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The Impact of Implementation of ISO 17025:2017 on Improvement of Laboratories Performance in Sudanese Agrofood Experts Laboratories for Analysis of Sudanese Agricultural Food and Products, Khartoum State- Sudan

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Abstract: *This descriptive case study was conducted in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products, Khartoum State- Sudan to assess the impact of implementation of ISO 17025:2017 on improvement of laboratories performance during the period from September 2025 to March 2026. A questionnaire was used as data collection tool to achieve the study objective. Thirty-seven questionnaires were distributed to all laboratory employees in the Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products, 25 of the laboratory employees were responded with percentage of (67.5%), while 12 were not responded. The data were analyzed using Statistical Package for Social Sciences (SPSS); the test used was (Chi-square). The study showed that there was a relationship between the service quality and productivity and improvement of laboratories performance according to requirements of ISO/IEC 17025:2017 in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products. The study reflected that there was a relationship between positive trends in the quality working environment and improvement of laboratories performance. In addition to, there was a relationship between the employees' performance and improvement of laboratories performance. The study revealed that there was a relationship between top management commitment and improvement of laboratories performance. The study concluded that implementation of ISO 17025:2005 have positive impact on improvement of laboratories performance in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products, Khartoum State- Sudan.*

Keywords— ISO/IEC 17025:2017; Improvement of Laboratories Performance; Sudanese Agrofood Experts Laboratories

1. INTRODUCTION

International organization for standardization/international electrotechnical commission (ISO/IEC) 17025 is the global quality standard for testing and calibration laboratories, it is the basis for accreditation from an accreditation body. Laboratories that are accredited to this international standard have demonstrated that they are technically competent and able to produce precise and accurate test 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 [1]. 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 stationery to show current and potential customers that your laboratory is committed to quality and has demonstrated technical competency to perform calibration or testing services [2]. There are two main clauses in ISO/ IEC 17025:2005: management requirements and technical requirements. Management requirements are specializing in the operations, activities and the effectiveness of the quality system in the laboratory. And it has requirements similar to the standard requirements of ISO 9001. Technical requirements address the competence of staff, testing, methodology, equipment's and reporting of test and calibration results. In the 10th items of the standard of ISO/IEC 17025:2005 improvement was 2 achieved as a basic requirement by improving the effectiveness of the quality system continuously by focusing on quality policy, quality objectives, internal audit results, data analysis, corrective actions, preventive actions and management review [3]. Auditing is defined as the on-site verification activity, such as inspection or examination, of a process or quality system, to ensure compliance to requirements. An audit can apply to an entire organization or might be specific to a function, process, or production step. Some audits have special administrative purposes, such as auditing documents, risk, or performance, or following up on completed corrective actions. Some audits are named according to their purpose or scope. The scope of a department or function audit is a particular department or function. The purpose of a management audit relates to management interests, such as assessment of area performance or efficiency [4]. The main objectives were to

assess the impact of implementation of ISO/IEC 17025:2017 on improvement of laboratories performance in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products, Khartoum State- Sudan, to identify relationship between the service quality and productivity and improvement of laboratories performance according to requirements of ISO/IEC 17025:2017 in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products, to identify relationship between the provide positive trends in the quality working environment and improvement of laboratories performance according to requirements of ISO/IEC 17025:2017 in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products, to identify relationship between the employees performance and improvement of laboratories performance according to requirements of ISO/IEC 17025:2017 in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products and to identify relationship between the top management commitment and improvement of laboratories performance according to requirements of ISO/IEC 17025:2017 in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.

2. Materials and methods

2.1 Study design:

It is a descriptive case study.

2.2 Study area:

The study was conducted at Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products, Khartoum State- Sudan

2.2.1 Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products:

Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products (SAFE), which is first laboratories in Sudan, provides food and agricultural products inspection and analysis service independently. To enhance this value, SAFE laboratories already accredited as per ISO/IEC 17025:2017. SAFE laboratories provide package of microbiological and chemistry tests for different matrix and different level (Raw, finished and environmental sample). In order to deliver above services (tests) SAFE laboratories follow international standards and guidelines designed for such type of business (ISO 17025, ISO 7218, Eurachem and official method). The most important step of SAFE laboratories deal with most advance technology to chive accurate results [5].

2.3 Study population:

The study was conducted on all Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products staff, targeted to all staff (department manager, section head, microbiologist, chemists and technicians) at Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.

