



Sudan University of Science and Technology

College of Graduate Studies



**Impact of Implementation of ISO 17025 in Laboratories Performance
(Case Study of Nano for Measurement and Calibration
Center-Khartoum Bahri-Sudan)**

**أثر تطبيق المواصفة ISO/IEC 17025 على أداء المختبرات
(دراسة حالة مركز نانو للقياس و المعايرة - الخرطوم بحري-السودان)**

A dissertation submitted for partial fulfillment for M.Sc. degree in Total Quality
Management and Excellence

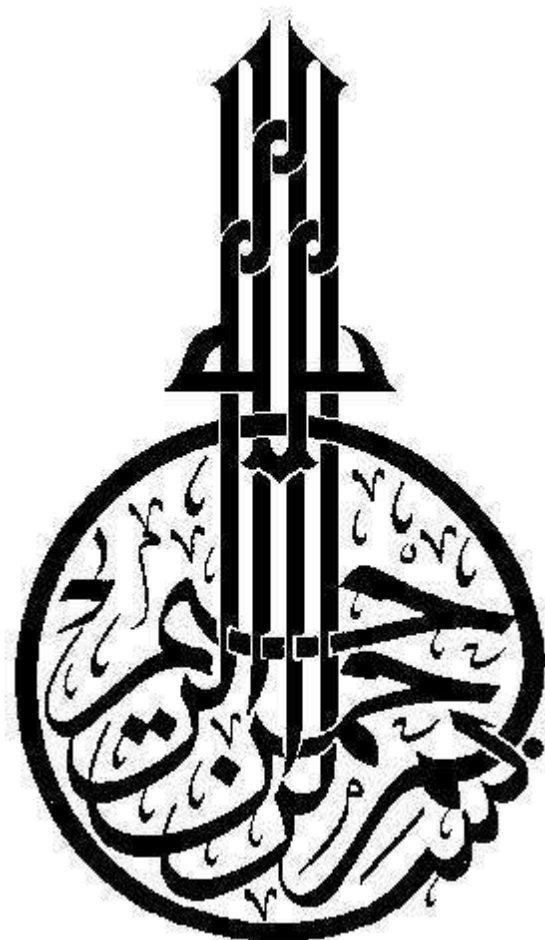
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الآية

قال تعالى:

﴿وَقُلْ رَبِّ زِدْنِي عِلْمًا﴾

سورة طه الآية (114)

Dedication

To my mother, father, brothers specially my little

brother Dr. Fawwaz and my sweet sister

Nahla "umm Reema".

To the spirit that inspired me, to my special world

To my friends and colleagues

I dedicate my humble effort

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Abstract

This descriptive study was carried out in Nano for measurement and calibration center –khartoum Bahri, during the period from March to November 2018. This study aimed to determine the impact of implementing ISO/IEC 17025 in Laboratories performance. Both secondary and primary data were used in this research. Secondary data was generated through a literature search on accreditation and ISO 17025 standard. Three survey questionnaires were designed to meet the research objectives, first one for technician ,second one for administration ,and third one for external customers then collected and analyzed using SPSS program ,frequencies and percentages were calculated. An evaluation of the organization performance in a case study laboratory –The NMCC- was carried out in some aspects like the management system, personnel qualification and performance, working environment, the key strategic results and customers satisfaction. Based on the results, it was found a strong relationship between laboratory accreditation and improvement of the management system applied in the laboratories, improvement of the personnel qualification and performance in laboratories, increase customers satisfaction, enhance working environment and increase the center's key strategic results.

Feasible recommendations were made to examine the reasons that prevent calibration laboratories to apply the standard of 17025 in Sudan and study deeply about the impact of implementing the ISO/IEC 17025 standard on economy in Sudan.

المستخلص

أجريت هذه الدراسة الوصفية في مركز نانو للقياس والمعايرة-الخرطوم بحري ، خلال الفترة من مارس إلى نوفمبر 2018. هدفت هذه الدراسة إلى تحديد أثر تطبيق ISO / IEC 17025 في أداء المختبرات. تم استخدام كل من البيانات الثانوية والإبتدائية في هذا البحث حيث تمّ جمع البيانات الثانوية من خلال المبحث النظري عن الإعتماد ومعايير المواصفة ISO 17025 . تمّ تصميم ثلاث إستبيانات إستطلاع لتحقيق أهداف البحث ، أولها للتقنيين ، والثانية للإدارة ، والثالثة للعملاء الخارجيين ، ثم تمّ جمعها وتحليلها بإستخدام برنامج التحليل الإحصائي ، وحسبت الترددات والنسب المئوية. تمّ تقييم أداء المؤسسة في بعض الجوانب في مختبر دراسة الحالة - مركز نانو للقياس والمعايرة - مثل نظام الإدارة ، مؤهلات الموظفين والأداء ، بيئة العمل ، النتائج الاستراتيجية الرئيسية ورضا العملاء. إستناداً إلى النتائج ، وجدت علاقة قوية بين إعتماد المختبرات وتحسين نظام الإدارة المطبقة في المختبرات ، تحسين كفاءة الموظفين والأداء في المختبرات ، زيادة رضا العملاء ، تعزيز بيئة العمل وزيادة النتائج الإستراتيجية الرئيسية للمركز . تم تقديم توصيات عملية لدراسة الأسباب التي تمنع مختبرات المعايرة من تطبيق المواصفة 17025 في السودان و دراسة بعمق عن أثر تطبيق المواصفة ISO/IEC 17025 على الاقتصاد في السودان.

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CHAPTER ONE
GENERAL RESEARCH FRAME WORK

CHAPTER ONE

General Research Frame work

1.1 Introduction

International Organization for Standardization and the International Electro technical Commission (ISO/IEC 17025) is the global quality standard for testing and calibration laboratories. It is the basis for accreditation from an accreditation body. The current release was published in 2017. Laboratories that are accredited to this international standard have demonstrated that they are technically competent and able to produce precise and accurate test and\ or calibration data, located anywhere in the world. Accreditation is an objective way to assure customers that technical competence has been fully implemented to provide reliable and accurate test or calibration results.

ISO/IEC 17025 is an ideal management system model for laboratories because it aims to control quality costs, improve measurement accuracy and guarantee consistency of results. It is also customer-driven when implemented correctly.

Furthermore, when your company achieves ISO/IEC 17025 accreditation, you will be presented with a certificate of accreditation. This certificate can be used in advertising, promotional literature and stationary to show current and potential customers that your laboratory is committed to quality and has demonstrated technical competency to perform calibration or testing services (Bhavan., 2013).

In this research Nano Measurement and Calibration Center (NMCC) was taken as an example to evaluate the implementation of ISO (17025-2005) in laboratories performance and to know the benefits obtained by following the application of the standard.

1.2 Problem statement:

The lack of full implementation of the control systems and quality assurance within the laboratories is the most important reasons that lead to inaccurate and retesting results.

This study tried to answer the following questions:

1. What is the impact of implementation of ISO/IEC17025-2005 standard on improve the performance of NMCC?
2. Is work environment inside the lab suitable and helps in correct testing results and provide reliable and high quality output of services?
3. How accreditation to ISO/IEC 17025 has improved customer satisfaction in accredited testing laboratories?

1.3 Significance of the research:

This research project is beneficial to the laboratory community and its customers as this study enhances the importance of accreditation to ISO/IEC 17025 for the economic and social development of the country.

This study also is helpful to assess the views of employees involved in the management system based on ISO/IEC 17025. Therefore, findings are expected to contribute towards improving staff motivation and the management system.

Nowadays, quality is important in business and industries world. Many of the customers require high quality product and service. In order to fulfill the requirements of the customers, the company must have a quality system to ensure that their product or service that provided has high quality to fulfill the customer requirement.

For a laboratory that only provide testing and calibration to the customer, it should have a quality system that to ensure the testing and calibration result has high quality that fulfill the requirement of the customers ,if the laboratory has been

accredited with this standard, the testing and calibration results are being recognize internationally.

1.4 Objectives of the study:

1.4.1 General objective:

To study the impact of implementing ISO/IEC 17025 standard in laboratories performance (NMCC).

1.4.2 Specific objectives:

- 1- To study and identify the final issue clauses of ISO/IEC 17025 .
- 2- To investigate whether accreditation to ISO/IEC 17025 had improved customers satisfaction in accredited measurement and calibration laboratories.
- 3- To examine if implementing ISO/IEC 17025 standard can provide high quality working environment.
- 4-To examine if implementing ISO/IEC 17025 standard can help the laboratory to provide reliable and high quality results.

1.5 Hypotheses:

- 1- There is a positive relationship between implementing of 17025 standard and management system.
- 2- There is a positive relationship between implementing of 17025 standard and customers satisfaction.
- 3- There is a positive relationship between implementing of 17025 standard and performance and competence of personnel.
- 4- There is a positive relationship between implementing of 17025 standard and key strategic results.
- 5- There is a positive relationship between implementing of 17025 standards and improvement of work environment.

1.6 Research Structure:

Chapter 1, provides a brief introduction of the subject matter of the study.

Chapter 2, theme 1 explains the history, importance, benefits of standard and explains the concept of accreditation to ISO/IEC 17025.

Theme 2, provides previous studies.

Chapter 3, provides a brief introduction of the company under the study and outlines the methodology used for the purpose of the study.

Chapter 4, presents data and analysis of the study.

Chapter 5, provides discussion, conclusion and recommendations of the study

CHAPTER TWO
LITERATURE REVIEW AND
PREVIOUS STUDIES

CHAPTER TWO

Literature review and previous studies

Theme one: Literature review

2.1 International Organization for Standardization and the International Electro technical Commission (ISO/IEC17025):

ISO is based global consortium in Geneva and has a membership of more than 90 national standardization body, was shortened (ISO) based on the Greek word "ISOS" which means "Equal". ISO creates documents that provide requirement, specification, guidelines or characteristics that can be used consistently to ensure that materials, product processes and services are fit for their purpose. It covers almost every industry, from technology to food safety, to agriculture and healthcare (Hahn *et al*, 2016).

