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The Effect of Quality Management System on Sustainability of Ministry of Infrastructure and Urban Development in the Northern State of Sudan: The Mediating Role of Consulting Engineering Works and Engineering Professional Ethics

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Abstract:

This study investigates the mediating role of Consulting Engineering Works (CEW) and Engineering Professional Ethics (EPE) in the relationship between Quality Management System (QMS) adoption and the sustainability of the Ministry of Infrastructure and Urban Development (MIUD) in the Northern State of Sudan. The research, motivated by observed weaknesses in the Ministry's performance indicators—affecting economic, environmental, and social sustainability—aims to assess the significance and impact of QMS, CEW, and EPE on Ministry's Sustainability (MS). Employing a quantitative research design, data were collected via questionnaires from 223 ministry employees, analyzed using descriptive and inferential statistics, and structural equation modeling (SEM) through SPSS and AMOS.

Key findings reveal that QMS has a high importance level, while CEW, EPE, and MS are of moderate importance. Path analysis demonstrated a statistically significant direct impact of QMS on MS (standardized effect = 0.584), as well as a full mediating effect of CEW and EPE together between QMS and MS, with a standardized indirect effect of 0.743 and total effect of 0.641. The results confirm that QMS implementation enhances CEW and EPE, which in turn drive the Ministry's sustainability. The study highlights the necessity for integrating strong quality management, ethical standards, and professional engineering practices to achieve sustainable development in public infrastructure institutions.

Key words: Quality Management System (QMS); Consulting Engineering Works (CEW); Engineering Professional Ethics (EPE); Ministry of Infrastructure and Urban Development in the Northern State (MIUD); Ministry's Sustainability (MS).

JEL Classification Codes: D83, O32, E58, H11.

Introduction:

The adoption of (QMS) is a strategic decision for an institution that can help to improve its overall performance and provide a sound for sustainable development initiatives (ISO 9001:2015).

The engineering profession is one of the ancient professions that has been practiced throughout the ages and is inherited from generation to generation. Moreover, engineers are the ones who build the future with their knowledge and professional skills, and their work is what shapes the future of nations, urban development, happiness and prosperity, or misery (Abd Ul-Rahim, 2015).

The improvement of (CEW) & (EPE) in the present era is one of the most important basic element as it is the focus of engineering work and its most important elements. It is a function inherent to the work of administrative leaders and engineers at various institutional level (Abdelhameed, et al, 2023). Therefore, this study sought to analyze the effect of (QMS) on (MS): the mediating role of (CEW) and (EPE).

General problematic and partial problematic:

The problem of the research focuses on weakness in Ministry's Performance indicators (Economical, Environmental and Social) perform to decrease of (MS) level which refer to unawareness of implementing effective managerial systems like (QMS) and (Sudan Engineering Council low, 1998). Hence, the maim question of this study is can (CEW) and (EPE) together mediated the relationship between (QMS) and (MS)? This central question includes several sub-questions, as follow:

1) What is important level of (QMS), (CEW), (EPE) and (MS)?
2) Is there is a statistically significant impact for (QMS) on (QMS) in (MIUD)?
3) Is there is a statistically significant impact for (QMS) on (CEW) in (MIUD)?
4) Is there is a statistically significant impact for (CEW) on (MS)?
5) Can (CEW) mediated the relationship between (QMS) and (MS)?
6) Is there is a statistically significant impact for (QMS) on (EPE) in (MIUD)?
7) Is there is a statistically significant impact for (EPE) on (MS)?
8) Can (EPE) mediated the relationship between (QMS) and (MS)?

General hypothesis and partial hypotheses:

The general hypothesis of this study is (CEW) and (EPE) together mediated the relationship between (QMS) and (MS). This main hypothesis includes partial hypotheses, as follow:

1) There is a statistically significant impact for (QMS) on (QMS) in (MIUD).
2) There is a statistically significant impact for (QMS) on (CEW) in (MIUD).
3) There is a statistically significant impact for (CEW) on (MS).
4) (CEW) mediated the relationship between (QMS) and (MS).
5) There is a statistically significant impact for (QMS) on (EPE) in (MIUD).
6) There is a statistically significant impact for (EPE) on (MS).
7) (EPE) mediated the relationship between (QMS) and (MS).