2.4 Sample size:

The targeted sample of this research was the total population of the laboratory staff (37) but the actual sample number (25) who were responded to fulfill the questionnaire.

2.5 Study period:

The study was conducted during the interval from September 2025 to March 2026.

3. Methods

3.1 Data collection methods:

Self-administrated questionnaire (appendix) was used as the basic tool in this study. The quantitative survey consisted of questionnaire contained four hypotheses that covered the research questions which were distributed to all laboratory staff. The study depends on the questionnaire as a key to offer gathering information from the study population.

3.2 Questionnaire design:

The following five steps of questionnaire design process were as follows:

Firstly, the information was determined to be drawn from the research objectives, questions and hypothesis with consideration to who will be able to supply the information. Secondly, the structure and the length of the questionnaire were determined, the questionnaire was self-administrated and thus they gave clear instructions with direct and simple questions. Thirdly a draft questionnaire was prepared considering the content, format, layout… etc. Fourthly, the questionnaire was pre-tested and revised. Fifthly, the questionnaire reliability and validity were assessed. Based on the above-mentioned steps, the questionnaire was divided and designed to evaluate the four hypotheses below:

1- First hypothesis: There is a statistically significant relationship between service quality and productivity and improvement of laboratories performance according to requirements of ISO/IEC 17025:2017 in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.

2- Second hypothesis: There is a statistically significant relationship between positive trends in the quality working environment and improvement of laboratories performance according to requirements of ISO/IEC 17025:2017 in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.

3- Third hypothesis: There is a statistically significant relationship between employee's performance and improvement of laboratories performance according to requirements of ISO/IEC 17025:2017 in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.

4- Fourth hypothesis: There is a statistically significant relationship between top management commitment and improvement of laboratories performance according to requirements of ISO/IEC 17025:2017 in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.

3.3 Data analysis:

The data obtained were analyzed using the Statistical Package for Social Sciences (SPSS). To achieve the objectives of the study, statistical methods were used the frequency distribution

of the answers, the percentages and Chi-square test for the significance of differences between the test results considering all other variables. Then data were presented in tables.

3.4 Ethical consideration:

Study permissions were obtained from College of Graduate Studies- Sudan University of Science and Technology, then from management of Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products. Also, permission was taken from all individuals before being included in the study. each individual was informed on the nature of the study.

4. Results

The study was conducted on 25 study subjects, 16 (64%) were males and 9 (36%) were females. The age ranged between 33-62 years old. Regarding the academic level of study subjects, 19 (76%) were having a bachelor degree. Regarding the years of experience, 19 (76%) were having experience between 6-10 years. Regarding the job title, 10 (40%) were microbiologist and chemist. Regarding the level of training on ISO 17025:2017, 20 (80%) were very good. Reliability and validity of questionnaire were shown in table (1). Table (2) showed: the accreditation system includes description of all the processes and technical activities of the laboratory within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products by the strongly agree (56%) and agree by (32%) and neutral by (8%) and disagree by (0.0%) and strongly disagree by (0.0%). The laboratory policies and objectives regarding quality are in line with what is stated in the Quality Manual in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products by the strongly agree (76%) and agree by (24%) and neutral by (12%) and disagree by (0.0%) and strongly disagree by (0.0%). There is a list of all laboratory methods used in the system in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products by the strongly agree (60%) and agree by (32%) and neutral by (8%) and disagree by (0.0%) and strongly disagree by (0.0%). The system settings are determined in case of nonconformity in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products by the strongly agree (44%) and agree by (40%) and neutral by (0.0%) and disagree by (4%) and strongly disagree by (0.0%). The results of table (4.3) interpreted as follows: the value of Chi-square calculated to signify the differences between "The accreditation system includes description of all the processes and technical activities of the laboratory within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products (7.280) with p-value (0.026) which was lower than the level of significant value (5%), these refer to the existence of statistically differences. The value of Chi-square calculated to signify the differences between "The laboratory policies and objectives regarding quality are in line with what is stated in the Quality Manual in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products was (6.760) with p-value (0.009) which was lower than the level of significant value (5%), these refer to the existence of statistically differences. The value of Chi-square calculated to signify the differences between "There is a list of all laboratory methods used in the system in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products was (10.160) with p-value (0.006) which was lower than the level of significant value (5%), these refer to the existence of statistically differences. The value of Chi-square calculated to signify the differences between "The system settings are determined in case of nonconformity in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products was (11.640) with p-value (0.009) which was lower than the level of significant value (5%), these refer to the existence of statistically differences. Table (4.4) showed: The laboratory management establishes procedures to ensure that samples under analysis or testing are not contaminated by the surrounding environment or by any other samples or solutions within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products by the strongly agree (56%) and agree by (36%) and neutral by (8%) and disagree by (0.0%) and strongly disagree by (0.0%). The employees perform analytical procedures in an excellent environment in terms of lighting, ventilation, humidity and temperature within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products by the strongly agree (52%) and agree by (40%) and neutral by (4%) and disagree by (4%) and strongly disagree by (0.0%). There is efficiency and effectiveness among the personnel working within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products by the strongly agree (56%) and agree by (36%) and neutral by (8%) and disagree by (0.0%) and strongly disagree by (0.0%). The validity and efficiency of analytical instruments are tested with standard samples before starting the analytical procedures within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products by the strongly agree (64%) and agree by (32%) and neutral by (0.0%) and disagree by (4%) and strongly disagree by (0.0%). The results of table (4.5) interpreted as follows: the value of Chi-square calculated to signify the differences between "The laboratory management establishes procedures to ensure that samples under analysis or testing are not contaminated by the surrounding environment or by any other samples or solutions within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products was (8.720) with p-value (0.013) which was lower than the level of significant value (5%), these refer to the existence of statistically differences. The value of Chi-square calculated to signify the differences between "The employees perform analytical procedures in an excellent environment in terms of lighting, ventilation, humidity and temperature within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products was (18.360) with p-value (0.000) which was lower than the level of significant value (5%), these refer to the existence of statistically differences. The value of Chi-square calculated to signify the differences