ISO/IEC17025 standard used by testing and calibration laboratories to provide a basis for accreditation of laboratory quality systems. There are many commonalities with the ISO 9000 family of standards, but ISO/IEC 17025 adds in the concept of competence to the equation, applying directly to those organizations that produce testing and calibration results. ISO/IEC 17025 was developed by laboratory experts from all over the world, along with 18 liaison organizations, such as the International Laboratory Accreditation Cooperation (ILAC), and many associations representing laboratories (Soon,2012).

Laboratories that are accredited to this international standard have demonstrated that they are technically competent and able to produce precise and accurate test and\ or calibration data. In most major countries, ISO/IEC 17025 is

the standard for which most laboratories must hold accreditation in order to be deemed technically competent.

In many cases, suppliers and regulatory authorities will not accept test or calibration results from laboratories that are not accredited.

Laboratories use ISO/IEC 17025 to implement a quality system aimed at improving their ability to consistently produce valid results (soon , 2012).

2.1.1 History of ISO/IEC 17025

ISO/IEC 17025 was originally known as ISO/IEC Guide 25, first released in 1978, with subsequent editions following in 1982 and 1990. Guide 25 was created with the belief that "third party certification systems [for laboratories] should, to the extent possible, be based on internationally agreed standards and procedures. In the mid- to late 1990s, an update to Guide 25 was required. However, the ISO decided to convert the guide into a standard and introduce tight compatibility with ISO 9001, which was also being revised, such that ISO 9001 would be treated as a master standard and the next evolution of Guide 25 to be treated as a standard to be specifically applied to testing and calibration laboratories. United Nations Industrial Development Organization (UNIDO) (2009).

ISO/IEC 17025:1999 was issued by the ISO in late 1999 and was internationally adopted in 2000. A second release - ISO/IEC 17025:2005 - was made on May 12, 2005 after it was agreed that it needed to have its wording more closely aligned with the 2000 version of ISO 9001. The most significant changes introduced greater emphasis on the responsibilities of senior management, as well as explicit requirements for continual improvement of the management system

itself, particularly communication with the customer (United Nations Industrial Development Organization (UNIDO) (2009). Finally upgraded to 2017 version.

This new standard ISO/IEC 17025:2017 includes some noteworthy changes related to its structure and scope that should be mentioned before we go into greater details of each section of the standard.

2.1.2 The standard

The requirements of the 2017 version of the ISO/IEC 17025 standard are applicable to all organizations performing testing, calibration, and/or sampling (ISO 17025: 2017) .

The ISO/IEC 17025:2005 standard itself comprises five elements: scope, normative references, terms and definitions, management requirements, and technical requirements. There are two main clauses management requirements and technical Requirements. Management requirements are related to the operation and effectiveness of the quality management system within the laboratory, and this clause has similar requirements to ISO 9001. Technical requirements address the competence of staff; testing methodology; equipment and quality; and reporting of test and calibration results (ISO 17025:2005).

The newest standard provides an update in:

- 1-Terminology;
- 2- Process approach, whereby the standard is aligned with other recent standards such as: ISO 9001;
- 3- Scope;
- 4- The usage of recent and updated IT technology; and
- 5- The concept of risk-based thinking.

2.1.3 ISO/IEC 17025: 2005 versus ISO/IEC 17025: 2017

To begin with, the 2005 version of ISO/IEC 17025 included the following:

- 1-Scope
- 2-Normative references
- 3-Terms and definitions
- 4-Management requirements
- 5-Technical requirements

Meanwhile, the 2017 version of ISO/IEC 17025 includes the following:

- 1-Scope
- 2-Normative references
- 3-Terms and definitions
- 4-General requirements
- 5-Structural requirements
- 6-Resource requirements
- 7-Process requirements
- 8-Management system requirements

When comparing the scope of ISO/IEC 17025:2005 version with the scope of ISO/IEC 17025:2017 version, it is noted that the 2017 version of the ISO/IEC 17025 standard specifies the general requirements for the competence, impartiality, and consistent operation of laboratories (ISO 17025 :2017).

Additionally, in the normative reference section of ISO/IEC 17025:2017, ISO/IEC Guide 99 is listed as a reference which provides the basic and general concepts, and associated terms. ISO/IEC 17000 is also listed as a reference, which specifies the vocabulary and the general principles for conformity assessment.

The terminology has been updated as well, which means that the ISO/IEC 17025:2017 standards cover the newest ISO/IEC terminology and the changes that

have been included in the International Vocabulary of Metrology (VIM). Under the section terms and definitions of the ISO/IEC 17025:2017 standard, the term “laboratory” has been added. This term refers to the bodies that perform one or more of the following activities such as testing, calibration, and/or sampling, associated with subsequent testing or calibration.

It is important to mention that the newest standard focuses more on information technology, mainly in the use of systems, the provision of electronic test results, and the provision of electronic records(ISO 17025 :2017).

2.1.4 Overview of the content of ISO/IEC 17025:2017

The Standard introduces its main requirements throughout the clauses 4 to 8.

2.1.4.1 Clause 4 General requirements

Impartiality and Confidentiality requirements are discussed in clause 4.1 and 4.2. The risk-based thinking is evident throughout the standard. It should be noted that the new standard expects from the laboratory to plan and implement actions to address risks and opportunities. Although addressing risks and opportunities is laboratory’s responsibility, the standard sets specific requirements. The first requirement of such risks and opportunities that is needed to be addressed is mentioned in clause 4, where the laboratory is required to identify and eliminate or minimize risks related to impartiality, on an on-going basis.

The confidentiality requirements include, among others, the responsibility of the laboratory to inform its customer in advance, of the information it intends to place in the public domain. It is also discussing how to handle the release of confidential information required by law or authorized by contractual arrangements. The confidentiality requirement is also extended to laboratory personnel, including any committee members, contractors, personnel of external bodies, or individuals

acting on the laboratory's behalf, even in the case that information is obtained from sources other than the customer (e.g. complainant, regulators) (ISO 17025 :2017).

2.1.4.2 Clause 5 Structural requirements

In clause 5, main requirements are defined, including: Legal status of the laboratory, organization and management structure, identification of management, range of laboratory activities, documenting its procedures, availability of personnel responsible for the implementation and maintaining the integrity of the management system.

It should be noted that the new standard clearly requires in clause 5.3 that the laboratory shall only claim conformity with this document for this range of laboratory activities, which excludes externally provided laboratory activities on an ongoing basis. This means that the laboratory is expected to be accredited, and include in the scope of accreditation only testing/calibration/sampling activities that is providing by utilizing its own resources (ISO 17025 :2017).

In its 2005 version the standard allowed to subcontract tests and calibrations in the case that the laboratory was not in position to perform them. According to the new standard the laboratory can be accredited only for those laboratory activities, for which it is competent. Subcontracting is allowed only for outstanding situations, like overload of work, sickness of personnel, maintenance of equipment or other similar cases(ISO 17025 :2017).

2.1.4.3 Clause 6 Resource requirements

Resource requirements are considered to include personnel, facilities, equipment, systems and support services necessary to manage and perform the laboratory activities. It is expected that all internal or external personnel of the laboratory shall be competent and act impartially. The standard doesn't refer at this clause to all personnel, but only to personnel who could influence on the results of laboratory activities. This is not only personnel who is directly involved in

testing/calibration/sampling activities, but also personnel who is indirectly involved, like technical personnel. For example, it can be personnel that perform maintenance of the equipment, or management system personnel, who evaluate suppliers and/or maintain the management system including internal auditing activities(ISO 17025 :2017).

The competence requirements, which are expected to be documented, include education, qualification, training, technical knowledge, skills (like capacity to evaluate the significance of laboratory activities deviations) and experience. In addition, procedure and records are expected for selection, training, supervision, authorization and monitoring of competence of personnel. The standard also defines the cases where it is expected for the laboratory to authorize personnel to perform specific laboratory activities(ISO 17025 :2017).

It is expected for the requirements for facilities and environmental conditions suitable for the laboratory activities to be documented, including the conditions related to monitoring, controlling and recording environmental conditions. The standard sets requirements to those environmental conditions which can effect on the results of laboratory activities. Depending on the nature of laboratory activities the same parameter can be or cannot be important for the testing results. Measures to control facilities may include access to and use of areas affecting laboratory activities, prevention of contamination and effective area separation, including sites or facilities outside of laboratory's permanent control(ISO 17025 :2017).

A procedure for handling, transport, storage, use and planned maintenance of equipment is required. Equipment requirements are applicable to hardware, software, measurement standards, reference materials, reference data, reagents, consumables or auxiliary apparatus - whatever is required for achieving correct results during laboratory activities. It is also expected that the equipment used for measurement should achieve the required measurement accuracy or measurement

uncertainty. The calibration requirements are described in details in clauses 6.4.6-6.4.13 including the requirements for relevant records(ISO 17025 :2017).

The standard is giving great attention to metrological traceability issues. In addition to the main requirements which are described in details in clause 6.5 an informative annex (Annex A) is available providing additional information, including guidance on how to establish and demonstrate metrological traceability(ISO 17025 :2017).

Requirements related to the control of and communication with, external organizations providing products and services affecting laboratory activities are described in clause 6.6 Procedure and records are required to define, review and approve the laboratory's requirements for externally provided products and services (purchasing requirements), setting the criteria for evaluation, selection, monitoring of performance and re-evaluation of the external providers, ensuring that they conform to requirements and taking appropriate actions in the case that they don't(ISO 17025 :2017).

2.1.4.4 Clause 7 Process requirements

Process requirements are deployed as follows:

1-Review of requests, tenders and contracts

A procedure is required to address issues such as the level of understanding of requirements; laboratory's capability and resources to meet the requirements; implementation of appropriate control over external providers used (if any); and selection of appropriate methods to meet the customers' requirements. It is expected that the laboratory shall inform the customer when the required testing/calibration/sampling method is considered to be inappropriate or out of date. When a statement of conformity to a specification or standard is required, the decision rule (which specifies pass/fail criteria) selected shall be communicated to, and agreed with, the customer. Contract review procedure shall be applied also for

any changes in the contract/tender/request. Relative review records are required(ISO 17025 :2017).