Objectives of the Study:

The general objective of this study is to investigate the mediating effect of (CEW) & (EPE) on the relationship between (QMS) and (MS). This main objective includes partial objectives, as follow:

1) To determine the important level of (QMS), (CEW), (EPE) and (MS).
2) To Validate the First proposed model investigating the impact of (QMS) on (MS) in (MIUD).
3) To examine the impact for (QMS) on (CEW) in (MIUD).
4) To explore the impact for (CEW) on (MS).
5) To validate the second proposed model investigating the relationship between (QMS) & (MS), a mediating role of (CEW) in (MIUD).
6) To examine the impact for (QMS) on (EPE) in (MIUD).
7) To explore the impact for (EPE) on (MS).
8) To validate the third proposed model investigating the relationship between (QMS) & (MS), a mediating role of (EPE) in (MIUD).
9) To validate the final proposed model investigating the relationship between (QMS) & (MS), a mediating role of (CEW) & (EPE) together in (MIUD).

Importance of the Study:

The importance of the study is as follows:

1) The importance of the variables being investigated represented in (QMS), (CEW), (EPE) and (MS).

2) Clarifying the impact extended from (QMS), (CEW) & (EPE) on (MS) in (MIUD).
3) The importance level of the (QMS) and its impact, within the study variables that clarify the situation before the decision makers in (MIUD).
4) The results of the study can provide a better context for the (MIUD) and more information for the decision makers about benefits of the (QMS), (CEW) & (EPE).

Methodology applied:

According to (Creswell, 2012; Kamel, et al, 2024) quantitative research is an investigation method that may be used to describe trends and explain the relationship between variables found in the literature. A questionnaire is utilized to collect data for this study. The researcher drew a convenience-sample out of the population regarding employees working in (MIUD), because of the easy of data collection and sample selection, and due to the limited time and cost. The questionnaire is distributed via (hand to hand through short visit to the ministry). The questionnaire data is analyzed using the Statistical Package for Social Sciences (SPSS) to analyze quantitative data, including descriptive statistics (frequencies and percentages) and inferential statistics (correlations), and Structural Equation Model analyses (SEM) using Analysis Moment of Structures (AMOS) software to analyze the hypothesized model.

Literature Review:

Independent Variable (Quality Management System):

A quality management system (QMS) is a set of policies, processes and procedures required for planning and delivering (production/development/service) in the core business area of an institution of any kind and size (Abu Al-Rub et al, 2020: 1)

(QMS) is continues improvement in managerial operations, services and procedures, and this improvement achieved through designing and building total system achieving with its needs for consumer (internal, outside) through quality service introduced to them (Abdelhameed, 2021).

The potential benefits to an institution of implementing a (QMS) based on (ISO:9001:2015) are: the ability to consistently provide products and services that meet customer and applicable statutory and regulatory requirements; facilitating opportunities to enhance customer satisfaction; addressing risks and opportunities associated with its context and objectives; and the ability to demonstrate conformity to specified (QMS) requirements.

The (QMS) requirements based on (ISO:9001:2015) are: scope, normative references, terms and definitions, context of the institution, leadership, planning, support, operation, performance evaluation and improvement.

The (QMS) principles based on (ISO:9001:2015) are: Customer focus, Leadership, engagement of people, process approach, improvement, evidence-based decision making and relationship management.

The First Mediator Variable (Consulting Engineering Works):

According to (Regulations on Practicing the Engineering Profession, 2000), consulting engineering services are the services provided by engineering agencies in the public or private sectors and consulting offices in the engineering fields and their branches. These services include engineering works (civil, mechanical, architectural, electrical, chemical, agricultural, surveying, mining and oil, textile, urban planning, and the environment) and in that it has the right to carry out studies and engineering supervision or manage project implementation.