between "There is efficiency and effectiveness among the personnel working within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products was (8.720) with p-value (0.013) which was lower than the level of significant value (5%), these refer to the existence of statistically differences. The value of Chi-square calculated to signify the differences between "The validity and efficiency of analytical instruments are tested with standard samples before starting the analytical procedures within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products was (13.520) with p-value (0.001) which was lower than the level of significant value (5%), these refer to the existence of statistically. Table (4.6) showed: All employees at Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products have a clear job description that defines their responsibilities and authorities by the strongly agree (68%) and agree by (28%) and neutral by (4%) and disagree by (0.0%) and strongly disagree by (0.0%). Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products train employee according to a procedure that determines training needs by the strongly agree (52%) and agree by (40%) and neutral by (8%) and disagree by (0%) and strongly disagree by (0%). Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products support the training program and the development of personal skills by the strongly agree (60%) and agree by (32%) and neutral by (8%) and disagree by (0%) and strongly disagree by (0%). Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products have a procedure for monitoring and evaluating employee performance by the strongly agree (56%) and agree by (32%) and neutral by (8%) and disagree by (4%) and strongly disagree by (0%). differences. The results of table (4.7) interpreted as follows: the value of Chi-square calculated to signify the differences between "All employees at the Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products have a clear job description that defines their responsibilities and authorities" was (15.680) with p-value (0.000) which was lower than the level of significant value (5%), these refer to the existence of statistically differences. The value of Chi-square calculated to signify the differences between "Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products train employee according to a procedure that determines training needs" was (7.760) with p-value (0.021) which was lower than the level of significant value (5%), these refer to the existence of statistically differences. The value of Chi-square calculated to signify the differences between "Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products support the training program and the development of personal skills" was (10.160) with p-value (0.006) which was lower than the level of significant value (5%), these refer to the existence of statistically differences. The value of Chi-square calculated to signify the differences between "Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products have a procedure for monitoring and evaluating employee performance" was (17.400) with p-value (0.001) which was lower than the level of significant value (5%), these refer to the existence of statistically differences. Table (4.8) showed: The top management is committed to provide the necessary human and material resources to implement the requirements within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products by the strongly agree (56%) and agree by (36%) and neutral by (8%) and disagree by (0.0%) and strongly disagree by (0.0%). The top management works on continuous monitoring and evaluation of the effectiveness of the quality system within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products by the strongly agree (64%) and agree by (24%) and neutral by (12%) and disagree by (0%) and strongly disagree by (0%).The top management provides a supportive work environment that encourages continuous performance improvement and development of competencies within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products by the strongly agree (52%) and agree by (44%) and neutral by (4%) and disagree by (0%) and strongly disagree by (0%). The top management's commitment is demonstrated through the support of employees training and development programs, which positively reflects on the performance improvement within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products by the strongly agree (56%) and agree by (40%) and neutral by (0%) and disagree by (4%) and strongly disagree by (0%). The results of table (4.9) interpreted as follows: the value of Chi-square calculated to signify the differences between "The top management is committed to provide the necessary human and material resources to implement the requirements within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products was (8.720) with p-value (0.013) which was lower than the level of significant value (5%), these refer to the existence of statistically differences. The value of Chi-square calculated to signify the differences between "The top management works on continuous monitoring and evaluation of the effectiveness of the quality system within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products was (11.120) with p-value (0.004) which was lower than the level of significant value (5%), these refer to the existence of statistically differences. The value of Chi-square calculated to signify the differences between "The top management provides a supportive work environment that encourages continuous performance improvement and development of competencies within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products was (9.920) with p-value (0.007) which was lower than the level of significant value (5%), these refer to the existence of statistically differences. The value of Chi-square calculated to signify the differences between "The top management's commitment is demonstrated through the support of employees training and development programs, which positively reflects on the performance improvement