2-Selection, verification and validation of methods

The term “method” in the standard is used to identify calibration method, testing/measurement procedure, sampling procedure. The laboratory is expected to ensure that it uses the latest valid version of a method, unless it is not appropriate or possible to do so. Methods used can include methods published in international, regional or national standards, or by reputable technical organizations, or in relevant scientific texts or journals, or as specified by the manufacturer of the equipment or laboratory-developed or laboratory-modified methods. The laboratory shall verify that it can properly perform selected methods. Deviations from methods shall occur only if the deviation has been documented, technically justified, authorized, and accepted by the customer. Non-standard methods, laboratory-developed methods and modified standard methods are expected to be validated, and relevant records are expected to be kept(ISO 17025 :2017).

3-Sampling

The requirements of this clause are applicable to the laboratories which perform just sampling activities as well as for testing and calibration laboratories which are responsible also for sampling. A sampling plan and a sampling method are expected to be available and implemented when the laboratory carries out sampling of substances, materials or products for subsequent testing or calibration. Records of sampling data should be retained per standard requirements(ISO 17025 :2017).

4-Handling of test or calibration items

A procedure for the transportation, receipt, handling, protection, storage, retention, and disposal or return of test or calibration items should be drafted

including a system for the identification of test or calibration items. Deviations from specified conditions are expected to be recorded and the customer to be consulted for next steps. In the case that some items have to be stored or conditioned under specified environmental conditions, these conditions shall be maintained, monitored and recorded(ISO 17025 :2017).

5-Technical records

Requirements to retain technical records are in place to ensure the traceability of laboratory activities and to provide information for potential decision making. The technical records are expected to contain the results, report and sufficient information to facilitate, if possible, identification of factors affecting the measurement result and its associated measurement uncertainty and enable the repetition of the laboratory activity if required, providing traceability to previous versions or to original observations if amended(ISO 17025 :2017).

6-Evaluation of measurement uncertainty

For testing laboratories it is expected to evaluate measurement uncertainty considering all contributions which are of significance, including those arising from sampling. It is noted in the standard that for a particular method, where the measurement uncertainty of the results has been established and verified, there is no need to evaluate measurement uncertainty for each result, if the laboratory can demonstrate that the identified critical influencing factors are under control.

For calibration laboratories it is expected to evaluate the measurement uncertainty for all calibrations considering all contributions which are of significance, including those arising from sampling(ISO 17025 :2017).

7-Ensuring the validity of results

A procedure and records are required for monitoring the validity of results, which can include, among others: use of reference materials or quality control (QC)materials; use of alternative traceable instrumentation; functional checks; use of

standards with control charts; intermediate checks; replicate tests or calibrations; retesting or recalibration; correlation of results; review of reported results; intra-laboratory comparisons; testing of blind samples. Participating in PT's (Proficiency Tests) and/or Interlaboratory comparisons (ILC's) is expected where available and appropriate. Such activities, according to the standard, must be planned and reviewed(ISO 17025 :2017).

8-Reporting of results

Laboratory activity results shall be reported. The standard sets requirements for results review and authorization as retained in the relative technical records. The common information required to be included in the test, calibration or sampling reports is presented in details in clause 7.8.2. In addition, the specific information for test reports is presented in clause 7.8.3, for calibration certificates in clause 7.8.4, for reporting sampling in clause 7.8.5, for reporting statements of conformity in clause 7.8.6, for reporting opinions and interpretations in clause 7.8.7 and for amendments to reports in clause 7.8.8(ISO 17025 :2017).

9-Complaints

A documented process is required for receiving, evaluating and making decisions on complaints. This process is expected to be available to any interested party upon request. The outcomes to be communicated to the complainant shall be made by, or reviewed and approved by, individual(s) not involved in the original laboratory activities in question(ISO 17025 :2017).

10-Nonconforming work

A nonconforming work procedure is expected to be in place ensuring that the responsibilities and authorities for the management of nonconforming work are defined, subsequent actions are taken considering the risk levels; an evaluation is made of the significance of the nonconforming work; a decision is taken on the acceptability of the nonconforming work; the customer is notified, if possible;

work is recalled, if needed; and the responsibility for authorizing the resumption of work is defined. Halting or repeating of work and withholding of reports, as necessary can be considered among the required actions. Records of nonconforming work and relative actions are expected to be retained(ISO 17025 :2017).

11-Control of data information management

This clause sets requirements for the laboratory information management system(s) used for the collection, processing, recording, reporting, storage or retrieval of data(ISO 17025 :2017).

2.1.4.5 Clause 8 management system requirements

The laboratory can choose between implementing a management system in accordance with option A or option B. Option A lists the minimum requirements for implementation of a management system in a laboratory. Care has been taken to incorporate all those requirements of ISO 9001 that are relevant to the scope of laboratory activities that are covered by the management system. Option B allows laboratories to establish and maintain a management system in accordance with the requirements of ISO 9001. Laboratories that implement option B will therefore also operate in accordance with ISO 9001. Conformity of a laboratory to the requirements of ISO 9001 does NOT, by itself, demonstrate the competence of the laboratory to produce technically valid data and results. This is accomplished only through compliance to ISO/IEC 17025.

The requirements for documentation have been significantly reduced in clause 8. The documentation requirements related to the operation of the management system per clause 8 are:

- 1- Management System policies and objectives (8.2.1)
- 2- Analysis of Customer feedback (8.6.2)
- 3- Corrective actions, non-conformities related records (8.7.3)

4- Internal audit and results records (8.8.2)

5- Management review input and output record (8.9.2)

It should be noted that there are no requirements any more for documented procedures related to management system activities referred in clause 8. There is also no requirement for quality manual.

By introducing the risk-based thinking in the standard some reduction in prescriptive requirements and their replacement by performance-based requirements was possible. Clause 8.5 that is dedicated on actions to address risks and opportunities is a new element added in the recent revision of the standard. This clause requires from the laboratory to consider the risks and opportunities associated with the laboratory activities. These activities are described throughout the standard and include risks related to impartiality (4.1.4), statements of conformity (7.8.6), nonconforming work (7.10.1), and corrective actions (8.7.1). It should be noted that the standard doesn't require a formal/specific method for risk management or a documented risk management process.(ISO/IEC 17025:2017).

2.1.5 Relationship to ISO 9001

ISO 9001 is the general standard which specifies the requirements for a quality management system. Laboratories which meet the requirements of ISO 17025 also operate in accordance with the requirements of ISO 9001 that are relevant to calibration and testing activities. Depending on the laboratory business, the laboratory could assess its QMS according to ISO 9001 or ISO 17025 standard. According to the ISO 17025 standard, the conformity of the quality management system with the requirements of ISO 9001 does not prove, by itself the competence of the laboratory to produce technically valid data and results. A laboratory that is accredited according to the ISO 17025 standard does not guarantee the fulfillment of all ISO 9001 requirements. By the other side, ISO 9001 certified laboratory could not have enough technical competence to assess conformity of certain

equipment, products or services or people. ISO 9001 standards is concerned mainly with what the laboratory does to ensure the compliance of their products or services according to customer requirements (Pizzolato *et al.*, 2008)

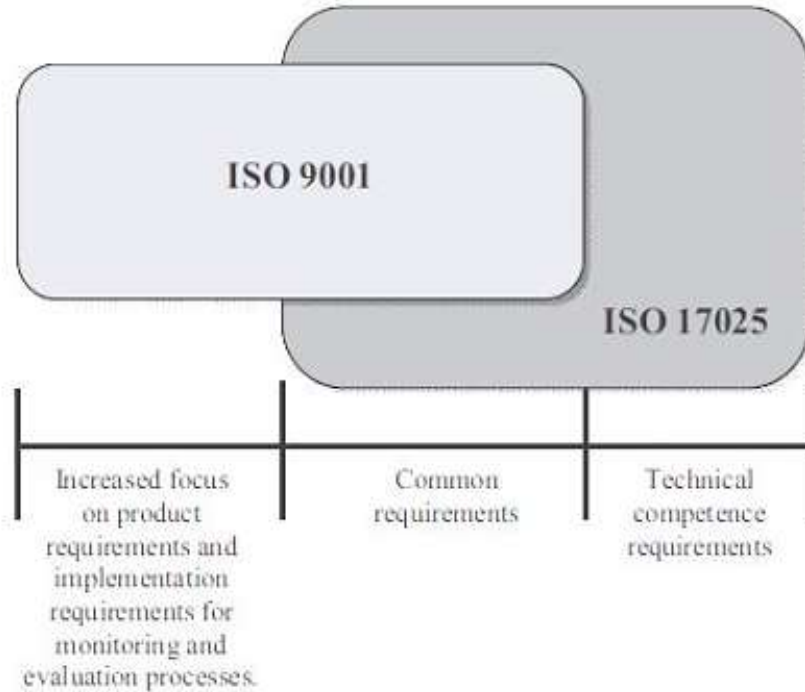


Fig.2.1: The interaction between ISO 9001 and ISO17025

Source: (Quality Management and Practices, 2012)

As is illustrated in figure2.1, there are some important differences between the two standards, because ISO 17025 does not meet all the ISO 9001 requirements, mainly those related to product requirements and implementation requirements for monitoring and evaluate processes. Those laboratories that are interested in demonstrate technical competence should adopt the ISO 17025 standard. Moreover, those laboratories that are already accredited by the ISO 17025 standard and that are embedded in organizations that also carry out activities such as accounting, marketing, consulting, training and other, should evolve to an ISO 9001 quality management system(Pizzolato *et al.* 2008),

2.2 Laboratory accreditation

2.2. 1 Definition of accreditation

ISO/IEC 17000:2004 defines accreditation as the “third-party attestation related to a conformity assessment body conveying formal demonstration of its competence to carry out specific conformity assessment tasks” (ISO/IEC17000., 2004).