The Second Mediator Variable (Engineering Professional Ethics):

According to (Abd Ul-Rahim, 2015) the term engineering professional ethics (EPE) refers to the field of applied ethics and a system of ethical principles that apply to the practice of engineering. This field deals with the obligations of the engineer towards society, towards his clients and his profession. In terms of being a scientific discipline, it is closely related to many topics such as the philosophy of science, the philosophy of engineering, and the ethics of technology.

Dependent Variable (Sustainable Development):

According to (Al-Shatnawi, 2022: 368), sustainable development is a concept that emerged about seven decades ago which is attracting a lot of attention since then, (Aras & Crowther, 2009) described Sustainability as an indicator of impacts of institution activities on its internal and external environments, both in the present & in the future. Sustainability has three principal dimensions, which are Social, Environmental, and Economic (SEE) dimensions. These three dimensions are linked in an indivisible complementary relationship that has led to emergence of the concept of comprehensive performance, which is the gateway to balancing profitability with the wishes of all the parties having interests in & relationships with the institution (Boodai & Kahli, 2013).

Previous Studies:

Table (1) explores a summary of the literature regarding the relationships between variables as follows:

Table (1): A Summary of the Literature Regarding the Relationships between Variables

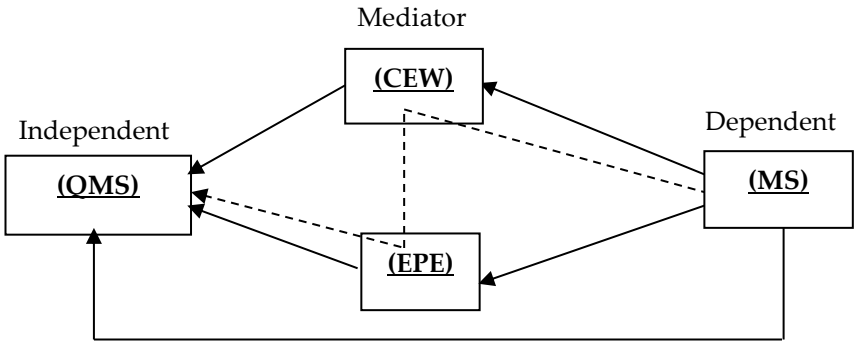
(QMS) & (MS)	
Authors/ Year	Findings
(Al-Zayadi, 2019)	High importance level of Sustainable Organizational Performance, direct effect of (TQM) practices on Strategic Flexibility and (SOP), also (SF) has a role of partial mediator in the relationship between TQM practices & (SOP).
(Abdelhameed, 2021)	High importance level of (QMS) and a significant impact of (QMS) on achieving organizational superiority at banking system.
(Musleh & Hasan, 2022)	Significant impact of administrative empowerment on achieving Sustainable Development for the Palestinian Security Establishment.
(QMS) on (CEW)	
(Osman, 2010)	Significant impact of quality criteria on increasing value of consulting engineering in Jordanians Consulting Engineering Offices.
(Ahmad, 2011)	Significant impact of using Quality Deming's Model on improving vehicle maintenance at Jett Tourist Transportation Company.
(CEW) on (MS)	
(Abdelhameed, 2024)	High importance level of (CEW), and a significant impact of (CEW) on performance of (MIUD).
(Al-Mansour, et al, 2023)	High importance level of (SD) and, a significant impact of business performance on Sustainable Development in (STC) Group.
(QMS) on (MS) through (CEW)	
(Abo-Alwafa, 2012)	Quality Orientation has a direct effect on Developing New Services, (DNS) has a direct effect on Commercial Banks Performance, and (DNS) mediates the relationship between (QO) and commercial bank's performance.
(Abdelhameed & Mahmoud, 2023)	The six sigma has a direct effect on consulting engineering services, (CES) has a direct effect on additive value, and consulting engineering services mediates the relationship between six sigma and additive value at (MIUD).
(QMS) on (EPE)	
(Daas, 2019)	High importance level of Integrated Management System and a significant impact of (IMS) on human performance in Algerian industrial Companies.
(Al-Janabi, 2020)	High importance level of professional ethics and a significant impact of Strategic Management on professional ethics at International Islamic Bank.
(EPE) on (MS)	
(Baves, 2012)	Relation between social responsibility & profession ethics in management.
(Abdullah, 2021)	Medium importance level of work ethics and social responsibility, a relationship between work ethics and social responsibility at Medical Supply Fund in the Northern State of Sudan.
(Abdelhameed & Abu-Salih, 2022)	High level of (EPE), (EPE) has a direct impact on achieving additive value at (MIUD), and a significant collective effect of strategy of building (QMS) according to (ISO 9001:2015) requirements and (EPE) on achieving additive value of works and services for the (MIUD).