within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products was (10.640) with p-value (0.005) which was lower than the level of significant value (5%), these refer to the existence of statistically differences. Table (4.10) showed that the value of the Chi-square test (11.000) by significant value (0.012) it was less than the probability value (0.05) and coefficient correlation (0.45), this means that there was a statistically significant relationship between service quality and productivity and improvement of laboratories performance according to requirements of ISO/IEC 17025:2017 in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products. Table (4.11) showed that the value of the Chi- square test (10.040) by significant value (0.018) it was less than the probability value (0.05) and coefficient correlation (0.62), this means that there was a statistically significant relationship between positive trends in quality working environment and improvement of laboratories performance according to requirements of ISO/IEC 17025:2017 in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products. Table (4.12) showed that the value of the Chi- square test (12.600) by significant value (0.006) it was less than the probability value (0.05) and coefficient correlation (0.60), this means that there was a statistically significant relationship between employee performance and improvement of laboratories performance according to requirements of ISO/IEC 17025:2017 in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products. Table (4.13) showed that the value of the Chi- square test (24.05) by significant value (0.00) it was less than the probability value (0.05) and coefficient correlation (0.63), this means that there was a statistically significant relationship between top management commitment and improvement of laboratories performance according to requirements of ISO/IEC 17025:2017 in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.

Table 1: Reliability and validity of questionnaire

The hypotheses	Reliability	Validity
The first hypothesis	0.93	0.79
The second hypothesis	0.798	0.90
The third hypothesis	0.731	0.82
The fourth hypothesis	0.738	0.78
Total	0.79	0.82

Table 2: The frequency distribution for the respondents' answers about the questions of the first hypothesis

Phrase	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. The accreditation system includes description of all the processes and technical activities of the laboratory within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	14	8	2	0	0
	56%	32%	8%	0%	0%
2. The laboratory policies and objectives regarding quality are in line with what is stated in the Quality Manual in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	19	6	3	0	0
	76%	24%	12%	0%	0%
3. There is a list of all laboratory methods used in the system in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	15	8	2	0	0
	60%	32%	8%	0%	0%
4. The system settings are determined in case of nonconformity in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	11	10	0	1	0
	44%	40%	0%	4%	0%

Table 3: Chi-square test results for respondents' answers regarding the questions of the first hypothesis

Phrase	Chi-Square	Df	Sig.	Median	Interpretation

1. The accreditation system includes description of all the processes and technical activities of the laboratory within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	7.280	2	0.026	5	Strongly agree
2. The laboratory policies and objectives regarding quality are in line with what is stated in the Quality Manual in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	6.760	1	0.009	5	Strongly agree
3. There is a list of all laboratory methods used in the system in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	10.160	2	0.006	5	Strongly agree
4. The system settings are determined in case of nonconformity in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	11.640	3	0.009	4	Agree

Table 4: The frequency distribution for the respondents' answers about the questions of the second hypothesis