2.2.2 The advantages of being an accredited laboratory (according to ILAC):

1- A recognition of testing competence

Laboratory accreditation provides formal recognition to competent laboratories, thus providing a ready means for customers to identify and select reliable testing, measurement and calibration services. To maintain this recognition, laboratories are re-evaluated regularly by the accreditation body to ensure their continued compliance with requirements, and to check that their standard of operation is being maintained(ILAC)(2008).

2- A Marketing advantage

Accreditation is an effective marketing tool for testing, calibration and measurement organizations, and a passport to submit tenders to contractors that require independently verified laboratories. Laboratory accreditation is highly regarded both nationally and internationally as a reliable indicator of technical competence. Many industries, such as the construction materials industry, routinely specify laboratory accreditation for suppliers of testing services. Many accreditation bodies also publish a directory of their accredited laboratories, which includes the laboratories’ contact details plus information on their testing capabilities. This is another means of promoting a laboratory’s accredited services to potential clients. Through a system of international agreements accredited laboratories receive a form of international recognition, which allows their data to be more readily accepted in overseas markets. This recognition helps to reduce

costs for manufacturers and exporters that have their products or materials tested in accredited laboratories, by reducing or eliminating the need for retesting in another country(ILAC)(2008).

3- A benchmark for performance

Laboratory accreditation benefits laboratories by allowing them to determine whether they are performing their work correctly and to appropriate standards, and provides them with a benchmark for maintaining that competence. Many such laboratories operate in isolation to their peers, and rarely, if ever, receive any independent technical evaluation as a measure of their performance. A regular assessment by an accreditation body checks all aspects of a facility's operations related to consistently producing accurate and dependable data. Areas for improvement are identified and discussed, and a detailed report provided at the end of each visit. Where necessary, follow-up action is monitored by the accreditation body so the facility is confident that it has taken the appropriate corrective action.

4- Enhance customer confidence and satisfaction

Confidence in a product is enhanced if customers know it has been thoroughly evaluated by an independent, competent testing facility, that is, an accredited laboratory. Increasingly, customers are relying on independent evidence, rather than simply accepting a supplier's word that the product is "fit for purpose".

A survey conducted by the Swedish National Testing and Research Institute in 2001-2002 concluded that 81 % of its customers valued the importance of an accredited test result and 12 % found irrelevant the use of accredited test result (ILAC)(2008).

5- Avoid retesting

Testing of products and materials can be expensive and time consuming, even when they are done correctly the first time. If not done correctly, then the cost

and time involved in re-testing can be even higher if the product has failed to meet specifications or expectations. Not only costs go up, but reputation as a supplier or manufacturer can go down. Thus, a product tested in a particular country by an accredited laboratory minimizes the chances of retesting and reducing chances of additional financial burden and time delays(ILAC)(2008).

6- International recognition

Laboratory accreditation ensures international acceptability of test data and facilitates trade among countries. This reduces cost for exporters and duplication of test in the importing countries (ILAC)(2008).

Theme Two: Previous studies

2.1 Previous studies:

Samia Fadul Mohamed,(2014) studied the impact of implementing ISO/IEC 17025 in the quality of Sudanese laboratories services and the problem with the study was that weakness in quality of laboratories services reflect in the total quality of products and services in many sectors in Sudan such as the pharmaceutical industry, electricity industry...etc

This study found that the service provided by National public health laboratory (NPHL) was low quality; there was no clear management system with unknown responsibilities inside NPHL, there was defect on the training method in side NPHL , and working environment inside NPHL was not suitable and not help in correct testing result, also the recommendations of this study were implementing the ISO/IEC 17025 inside the NPHL, this research is more useful if it is studied in a larger scope which covers large number of testing laboratories in Sudan, the further research needs to study all the impacts of applying ISO/IEC17025 on the service quality, and it is necessary to assess the views of laboratories customers on the value of implementation.

Another study by Layla Khalifa Hamza,(2015) in the impact of implementing ISO/IEC17025-2005 standards and its role in improving the performance of the laboratories of Sudanese standards and metrology organization(SSMO).

The problem with the study was the lack of full implementation of the control systems and quality assurance within the laboratories is the most important reasons that lead to inaccurate results.

This study found that the awareness and perception of top managers of ISO helped them in the process of evaluation and measuring the system as well achieving intended result, work environment inside the laboratory was suitable and help in correct testing results and provided reliable and high quality result, implementing ISO system enhanced the performance and the quality of the laboratory of SSMO, there was a system to identify training needs and staff training, and the research was convinced that the (SSMO) is working to educate all employees and their knowledge of procedures for the application of ISO 17025-2005,the (SSMO) was maintain improvement measurement accuracy and ensuring the consistency of the results and ensuring that customers' needs were met in high level of quality, and the recommendations were to keep improving measurement accuracy and ensure the consistency of the results, always ensure that meeting the needs of customers to highest level of quality, continuous improvement and development to achieve customer satisfaction, continuous training of staff and finding out their needs, and maintain continues review of the management system and testing and/or calibration activities to ensure their suitability, effectiveness and necessary changes or improvement on their laboratory .

Study by Egbal Said Ahmed Mohammed,(2016) in the impact of implementation of ISO 17025 in chemical laboratories and aimed to detect the laboratories performance before and after implementation of ISO 17025.

This study found that the effect of the ISO 17025 was clearly visible, the systems have been improved to the best, and the recommendation were the further studies should be done by expansion area of research to not just include the head technician but all the workers in technical and management area, and ISO 17025 should be implemented to other laboratories of SSMO (Egbal., 2016).

Study By Bibi Farzeena Shehroze Ramjun,(2009) in the impact of accreditation to ISO/IEC 17025 in accredited testing laboratories in Mauritius.

The results of this study confirmed the accreditation to ISO/IEC 17025 has a positive impact on laboratories, the performance of laboratories has improved through better control of operations and staff working diligently and efficiently, leading to enhanced customer satisfaction, there was no association between degree of impact and nature of laboratory both public and private laboratories have reaped similar benefits from accreditation, that accreditation provided better job satisfaction to employees despite no additional financial benefit, the benefits of accreditation extend not only to the accredited laboratories, but also to users of these services, regulatory bodies and the general public and the problems faced by laboratories were specific to Mauritius, such as unavailability of proficiency testing scheme in their field of testing, lack of accredited calibration services and lack of suppliers of calibrated equipment, and recommended that further research would be necessary to assess the views of laboratories' customers on the value of accreditation, an analysis of customer satisfaction could demonstrate the success of accredited laboratories , and a larger sample population, including calibration laboratories, could be surveyed for an in-depth analysis of the associated cost of accreditation .

2.2 Comparison between this study and previous studies:

Firstly, previous studies focused in the impact of implementation of ISO/IEC 17025 on management system, personnel and work environment. But, in this thesis and beside axes above studied the impact of implementation of ISO/IEC 17025 on external customer satisfaction as well, and also discussed how can implementing the international standard 17025 increase the key strategic results. Finally this study discussed also the clauses of international standard 17025 version while previous studies were version 2005 .

CHAPTER THREE
MATERIALS AND METHODS

CHAPTER THREE

Materials and Methods

3.1 Materials:

3.1.1 Study design:

This is a descriptive study, aimed to study the impact of implementation of ISO17025 in laboratories performance.

Nano for measurement and calibration center (NMCC) was chosen as a research area because it is the only internationally accredited laboratory in the field of calibration in Sudan. According to objectives of research five hypotheses are assumed to evaluate the impact of implementing ISO/IEC 17025 in laboratories performance, Questionnaire survey was conducted and data was analyzed by using SPSS software program.

Company overview, The (NMCC) began to provide the calibration service on a trial basis since 2011 meanwhile, the diligence of providing calibration technical requirements in parallel with the activities of establishing the permanent headquarters of the center until the completion of the (NMCC) at the end of 2012, to start the actual activity in early 2013 for most laboratories.

The quality system was established on the basis of the requirements of the standard ISO17025: 2005 in 2015 until it was completed by adopting seven laboratories in 2017 from the National Council for Accreditation in Egypt (EGAC),

See appendix (1).

which:

Calibration laboratory of medical equipment.

Calibration laboratory for thermometers.

Calibration of electrical devices.

Calibration of telecommunication devices.

Calibration laboratory of mass meters.

Calibration laboratory for pressure measurement.

Calibration Laboratory for measuring dimensions devices.

See appendix (2).

Now the center is in the process of transition to the new version of standard 2017.

Interviews were conducted with some of the employees and it was found that some challenges faced the implementing of standard in the (NMCC), like the weak of quality culture in the country, absence of the national institute of measurement, lack of specialized staff in calibration operations and activities and lack of previous experience in Sudan (no previous calibration laboratories).

3.1.2A study population:

The target population of this study including personnel from all departments of (NMCC) Khartoum-Bahri- Sudan and their external customers.

3.1.3 Sampling:

Comprehensive survey technique is used to cover all lab technicians (were 30) and managers (were 9) , and random sampling technique used to select 30 from their external customers (were 50).

3.1.4 Study Subjects:

The questionnaire was distributed to lab technicians, managers and external customers.

3.1.5 Data collection and analysis:

Data was collected through questionnaires that distributed was analyzed using SPSS program. A survey questionnaire was developed using 5 point Likert scale (Strongly agree; agree; Neutral; Disagree; strongly disagree) to obtain feedbacks about the opinions of participants on different variables.

See appendix (3),(4),(5),(6).

3.1.6 Ethical consideration:

Approval for this study was taken from collage of graduate studies, Sudan University of Science and Technology then written permission from NMCC.

See appendix (7).

3.2 Method:

This study based on theoretical background of methodology and the quantitative design using a hypothesis testing approach.

