصورة دقيقة لمؤسستين هما، الهيئة القومية للكهرباء وشركة عزة للنقل الجوى على التوالى، باستخدام الاستبيان.

**محتويات البحث** تشمل خمسة فصول، الفصل الأول مقدمة تناولت الإطار العام للبحث، الثانى تناول الأدبيات والدراسات ذات الصلة بنظم الجودة وإدارة الجودة الشاملة. الثالث وضح المنهجية والمتعلقة البيانات العملية التى جمعت للتحليل الدقيق وتقييم نظم الجودة المطبقة فى المؤسستين المستهدفتين. الفصل الرابع احتوى على التحليل ونقاش النتائج حيث أخذ التقييم والتحسين لتلك النظم فى الاعتبار.

أخيراً **ختم البحث** بتقديم بعض النتائج مثل؛ تطبيق نظم الجودة فى السودان ضعيف وفى زيادة مع مرور الزمن، ليس هناك تطبيق لنظام إدارة الجودة الشاملة حتى الآن، أغلبية النظم المطبقة هى نظام إدارة الجودة (ISO9000)، وتطبيقه غير فاعل.

وفقاً لذلك قدم البحث اثنتى عشر (12) توصية لتحقيق أداء مؤسسى بجودة عالية.

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## **List of Abbreviations and Symbols**

|           |                                                      |
|-----------|------------------------------------------------------|
| Q         | Quality                                              |
| QC        | Quality Control                                      |
| TQC       | Total Quality Control                                |
| TQM       | Total Quality Management                             |
| QFD       | Quality Function Deployment                          |
| ISO       | The International Organization for Standardization   |
| QS        | Quality System                                       |
| QMS       | Quality Management System                            |
| ISO9000   | International standard for Quality Management System |
| MBNQA     | Malcolm Baldrige National Quality Award              |
| EFQM      | European Foundation Quality Management model         |
| PCR or Cp | Process Capability Ratio                             |
| $\mu$     | Process or any type of performance mean (average)    |
| $\Sigma$  | Process or performance Standard deviation            |

| <b>Term</b>           | <b>Definition</b>                                                                                                      |
|-----------------------|------------------------------------------------------------------------------------------------------------------------|
| Product               | Result of a process.                                                                                                   |
| Process               | Set of interrelated or interacting activities which transforms inputs into outputs.                                    |
| Quality               | Degree to which a set of inherent characteristics fulfils requirements.                                                |
| Quality planning      | Part of quality management focused on setting quality objectives and specifying necessary.                             |
| Quality control       | Part of quality management focused on fulfilling quality requirements.                                                 |
| Quality assurance     | Part of quality management focused on providing confidence that quality requirements will be fulfilled.                |
| Quality improvement   | Part of quality management focused on increasing the ability to fulfill quality requirements.                          |
| Quality policy        | Overall intentions and direction of an organization related to quality as formally expressed by top management.        |
| Quality objective     | Something sought, or aimed for, related to quality.                                                                    |
| management            | Coordinated activities to direct and control an organization.                                                          |
| Top management        | Person or group of people who directs and controls an organization at the highest level.                               |
| Requirement           | Need or expectation that is stated, generally implied or obligatory.                                                   |
| Grade                 | Category or rank given to different quality requirements for products, processes or systems.                           |
| Customer satisfaction | Customer's perception of the degree to which the customer's requirements have been fulfilled.                          |
| Capability            | Ability of an organization, system or process to realize a product that will fulfill the requirements for that product |
| Competence            | Demonstrated ability to apply knowledge and skills.                                                                    |

| <b>Term</b>               | <b>Definition</b>                                                                                                                                                        |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| System                    | Set of interrelated or interacting elements.                                                                                                                             |
| Management system         | System to establish policy and objectives and to achieve those objectives.                                                                                               |
| Quality management system | Management system to direct and control an organization with regard to quality.                                                                                          |
| Effectiveness             | Extent to which planned activities are realized and planned results achieved.                                                                                            |
| Efficiency                | Relationship between the result achieved and the resources used.                                                                                                         |
| Organization              | Group of people and facilities with an arrangement of responsibilities, authorities and relationships                                                                    |
| Organizational structure  | Arrangement of responsibilities, authorities and relationships between people.                                                                                           |
| Infrastructure            | (Organization) system of facilities, equipment and services needed for the operation of an organization.                                                                 |
| Work environment          | Set of conditions under which work is performed.                                                                                                                         |
| Customer                  | Organization or person that receives a product.                                                                                                                          |
| Supplier                  | Organization or person that provides a product.                                                                                                                          |
| Conformity                | Fulfillment of a requirement.                                                                                                                                            |
| Nonconformity             | Non-fulfillment of a requirement.                                                                                                                                        |
| Defect                    | Non-fulfillment of a requirement related to an intended or specified use.                                                                                                |
| Preventive action         | Action to eliminate the cause of a potential nonconformity or other undesirable potential situation.                                                                     |
| Corrective action         | Action to eliminate the cause of a detected nonconformity or other undesirable situation.                                                                                |
| Competence                | (Audit) demonstrated personal attributes and demonstrated ability to apply knowledge and skills.                                                                         |
| Review                    | Activity undertaken to determine the suitability, adequacy and effectiveness of the subject matter to achieve established objectives.                                    |
| Audit                     | Systematic, independent and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which audit criteria are fulfilled. |
| Audit criteria            | Set of policies, procedures or requirements.                                                                                                                             |

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**List of Techniques, Approaches, and Schemes for achieving high Quality Performance**

|                                |                                                                                                                                                                                                                                                                                    |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>TAYEP-6Sigma-SSP</b></p> | <p>Statistical Software Program for measuring quality performance level for any entity - designed by Al Tayep (the researcher).<br/>References: Chapter 2, page 39 of this research, and Excel Software Statistical program</p>                                                    |
| <p><b>PSP</b></p>              | <p>Project or Process Scheduling Program - Statistical Software Program for performance optimization, particularly processes time mismanagement designed by Al Tayep (the researcher)<br/>References: Dervitsiotis (1981, p 604 – 608), and Excel Software Statistical program</p> |
| <p>4A x 7W - QPM</p>           | <p>4 Activities by 7 Ws- based Quality Performance Matrix</p>                                                                                                                                                                                                                      |
| <p>4A</p>                      | <p>TAYEP-4A-cycle (Assign, Achieve, Assess, Advise)</p>                                                                                                                                                                                                                            |
| <p>7W</p>                      | <p>TAYEP - What, Why, Where, When, Who, Whom, Way</p>                                                                                                                                                                                                                              |
| <p><b>TAYEP-ITQPA</b></p>      | <p>Integrated Total Quality Performance Approach developed by Al Tayep (the researcher)</p>                                                                                                                                                                                        |