Phrase	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. The laboratory management establishes procedures to ensure that samples under analysis or testing are not contaminated by the surrounding environment or by any other samples or solutions in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	14	9	2	0	0
	56%	36%	8%	0%	0%
2. The employees perform analytical procedures in an excellent environment in terms of lighting, ventilation, humidity and temperature within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	13	10	1	1	0
	52%	40%	4%	4%	0%
3. There is efficiency and effectiveness among the personnel working in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	14	9	2	0	0
	56%	36%	8%	0%	0%
4. The validity and efficiency of analytical instruments are tested with standard samples before starting the analytical procedures within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	16	8	0	1	0
	64%	32%	0%	4%	0%

Table 5: Chi-square test results for respondents' answers regarding the questions of the second hypothesis

Phrase	Chi-Square	Df	Sig.	Median	Interpretation
1. The laboratory management establishes procedures to ensure that samples under analysis or testing are not contaminated by the surrounding environment or by any other samples or solutions within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	8.720	2	0.013	5	Strongly agree

2. The employees perform analytical procedures in an excellent environment in terms of lighting, ventilation, humidity and temperature within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	18.360	3	0.000	5	Strongly agree
3. There is efficiency and effectiveness among the personnel working within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	8.720	2	0.013	5	Strongly agree
4. The validity and efficiency of analytical instruments are tested with standard samples before starting the analytical procedures within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	13.520	2	0.001	5	Strongly agree

Table 6: The frequency distribution for the respondents' answers about the questions of the third hypothesis

Phrase	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. All employees at Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products have a clear job description that defines their responsibilities and authorities.	17	7	1	0	0
	68%	28%	4%	0%	0%
2. Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products train employee according to a procedure that determines training needs.	13	10	2	0	0
	52%	40%	8%	0%	0%
3. Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products support the training program and the development of personal skills.	15	8	2	0	0
	60%	32%	8%	0%	0%
4. Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products have a procedure for monitoring and evaluating employee performance.	14	8	2	1	0
	56%	32%	8%	4%	0%

Table 7: Chi-square test results for respondents' answers regarding the questions of the third hypothesis

Phrase	Chi-Square	DF	Sig.	Median	Interpretation
1. All employees at the Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products have a clear job description that defines their responsibilities and authorities.	15.680	2	0.000	5	Strongly agree
2. Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products train employee according to a procedure that determines training needs.	7.760	2	0.021	5	Strongly agree
3. Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products support the training program and the development of personal skills.	10.160	2	0.006	5	Strongly agree

4. The Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products have a procedure for monitoring and evaluating employee performance.	17.400	3	0.001	5	Strongly agree

Table 8: The frequency distribution for the respondents' answers about the questions of the fourth hypothesis

Phrase	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. The top management is committed to provide the necessary human and material resources to implement the requirements within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	14	9	2	0	0
	56%	36%	8%	0%	0%
2. The top management works on continuous monitoring and evaluation of the effectiveness of the quality system within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	16	6	3	0	0
	64%	24%	12%	0%	0%
3. The top management provides a supportive work environment that encourages continuous performance improvement and development of competencies within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	13	11	1	0	0
	52%	44%	4%	0%	0%
4. The top management's commitment is demonstrated through the support of employees training and development programs, which positively reflects on the performance improvement within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	14	10	0	1	0
	56%	40%	0%	4%	0%

Table 9: Chi-square test results for respondents' answers regarding the questions of the fourth hypothesis

Phrase	Chi-Square	Df	Sig.	Median	Interpretation
1. The top management is committed to provide the necessary human and material resources to implement the requirements within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	8.720	2	0.013	5	Strongly agree
2. The top management works on continuous monitoring and evaluation of the effectiveness of the quality system within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	11.120	2	0.004	5	Strongly agree
3. The top management provides a supportive work environment that encourages continuous performance improvement and development of competencies within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	9.920	2	0.007	5	Strongly agree
4. The top management's commitment is demonstrated through the support of employees training and development programs, which positively reflects on the performance improvement within Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.	10.640	2	0.005	5	Strongly agree

Table 10: Result of the first hypothesis (There is a statistically significant relationship between service quality and productivity and improvement of laboratories performance according to requirements of ISO/IEC 17025:2017 in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products)

Number	Correlation coefficient	Chi-Square	Df	Sig.	Median	Scale	Statistically significant
25	0.45	11.000	3	0.012	5	Strongly agree	Significant