CHAPTER FOUR

RESULTS

CHAPTER FOUR

Results

4.1 Data analysis for technicians:

First: population and sample of the study

Table (4.1): Frequency and percentage for the sex

Sex	Frequencies	Percentage
Male	24	80.0%
Female	6	20.0%
Total	30	100.0%

Researcher survey (2018)

Table (4.1) illustrates the views of the distribution of the sex .out of 30 subjects 24(80 %) were males and 6 (20%) were females.

Table (4.2): Frequency and percentage for the qualification.

Value	Frequencies	Percentage
Bachelor	13	43.3%
Master	7	23.3%
Ph.d.	10	33.3%
Total	30	100.0%

Researcher survey (2018)

Table (4.2) illustrates the views of the distribution of the qualification . Bachelor were 13 (%43.3) and Master were 7 (%23.3) and Ph.d. were 10 (%33.3) .

Table (4.3): Frequency and percentage for experience

Value	Frequencies	Percentage
Less than 5 years	23	76.7%
From 5 and less than 10 years	5	16.7%
From 10 and less than 15 years	2	6.7%
Total	30	100.0%

Researcher survey (2018)

Table (4.3) illustrates the views of the distribution of the experience. Less than 5 years were 23 (%76.7) , From 5 and less than 10 years were 5 (%16.7) and from 10 and less than 15 years were 2 (%6.7).

Table (4.4): Frequency and percentage for job title.

Value	Frequencies	Percentage
One	1	3.3%
Two	6	20.0%
More than three	23	76.7%
Total	30	100.0%

Researcher survey (2018)

Table (4.4) illustrates the views of the distribution of the experience. One year were 1 (%3.3) and two years were 6 (%20.0) and more than three years were 23 (%76.7) .

Second: Reliability and validity

Cranach's alpha method: -

Where reliability was calculated using Cranach's alpha equation shown below:

$$\text{Reliability coefficient} = \frac{n}{N-1} * \frac{1 - \text{Total variations questions}}{\text{variation college grades}}$$

$$\text{Validity} = \sqrt{\frac{n}{N-1} * \frac{1 - \text{Total variations questions}}{\text{variation college grades}}}$$

Cranach alpha coefficient = (0.75), a reliability coefficient is high and it indicates the stability of the scale and the validity of the study.

Validity coefficient is the square of the islands so Validity coefficient is (0.87), and this shows that there is a high sincerity of the scale and that the benefit of the study.

Cranach’s alpha method

No	Value	Reliability	Validity
1	Management system	0.68	0.82
2	Performance and competence of personnel	0.67	0.82
3	Work environment	0.64	0.80
Total		0.75	0.87

Researcher survey (2018)

The second subject

View and analyze data

Table (4.5): Frequency and percentage for management system

No	Items	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	The senior management of the center is committed to applying the requirements of the ISO 17025 standard which has helped to improve performance	23	7	0	0	0
		76.7	23.3	0.0	0.0	0.0
2	The center has an integrated, clear and applied management system.	21	8	1	0	0
		70.0	26.7	3.3	0.0	0.0

3	Senior management shall provide the necessary resources to implement the management system based on the requirements of the standard	13	17	0	0	0
		43.3	56.7	0.0	0.0	0.0
4	The manger has a mechanism to determine the potential problems and take action to prevent them.	7	22	1	0	0
		23.3	73.3	3.3	0.0	0.0

Researcher survey (2018)

From the above table result shows:

The senior management of the center is committed to applying the requirements of the ISO 17025 standard which has helped to improve performance by the strongly agree (%76.7) and agree by (%23.3) and neutral by (%0.0) and disagree by (%0.0) and strongly disagree by (0.0%).

The center has an integrated, clear and applied management system by the strongly agree (%70.0) and agree by (%26.7) and neutral by (%3.3) and disagree by (%0.0) and strongly disagree by (%0.0).

Senior management shall provide the necessary resources to implement the management system based on the requirements of the standard by the strongly agree (%43.3) and agree by (%56.7) and neutral by (%0.0) and disagree by (%0.0) and strongly disagree by (%0.0).

The manger has a mechanism to determine the potential problems and take action to prevent them by the strongly agree (%23.3) and agree by (%73.3) and neutral by (%3.3) and disagree by (%0.0) and strongly disagree by (%0.0).

Table (4.6): Chi-square test results for management system.

No	Phrases	Chi-square value	df	Sig.	Median	Interpretation
1	The senior management of the center is committed to applying the requirements of the ISO 17025 standard which has helped to improve performance.	18.533	1	0.000	5.00	strongly agree
2	The Center has an integrated, clear and applied management system	20.600	2	0.000	5.00	strongly agree
3	Senior management shall provide the necessary resources to implement the management system based on the requirements of the standard.	12.533	1	0.000	4.00	agree
4	The manger has a mechanism to determine the potential problems and take action to prevent them.	23.400	2	0.000	4.00	agree

Researcher survey (2018)

The results of table (4.6) interpreted as follows:

1. The value of chi – square calculated to signify the differences between P-value and significant value (5%), chi – square of the attribute: senior management of the center is committed to applying the requirements of the ISO 17025 standard which has helped to improve performance was (18.533) with P-value (0.000) which is lower than the level of significant value (5%), the difference was found to be statistically significant at p.value =0.000
2. The value of chi – square calculated to signify the differences between P-value and significant value (5%), chi - square of the attribute: the center has an integrated, clear and applied management system was (20.600) with P-value (0.000) which is lower than the level of significant value (5%), the difference was found to be statistically significant at p.value =0.000

3. The value of chi – square calculated to signify the differences between P-value and significant value (5%), chi – square of attribute: the Senior management shall provide the necessary resources to implement the management system based on the requirements of the standard was (12.533) with P-value (0.000) which is lower than the level of significant value (5%), the difference was found to be statistically significant at p.value =0.000.
4. The value of chi – square calculated to signify the differences between P-value and significant value (5%), chi – square of the attribute: the manger has a mechanism to determine the potential problems and take action to prevent them was (23.400) with P-value (0.000) which is lower than the level of significant value (5%), the difference was found to be statistically significant at p.value =0.000.

Table (4.7):Frequency and percentage for performance and competence of personnel.

No	Items	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	The Center trains staff in accordance with a procedure that identifies the training need	11	16	2	1	0
		36.7	53.3	6.7	3.3	0.0
2	All workers in the laboratory have a clear job description that defines the powers and responsibilities	20	10	0	0	0
		66.7	33.3	0.0	0.0	0.0
3	The implementation of the standard ensures the participation of all employees in the management system implementation and the required improvement processes.	13	17	0	0	0
		43.3	56.7	0.0	0.0	0.0
4	Implementing of ISO 17025 increases in personnel confidence performing	19	10	1	0	0
		63.3	33.3	3.3	0.0	0.0

	Calibrations.					
5	The centre follows a mechanism to assess the performance of employees on a regular basis to assess their competence.	12	16	1	1	0
		40.0	53.3	3.3	3.3	0.0

Researcher survey (2018)

From the above table result shows:

The center trains staff in accordance with a procedure that identifies the training need by the strongly agree (%36.7) and agree by (%53.3) and neutral by (%6.7) and disagree by (%3.3) and strongly disagree by (%0.0).

All workers in the laboratory have a clear job description that defines the powers and responsibilities by the strongly agree (%66.7) and agree by (%33.3) and neutral by (%0.0) and disagree by (%0.0) and strongly disagree by (%0.0).

The implementation of the standard ensures the participation of all employees in the management system implementation and the required improvement processes by the strongly agree (%43.3) and agree by (%56.7) and neutral by (%0.0) and disagree by (%0.0) and strongly disagree by (%0.0).

Implementing of ISO 17025 increases in personnel confidence performing Calibrations by the strongly agree (%63.3) and agree by (%33.3) and neutral by (%3.3) and disagree by (%0.0) and strongly disagree by (%0.0).

Mechanism to assess the performance of employees on a regular basis to assess their competence by the strongly agree (%40.0) and agree by (%53.3) and neutral by (%3.3) and disagree by (%3.3) and strongly disagree by (%0.0).

Table (4.8): Chi-square test results for performance and competence of personnel.

No	Phrases	Chi-square value	df	Sig.	Median	Interpretation
1	The center trains staff in accordance with a procedure that identifies the training need.	20.933	3	0.000	4.00	agree
2	All workers in the laboratory have a clear job description that defines the powers and responsibilities.	13.333	1	0.000	5.00	strongly agree
3	The implementation of the standard ensures the participation of all employees in the management system implementation and the required improvement processes.	11.533	1	0.000	4.00	agree
4	Implementing of ISO 17025 increases in personnel confidence performing Calibrations.	16.200	2	0.000	5.00	strongly agree
5	The Center follows a mechanism to assess the performance of employees on a regular basis to assess their competence.	23.600	3	0.000	4.00	agree

Researcher survey (2018)

The results of table (4.8) interpreted as follows:

1. The value of chi – square calculated to signify the differences between P-value and significant value (5%), chi – square of the attribute: the center trains staff in accordance with a procedure that identifies the training need was (20.933) with P-value (0.000) which is lower than the level of significant value (5%), the difference was found to be statistically significant at p.value =0.000.
2. The value of chi – square calculated to signify the differences between P-value and significant value (5%), chi – square of attribute: all workers in the laboratory have a clear job description that defines the powers and responsibilities was (13.333) with P-value (0.000) which is lower than the level

of significant value (5%), the difference was found to be statistically significant at p.value =0.000.

3. The value of chi – square calculated to signify the differences between P-value and significant value (5%), chi – square of the attribute: the implementation of the standard ensures the participation of all employees in the management system implementation and the required improvement processes was (11.533) with P-value (0.000) which is lower than the level of significant value (5%), the difference was found to be statistically significant at p.value =0.000.
4. The value of chi – square calculated to signify the differences between P-value and significant value (5%), chi – square of the attribute: implementing of ISO 17025 increases in personnel confidence performing Calibrations was (16.200) with P-value (0.000) which is lower than the level of significant value (5%), the difference was found to be statistically significant at p.value =0.000.
5. The value of chi – square calculated to signify the differences between P-value and significant value (5%), chi – square of the attribute: the center follows a mechanism to assess the performance of employees on a regular basis to assess their competence was (23.600) with P-value (0.000) which is lower than the level of significant value (5%), the difference was found to be statistically significant at p.value =0.000.

Table (4.9): Frequency and percentage for work environment

No	Items	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	Implementation of ISO 17025 standard Enhances the environment inside the lab which increases the quality of the calibration	23	7	0	0	0
		76.7	23.3	0.0	0.0	0.0
2	Instructions are available to control and adjust the entry of persons unauthorized	13	13	1	3	0
		43.3	43.3	3.3	10.0	0.0
3	Monitoring and control of environmental conditions and the necessary adjustment are carried out when the environmental conditions exceed the permissible limits.	16	13	1	0	0
		53.3	43.3	3.3	0.0	0.0

Researcher survey (2018)

From the above table result shows:

Implementation of ISO 17025 standard enhances the environment inside the lab which increases the quality of the calibration by the strongly agree (%76.7) and agree by (%23.3) and neutral by (%0.0) and disagree by (%0.0) and strongly disagree by (%0.0).

Instructions are available to control and adjust the entry of persons unauthorized by the strongly agree (%43.3) and agree by (%43.3) and neutral by (%3.3) and disagree by (%10.0) and strongly disagree by (%0.0).

Monitoring and control of environmental conditions and the necessary adjustment are carried out when the environmental conditions exceed the permissible limits by the strongly agree (%53.3) and agree by (%43.3) and neutral by (%3.3) and disagree by (%0.0) and strongly disagree by (%0.0).

Table (4.10):Chi-square test results for work environment

No	Phrases	Chi-square value	df	Sig.	Median	Interpretation
1	Implementation of ISO 17025 standard Enhances the environment inside the lab which increases the quality of the calibration.	18.533	1	0.000	5.00	strongly agree
2	Instructions are available to control and adjust the entry of persons unauthorized.	16.400	3	0.000	4.00	agree
3	Monitoring and control of environmental conditions and the necessary adjustment are carried out when the environmental conditions exceed the permissible limits.	12.600	2	0.000	5.00	strongly agree

Researcher survey (2018)

The results of table (4.10) interpreted as follows:

1. The value of chi – square calculated to signify the differences between P-value and significant value (5%), chi – square of the attribute: implementation of ISO 17025 standard Enhances the environment inside the lab which increases the quality of the calibration was (18.533) with P-value (0.000) which is lower than the level of significant value (5%), the difference was found to be statistically significant at p.value =0.000.
2. The value of chi – square calculated to signify the differences between P-value and significant value (5%), chi – square of the attribute: instructions are available to control and adjust the entry of persons unauthorized was (16.400) with P-value (0.000) which is lower than the level of significant value (5%), the difference was found to be statistically significant at p.value =0.000.

3. The value of chi – square calculated to signify the differences between P-value and significant value (5%), chi – square of the attribute: monitoring and control of environmental conditions and the necessary adjustment are carried out when the environmental conditions exceed the permissible limits was (12.600) with P-value (0.000) which is lower than the level of significant value (5%), the difference was found to be statistically significant at p.value =0.000.

4.2 Data analysis for administration:

Table (4.11): Frequency and percentage for the sex

sex	Frequencies	Percentage
Male	5	55.6%
Female	4	44.4%
Total	9	100.0%

Researcher survey (2018)

Table (4.11) illustrates the views of the distribution of the sex. 5(%55.6) were males and 4(%44.4) were females.

Table (4.12) :Frequency and percentage for the qualification

Value	Frequencies	Percentage
Bachelor	1	11.1%
Master	1	11.1%
P.hd	5	55.6%
Others	2	22.2%
Total	9	100.0%

Researcher survey (2018)

Table (4.12) illustrates the views of the distribution of the qualification. Bachelor was 1 (%11.1) and Master was 1 (%11.1) and P.hd were 5 (%55.6) and others were 2 (%22.2) .

Table (4.13) :Frequency and percentage for experience

Value	Frequencies	Percentage
Less than 5 years	0	0.0%
5 and less than 10 years	1	11.1%
10and less than 15 years	8	88.9%
Total	9	100.0%

Researcher survey (2018)

Table (4.13) illustrates the views of the distribution of the experience. Less than 5 years was 0 (%0.0) and 5 and less than 10 years were (%11.1) and 10and less than15 years were 8 (%88.9) .

Table (4.14) :Frequency and percentage for training

Value	Frequencies	Percentage
Director general	1	11.1%
Technical manager	1	11.1%
Quality manager	0	0.0%
Head of the department	3	33.3%
Others	4	44.4%
Total	9	100.0%

Researcher survey (2018)

Table (4.14) illustrates the views of the distribution of the experience. Director General was 1 (%11.1) and technical manager was 1 (%11.1) and quality manager

was 0 (%0.0) and head of the department were 3 (%33.3) and others were 4 (%44.4).

Second: Reliability and Validity

Cranach’s alpha method: -

Where reliability was calculated using Cranach’s alpha equation shown below:

$$\text{Reliability coefficient} = \frac{n}{N-1} * \frac{1 - \text{Total variations questions}}{\text{variation college grades}}$$

$$\text{Validity} = \sqrt{\frac{n}{N-1} * \frac{1 - \text{Total variations questions}}{\text{variation college grades}}}$$

Cranach alpha coefficient = (0.66), a reliability coefficient is high and it indicates the stability of the scale and the validity of the study

Validity coefficient is the square of the islands so reliability coefficient is (0.81), and this shows that there is a high sincerity of the scale and that the benefit of the study.

Table (4.15) :Frequency and percentage for key strategic result

No	Phrases	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	Implementation of Standard 17025 has helped to increase market share.	4	4	1	0	0
		44.4	44.4	11.1	0.0	0.0
2	Implementation of Standard 17025 increases the volume of sales.	4	4	1	0	0
		44.4	44.4	11.1	0.0	0.0
3	Implementation of Standard 17025 has helped to increase the number of customers.	4	4	1	0	0
		44.4	44.4	11.1	0.0	0.0
4	Increasing the satisfaction of customers, employees and other interested parties after applying the centre to ISO 17025.	5	4	0	0	0
		55.6	44.4	0.0	0.0	0.0
5	Implementation of Standard 17025 has helped to increase control, control operations and reduce waste	5	3	1	0	0
		55.6	33.3	11.1	0.0	0.0
6	Implementation of Standard 17025 has helped to achieve the planned strategic objectives	5	4	0	0	0
		55.6	44.4	0.0	0.0	0.0

Researcher survey (2018)

From the above table results shows:

Implementation of standard 17025 has helped to increase market share by the strongly agree (%44.4) and agree by (%44.4) and neutral by (%11.1) and disagree by (%0.0) and strongly disagree by (%0.0).

Implementation of standard 17025 increases the volume of sales by the strongly agree (%44.4) and agree by (%44.4) and neutral by (%11.1) and disagree by (%0.0) and strongly disagree by (%0.0).

Implementation of Standard 17025 has helped to increase the number of customers by the strongly agree (%44.4) and agree by (%44.4) and neutral by (%11.1) and disagree by (%0.0) and strongly disagree by (%0.0).

Increasing the satisfaction of customers, employees and other interested parties after applying the center to ISO 17025 by the strongly agree (%55.6) and agree by (%44.4) and neutral by (%0.0) and disagree by (%0.0) and strongly disagree by (%0.0).

Implementation of Standard 17025 has helped to increase control, control operations and reduce waste by the strongly agree (%55.6) and agree by (%33.3) and neutral by (%11.1) and disagree by (%0.0) and strongly disagree by (%0.0).

Implementation of standard 17025 has helped to achieve the planned strategic objectives by the strongly agree (%55.6) and agree by (%44.4) and neutral by (%0.0) and disagree by (%0.0) and strongly disagree by (%0.0).

Table (4.16) Chi-square test results for key strategic result

No	Phrases	Chi-square value	df	Sig.	Median	Interpretation
1	Implementation of Standard 17025 has helped to increase market share.	12.251	2	0.000	4.00	agree
2	Implementation of Standard 17025 increases the volume of sales.	12.251	2	0.000	4.00	agree
3	Implementation of Standard 17025 has helped to increase the number of customers.	12.251	2	0.000	4.00	agree
4	Increasing the satisfaction of customers, employees and other interested parties after applying the center to ISO 17025.	10.210	2	0.000	5.00	strongly agree
5	Implementation of Standard 17025 has helped to increase control, control operations and reduce waste.	21.032	2	0.000	5.00	strongly agree
6	Implementation of Standard 17025 has helped to achieve the planned strategic objectives.	10.210	2	0.000	5.00	strongly agree

Researcher survey (2018)

The results of table (4.16) interpreted as follows:

1. The value of chi- square calculated to signify the differences between P-value and significant value (5%), chi- square of the attribute: the Implementation of Standard 17025 has helped to increase market share was (12.251) with P-value (0.000) which is lower than the level of significant value (5%), the difference was found to be statistically significant at p.value =0.000.
2. The value of chi- square calculated to signify the differences between P-value and significant value (5%), chi- square of the attribute: the Implementation of Standard 17025 increases the volume of sales was (12.251) with P-value (0.000) which is lower than the level of significant value (5%), the difference was found to be statistically significant at p.value =0.000.