Table 11: Result of the second hypothesis (There is a statistically significant relationship between positive trends in the quality working environment and improvement of laboratories performance according to requirements of ISO/IEC 17025:2017 in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products)

Number	Correlation Coefficient	Chi-Square	Df	Sig.	Median	Scale	Statistically significant
25	0.62	10.040	3	0.018	5	Strongly agree	Significant

Table 12: Result of the third hypothesis (There is a statistically significant relationship between employee's performance and improvement of laboratories performance according to requirements of ISO/IEC 17025:2017 in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products)

Number	Correlation Coefficient	Chi-Square	Df	Sig.	Median	Scale	Statistically significant
25	0.60	12.600	3	0.006	5	Strongly agree	Significant

Table 13: Result of the fourth hypothesis (There is a statistically significant relationship between top management commitment and improvement of laboratories performance according to requirements of ISO/IEC 17025:2017 in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products)

Number	Correlation Coefficient	Chi-Square	Df	Sig.	Median	Scale	Statistically significant
25	0.67	10.040	3	0.018	5	Strongly agree	Significant

5. Discussion

The current study showed that the most frequency distribution for the respondents' answers regarding the questions of the first hypothesis was (76%) strongly agree for the statement (The laboratory policies and objectives regarding quality are in line with what stated in the Quality Manual), in general, means that most of the respondents have strongly agreed with all what mentioned about the first hypothesis. Regarding the first hypothesis, the results showed that the value of the Chi-square test by significant value it was less than the probability value and coefficient correlation value, this means that there was a statistically significant relationship between service quality and productivity and improvement of laboratories performance according to requirements of ISO/IEC 17025:2017 in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products. The results reflected that the most frequency distribution for the respondents' answers regarding the questions of the second hypothesis was (64%) strongly agree for the statement (The validity and efficiency of analytical instruments are tested with standard samples before starting the analytical procedures), in general, means that most of the respondents have strongly agreed with all what mentioned about the second hypothesis. Regarding the second hypothesis, the results showed that the value of the Chi-square test by significant value it was less than the probability value and coefficient correlation value, this means that there was a statistically significant relationship between positive trends in the quality working environment and improvement of laboratories performance according to requirements of ISO/IEC 17025:2017 in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products. The current study showed that the most frequency distribution for the respondents' answers regarding the questions of the third hypothesis was (68%) strongly agree for the statement (All employees at Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products have a clear job description that defines their responsibilities and authorities), in general, means that most of the respondents have strongly agreed with all what mentioned about the third hypothesis. Regarding the third hypothesis, the results showed that the value of the Chi-square test by significant value it was less than the probability value and coefficient correlation value, this means that there was a statistically significant relationship between employee's performance and improvement of laboratories performance according to requirements of ISO/IEC 17025:2017 in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products. The current study showed that the most frequency distribution for the respondents' answers regarding the questions of the fourth hypothesis was (64%) strongly agree for the statement (The top management works on continuous monitoring and evaluation of the effectiveness of the quality system within

Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products), in general, means that most of the respondents have strongly agreed with all what mentioned about the fourth hypothesis. Regarding the fourth hypothesis, the results showed that the value of the Chi-square test by significant value it was less than the probability value and coefficient correlation value, this means that there was a statistically significant relationship between top management commitment and improvement of laboratories performance according to requirements of ISO/IEC 17025:2017 in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products. The findings of the current study were in agreement with the findings of Hamza (2015) [6] who 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 results, work environment inside the laboratory was suitable and helped in correct testing results and provided implementing ISO system enhanced the performance and the quality of the laboratory. The Findings from the present study were in disagreement with findings obtained by Fadul (2014) [7] who found that the services provided by national public health laboratory (NPHL) was low quality; there was no clear management system with unknown responsibilities inside NPHL. The findings of the current study were in agreement with the findings of Mohamed (2016) [8] who found that the effect of the ISO 17025 was clearly visible the systems have been improved to the best. Also, the findings of the current study were in agreement with the findings of Bui (2017) [9] who supported the positive impact of ISO 17025 on laboratory performance and emphasized successful accreditation in digital television testing services.

6. Conclusion

The study concluded that service quality and productivity, positive trends in the quality working environment, employee performance and top management commitment have positive impact on improvement of laboratory performance according to requirements of ISO/IEC 17025:2017 in Sudanese Agrofood Experts Laboratories for analysis of Sudanese Agricultural Food and Products.

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