3. The value of chi- square calculated to signify the differences between P-value and significant value (5%), chi- square of the attribute: the implementation of standard 17025 has helped to increase the number of customers was (12.251) with P-value (0.000) which is lower than the level of significant value (5%), the difference was found to be statistically significant at p.value =0.000.
4. The value of chi-square calculated to signify the differences between P-value and significant value (5%), chi- square of the attribute: the increasing the satisfaction of customers, employees and other interested parties after applying the center to ISO 17025 was (10.210) with P-value (0.000) which is lower than the level of significant value (5%), the difference was found to be statistically significant at p.value =0.000.
5. The value of chi-square calculated to signify the differences between P-value and significant value (5%), chi – square of the attribute:the implementation of Standard 17025 has helped to increase control, control operations and reduce waste was (21.032) with P-value (0.000) which is lower than the level of significant value (5%), the difference was found to be statistically significant at p.value =0.000.
6. The value of chi – square calculated to signify the differences between P-value and significant value (5%), chi – square of the attribute:the implementation of standard 17025 has helped to achieve the planned strategic objectives was (10.210) with P-value (0.000) which is lower than the level of significant value (5%), the difference was found to be statistically significant at p.value =0.000..

4.3 Data analysis for Customer satisfaction:

Reliability and validity

Cranach's alpha method: -

Where reliability was calculated using Cranach's alpha equation shown below:

$$\text{Reliability coefficient} = \frac{n}{N-1} * \frac{1 - \text{Total variations questions}}{\text{variation college grades}}$$

$$\text{Validity} = \sqrt{\frac{n}{N-1} * \frac{1 - \text{Total variations questions}}{\text{variation college grades}}}$$

Cranach alpha coefficient = (0.72), a reliability coefficient is high and it indicates the stability of the scale and the validity of the study

Validity coefficient is the square of the islands so Validity coefficient is (0.85), and this shows that there is a high sincerity of the scale and that the benefit of the study.

Table (4.17): Frequency and percentage for Customer satisfaction

No	Phrases	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	I am confident in the quality and accuracy of the calibration process.	20	9	1	0	0
		66.3	30.0	3.3	0.0	0.0
2	The center provides the calibration service at an appropriate cost compared to accredited laboratories outside Sudan.	12	10	8	0	0
		40.0	33.3	26.7	0.0	0.0
3	The Center committed with the agreed delivery time.	20	8	2	0	0
		66.3	26.8	6.7	0.0	0.0
4	Comments, complaints and suggestions are dealt with .interest	23	6	1	0	0
		76.7	20.0	3.3	0.0	0.0
5	The center maintains the customers' Properties until they are received.	20	10	0	0	0
		66.7	33.3	0.0	0.0	0.0
6	I will not hesitate to deal again with the center.	30	0	0	0	0
		100.0	0.0	0.0	0.0	0.0

Researcher survey (2018)

From the above table result shows:

I am confident in the quality and accuracy of the calibration process by the strongly agree (%66.3) and agree by (%30.0) and neutral by (%3.3) and disagree by (%0.0) and strongly disagree by (%0.0).

The center provides the calibration service at an appropriate cost compared to accredited laboratories outside Sudan by the strongly agree (%40.0) and agree by (%33.3) and neutral by (%26.7) and disagree by (%0.0) and strongly disagree by (%0.0).

The center committed with the agreed delivery time by the strongly agree (%66.3) and agree by (%26.8) and neutral by (%6.7) and disagree by (%0.0) and strongly disagree by (%0.0).

Comments, complaints and suggestions are dealt with interest by the strongly agree (%76.7) and agree by (%20.0) and neutral by (%3.3) and disagree by (%0.0) and strongly disagree by (%0.0).

The center maintains the customers' properties until they are received by the strongly agree (%66.7) and agree by (%33.3) and neutral by (%0.0) and disagree by (%0.0) and strongly disagree by (%0.0).

I will not hesitate to deal again with the center by the strongly agree (%100.0) and agree by (%0.0) and neutral by (0.0%) and disagree by (%0.0) and strongly disagree by (%0.0).

Table (4.18): Chi-square test results for Customer satisfaction

No	Phrases	Chi-square value	df	Sig.	Median	Interpretation
1	I am confident in the quality and accuracy of the calibration process.	18.200	2	0.000	5.00	strongly agree
2	The center provides the calibration service at an appropriate cost compared to accredited laboratories outside Sudan.	11.800	2	0.000	4.00	agree
3	The center committed with the agreed delivery time.	16.800	2	0.000	5.00	strongly agree
4	Comments, complaints and suggestions are dealt with care.	26.600	2	0.000	5.00	strongly agree
5	The center maintains the customers' properties until they are received.	13.33	1	0.000	5.00	strongly agree
6	I will not hesitate to deal again with the center.	26.133	1	0.000	1.00	strongly agree

Researcher survey (2018)

The results of table (4.18) interpreted as follows:

1. The value of chi- square calculated to signify the differences between P-value and significant value (5%), chi – square of the attribute: i am confident in the quality and accuracy of the calibration process was (18.200) with P-value (0.000) which is lower than the level of significant value (5%), the difference was found to be statistically significant at p.value =0.000.
2. The value of chi- square calculated to signify the differences between P-value and significant value (5%), chi – square of the attribute: the attribute: center provides the calibration service at an appropriate cost compared to accredited laboratories outside Sudan was (11.800) with P-value (0.000) which is lower than the level of significant value (5%), the difference was found to be statistically significant at p.value =0.000.

3. The value of chi- square calculated to signify the differences between P-value and significant value (5%), chi – square of the attribute: the Center committed with the agreed delivery time was (16.800) with P-value (0.000) which is lower than the level of significant value (5%), the difference was found to be statistically significant at p.value =0.000.
4. The value of chi- square calculated to signify the differences between P-value and significant value (5%), chi – square of the attribute: the Comments, complaints and suggestions are dealt with care was (26.600) with P-value (0.000) which is lower than the level of significant value (5%) , the difference was found to be statistically significant at p.value =0.000.
5. The value of chi – square calculated to signify the differences between P-value and significant value (5%), chi – square of the attribute: the center maintains the customers' Properties until they are received was (13.33) with P-value (0.000) which is lower than the level of significant value (5%), the difference was found to be statistically significant at p.value =0.000.
6. The value of chi- square calculated to signify the differences between P-value and significant value (5%), chi- square of the attribute: I will not hesitate to deal again with the center was (26.133) with P-value (0.000) which is lower than the level of significant value (5%), the difference was found to be statistically significant at p.value =0.000.

Hypotheses:-

1-There was a positive relationship between implementing of 17025 standard and management system.

No	Chi-square	Df	Sig.	Median	Scale	Statistical significant
30	25.23	3	0.0	4.0	Agree	Significant

Researcher survey (2018)

Table (4.19) shows that the value of the chi-square test (25.23) by significant value (0.00) it was less than the probability value (0.05) this means that there was a positive relationship between implementing of 17025 standard and management system .

2- There was a positive relationship between implementing of 17025 standard and customers satisfaction.

No	Chi-square	Df	Sig.	Median	Scale	Statistical significant
30	32.21	4	0.0	4.0	Agree	Significant

Researcher survey (2018)

Table (4.20) shows that the value of the chi-square test (32.21) by significant value (0.00) it was less than the probability value (0.05) this means that There was a positive relationship between implementing of 17025 standard and customers satisfaction.

3- There was a positive relationship between implementing of 17025 standard and performance and competence of personnel.

No	Chi-square	Df	Sig.	Median	Scale	Statistical significant
30	33.01	3	0.0	4.0	Agree	Significant

Researcher survey (2018)

Table (4.21) shows that the value of the chi-square test (33.01) by significant value (0.00) it was less than the probability value (0.05) this means that There was a

positive relationship between implementing of 17025 standard and personnel awareness and performance.

4- There was a positive relationship between implementing of 17025 standard and key strategic result.

No	Chi-square	Df	Sig.	Median	Scale	Statistical significant
9	25.40	3	0.0	4.0	Agree	Significant

Researcher survey (2018)

Table (4.22) shows that the value of the chi-square test (25.40) by significant value (0.00) it was less than the probability value (0.05) this means that there was a positive relationship between implementing of 17025 standard and key strategic result.

5- There was a positive relationship between implementing of 17025 standard and improvement of work environment.

No	Chi-square	Df	Sig.	Median	Scale	Statistical significant
30	26.35	3	0.0	4.0	Agree	Significant

Researcher survey (2018)

Table (4.23) shows that the value of the chi-square test (26.35) by significant value (0.00) it was less than the probability value (0.05) this means that there was a positive relationship between implementing of 17025 and improvement of work environment.

CHAPTER FIVE
DISCUSSION, CONCLUSION AND
RECOMMENDATIONS

CHAPTER FIVE

Discussion, Conclusion and Recommendations

5.1 Discussion

The present study showed that there was positive relationship between implementing of ISO 17025 standard and improved the management system , and enhanced the work environment these findings were in agreement of findings of study done by(Samia Fadul,2014) , (Egbal Said Ahmed,2016),and study done by (Layla Khalifa,2015) .Also this study showed that there was positive relationship between implementing of ISO 17025 standard and increased performance and competence of personnel these findings were in agreement of findings of study done by (Bibi Frzeena,2009).

As we mentioned before this research is distinguished from the previous studies that discussed the impact of implementation the standard to increase the satisfaction of external customers and improve the main strategic results, and previous results found that were a strong relationship between the implementation of the ISO 17025 standard and increase the main strategic results and also increase the quality of service provided thereby increase customer satisfaction.

5.2 Conclusion

Although, there is no calibrating and measuring laboratories applied the ISO/IEC 17025 standard in Sudan and that was one of the obstacles facing the center, but the impact of implementing ISO 17025 standards on the (NMCC) was clear in many ways and achieved the required result efficiently.

From this study was concluded that the implementing of ISO/IEC 17025 has a positive impact on laboratories. The performance of laboratories has improved

through better control of operations and management system, staff working diligently and efficiently that leading to increase the customer satisfaction, also enhanced the work environment inside the laboratory and helped in correct measuring and calibrating results and provide reliable and high quality result, finally helped in achieve the key strategic results.

5.3 Recommendations:

- Keep improving management system and ensure that meeting the needs of customers to highest level of quality.
- Extended studies should focus on other areas of impact such as; economy.
- Further studies should focus on the obstacles and limitations that face sudanese laboratories to implement and adopt ISO/IEC 17025.

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APPENDICES

Appendice (1)

شهادة اعتماد رقم (٤١٦٠٠٥)

ILAC-MRA

المجلس الوطني للاعتماد
EGAC

جمهورية مصر العربية
المجلس الوطني للاعتماد (إيجاك)
يشهد بأن
مركز نانو للقياس والمعايرة - السودان
الخرطوم بحرى - شارع المطار الكدرو
الخرطوم - السودان

قد حصل على اعتماد المجلس حيث تم تقييمه طبقاً للمواصفة الدولية
ISO/IEC 17025:2005
في مجال المعايير الكهربائية والحرارية والكتلة والموازن
والضغط والاجهزة الطبية والابعاد الهندسية
والموضحة بالبيان المرفق رقم (٤١٦٠٠٥) ب)
رقم إصدار المجال (١)

إصدار رقم (١) : ٠١ أغسطس ٢٠١٧
صالحة حتى : ٣١ يوليو ٢٠٢١

شرط الحفاظ على التوافق مع المواصفات أعلاه والمتطلبات الخاصة بالمجلس
والمجلس الوطنى للاعتماد موقع على اتفاقية الاعتراف المتبادل مع منظمة التعاون الدولى لاعتماد المعامل (ILAC)
في مجال اعتماد معامل المعايرة والاختبار

مهندس / طارق قابيل
رئيس المجلس
وزير التجارة والصناعة

مهندس / هانى الدسوقي
المدير التنفيذي للمجلس

٤٢٨٥٦

Appendice (2)



مركز نانو للقياس والمعايرة
Nano for Measurement and Calibration Center



Calibration Certificate

Certificate No. NMCC/2018 - 00965 Issue Date: 2018/04/24

CLIENT INFORMATION

Company : NANO FOR MEASUREMENT AND CALIBRATION CENTER
Address : Khartoum north
Telephone /Fax : +249155116690

DATES & CONDITIONS

Calibration Laboratory : ELECTROMECHANICAL
Calibration Location : Permanent
Calibration Temperature : 23 ± 3 °C
Relative Humidity : 20 TO 60 %
Receiving Date : 03 / 04 / 2018
Calibration Date : 03 / 04 / 2018
Due Date : 03 / 04 / 2019

UNIT UNDER CALIBRATION

Description : Thermocouple type K with indicator
Manufacturer : Testo
Model : Testo 925
Serial No. : N/A
Instrument ID : 4E3710
Customer ID No : NMCC.Te.20-0.6-6
Range : (-30-350) °C

CALIBRATION METHODS

The Calibration is performed by direct comparison of the measurements results of calibration item against to the laboratory reference standards values according to the In-house procedure No. NMCC/Cal.P/06/01.

SIGNATURES

Calibration Engineer 74

Name : Mustafa Ibrahim

Sign :

Date : 24.04.2018

Section Head

Name : Abobakr Glal

Sign :

Date : 24.4.2018

Technical Manager

Name : Abdelmoneim Mohammad

Sign :

Date : 24.4.2018

This certificate provides traceability of measurement to recognized national standards, and to units of measurement realized at recognized national standards laboratories. This certificate may not be reproduced other in full, except with the prior written approval of the NMCC general manager.

QF 5101



Page 1 of 2

الخرطوم بحري - الحلفايا - شارع الطيار الكندرو

Tel: +249 123036972 - +249 123036973

Tel: +249 123036974

Fax : +249 155 116690

Email: nanocentre@yahoo.com

Appendice (3)



بسم الله الرحمن الرحيم
جامعة السودان للعلوم و التكنولوجيا
عمادة الجودة و التطوير



السادة/ موظفو مركز النانو للقياس و المعايرة

الكرام،،،

السلام عليكم و رحمة الله تعالى و بركاته،،،

الموضوع /إستبيان بغرض البحث العلمي..

يهدف هذا الإستبيان (الذي هو جزء من متطلبات البحث التكميلي لنيل درجة الماجستير في إدارة الجودة الشاملة و التميز)إلى الوقوف على وضع مختبرات المعايرة و القياس المطبقة لنظام ISO/IEC 17025 و أثر تطبيقها على أداء المؤسسة و الذي سيتيح لنا أيضاً معرفة مدى وعي العملاء بأنظمة الجودة و إقبالهم على المؤسسات المطبقة لها، نرجو من سيادتكم التكرم بالتعاون معنا في هذا البحث و الإجابة بدقة على الأسئلة الآتية ، مع العلم أن إجاباتكم ستعامل بسرية تامة و لن يتم إستخدامها إلا لأغراض البحث العلمي ، شاكرين لسيادتكم الوقت و حُسن الإهتمام...

تقبلوا فائق التقدير و الإحترام

الباحثة: نازك عبد المجيد أحمد داوود

Section One: Personal Information:

1-Gender:

Male Female

2- Educational Qualification :

Secondary Bachelor Master PhD Others

3- Years of Experience:

Less than 5 years 5 and less than 10 years 10 and less than 15 years
More than 15 years

4- Training courses :

One course Two courses More than three courses None

Section Two:

This section is divided into three axes that related to what extent do you agree that being an accredited laboratory brings the following changes to your organization? (*Tick as appropriate*)

1- Management system:

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The senior management of the Center is committed to applying the requirements of the ISO 17025 standard which has helped to improve performance.					
The Center has an integrated, clear and applied management system					
Senior management shall provide the necessary resources to implement the management system based on the requirements of the standard.					
The manger has a mechanism to determine the potential problems and take action to prevent them.					

2- Performance and competence of personnel:

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The Center trains staff in accordance with a procedure that identifies the training need					
All workers in the laboratory have a clear job description that defines the powers and responsibilities					
The implementation of the standard ensures the participation of all employees in the management system implementation and the required improvement processes					
Implementing of ISO 17025 increases in personnel confidence performing Calibrations.					
The Center follows a mechanism to assess the performance of employees on a regular basis to assess their competence.					

3-Work environment:

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Implementation of ISO 17025 standard Enhances the environment inside the lab which increases the quality of the calibration.					
Instructions are available to control and adjust the entry of persons unauthorized .					
Monitoring and control of environmental conditions and the necessary adjustment are carried out when the environmental conditions exceed the permissible limits.					

End of Questionnaire

Thanking you for your precious time in completing the questionnaire ☺

Appendice (4)

Section One:

Personal Information:

1-Gender:

Male Female

2- Educational Qualification :

Secondary Bachelor Master PhD Others

3- Years of Experience:

Less than 5 year 5 and less than 10 years 10 and less than 15 years More than 15 years

4- Training courses :

One course Two courses More than three courses None

5- Job title:

General director Technical Manager Quality Manager Head of the Department Other

Section Two:

This part of the questionnaire aims to study the extent to which the implementing of the standard 17025 has affected the achievement of the objectives and strategy of the Center. **Please mark (✓) the appropriate option.**

4- Key Strategic Result

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Implementation of Standard 17025 has helped to increase market share.					
Implementation of Standard 17025 increases the volume of sales.					
Implementation of Standard 17025 has helped to increase the number of customers.					
Increasing the satisfaction of customers, employees and other interested parties after applying the center to ISO 17025.					
Implementation of Standard 17025 has helped to increase control, control operations and reduce waste.					
Implementation of Standard 17025 has helped to achieve the planned strategic objectives.					

End of Questionnaire

Thanking you for your precious time in completing the questionnaire ☺

Appendice (5)

Dear Customer:

To what extent the implementing of the standard 17025 meets the needs and expectation of customers and their satisfaction. **Please mark (✓) in the appropriate option.**

5- Customer satisfaction

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I am confident in the quality and accuracy of the calibration process.					
The center provides the calibration service at an appropriate cost compared to accredited laboratories outside Sudan.					
The center committed with the agreed delivery time.					
Comments, complaints and suggestions are dealt with care.					
The center maintains the customers' properties until they are received.					
I will not hesitate to deal again with the center.					

End of Questionnaire

Thanking you for your precious time in completing the questionnaire ☺

Appendice (6)

الأساتذة المحكمون للإستبانة

الجامعة	الصفة	الاسم	الرقم
جامعة السودان المفتوحة.	أ.مشارك	د.أحمد موسى إسماعيل.	1
جامعة السودان للعلوم و التكنولوجيا.	أ.مساعد	د.أشرف حسن إدريس.	2
جامعة السودان للعلوم و التكنولوجيا.	أ.مساعد	د.عبدالمطلب عبدالرسول إبراهيم.	3

Appendice (7)

بسم الله الرحمن الرحيم

جامعة السودان للعلوم والتكنولوجيا
كلية الدراسات العليا
مكتب المسجل



Sudan University of Science & Technology
College of Graduate Studies
Registrar's Office

التاريخ: 2018/10/21م

شهاده لمن يهيمه الامر

الموضوع : تيسير عمل الباحثة/
نازك عبدالمجيد احمد داؤد (سودانية الجنسية)

تشهد ادارة كلية الدراسات العليا بان الدارسة المذكورة اعلاه تقوم بالتحضير لدرجة الماجستير بالمقررات والبحث التكميلي في ادارة الجودة والامتيانز بعمادة التطوير والجودة للعام الدراسي 2016- 2017م ولمدة عامين.
نرجو كريم تفضلكم بمدىها بالمعلومات التي تحتاج اليها طرفكم بالاضافه الى البحوث والدوريات والتطبيقات العلميه التي تستخدم للاغراض الاكاديميه والبحثيه فقط.

والله الموفق ...


عائشة جعفر ابراهيم
م.مسجل الكلية

1/ تصريف بالمعاشرة رقم 17025
2/ تصريف بجمعيات RADAR
3/ تصريف منشورات قياس آداب من فرع فعاية تفانين لعلومه بنافه .
4/ قياس فعاية نظريه لعلومه بنافه
5/ تصريف اتصالات الفاعليه
6/ تصريف اتصالات الرياضيه
7/ تصريف بحوث لسانه (للسا لاقطار ما يتاهاه)


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