Source: Prepared by the Researcher from previous studies in the same table, Dongola, 2024.

Conceptual Framework of the study:

The conceptual framework was established after analyzing existing theories and models and was applied to the data collection and data analysis. The aim of this study was to gain a deeper insight into the field of interest by examining the relationship between the independent variable (Quality Management System), mediators variables ((Consulting Engineering Works) & (Engineering Professionals Ethics)) and dependent variable (Ministry's Sustainability). Based on the literature review and previous studies discussed above, the conceptual framework of the study was formulated as Figure (1) below:

Figure (1): Conceptual Framework of the study



Source: Prepared by researcher refer to previous studies, Dongola, 2024.

Operational Definitions:

The operational definitions for the conceptual framework of the study are illustrated in Table (1).

Table (2): Operational Definitions

Variables	Dimensions	Source(s)
(QMS)	Policy	(ISO 9001:2015); (Daas, 2019); (Abdelhameed, 2021)
	Planning	
	Implementation	
	Checking	
	Management Review	
(CEW)	Studies	(Regulations on Practicing the Engineering Profession, 2000); (Abdul Rahim, 2015); (Abdelhameed, 2024)
	Engineering Supervision	
	Manage Project Execution	
(EPE)	Engineering Professional Ethics	(Abdelhameed & Abu-Salih, 2022)
(MS)	Economic	(Al-Zayadi, 2019); (Al-Mansour, et al, 2023)
	Environmental	
	Social	

Source: Prepared by the Researcher from previous studies in the same table, Dongola, 2024.

Applied Study:

Ministry of Infrastructure and Urban Development in the Northern State of Sudan:

(Fageery, 2024) mentioned that the (MIUD) is a public institution that exercises the functions, powers, tasks, works and activities stipulated in State Decree No. (11) of 2018 related to the establishment of ministries and defining their tasks and competencies.

Study's Variables in (MIUD):

(Mahjob, 2024) mentioned the ministry establish Quality and Administrative Development Management and implement (ISO:9001:2015) since (2016) at all organizational unit. (Imam, 2024) adds that the ministry has a very important role in the community of the northern state, due to the services it provides in several different engineering fields. Therefore, there is a need for strong human energies of engineers with a set of ethics concerned with this sensitive task. This in turn increases its performance to help it provide its engineering services with fairness and sustainable development. (Abd Al-Mageed, 2024) indicated that no engineer is appointed to an engineering job unless he is registered with the Sudan Engineering Council. The registration certificate is one of the employment documents and is placed in the engineer's service file at the Service Affairs Department. The engineer is not promoted from the ninth to the eighth grade (probationary period/ competency barrier) if he does not bring evidence of his registration with an engineering number in the Sudan Engineering Council within the category of graduate engineer. However, the rest of the promotions in planning the career path of the engineer are not linked to the rest of the Engineering Council grades, especially the specialist and the consulting engineer.

Results and Findings:

The population of the study consist of all employees in the ministry which accounting is (527) employees according to approved statistics at Service Affaires Administration in the (MIUD), by using electronic site to determine sample size calculator (https://www.calculator.net/sample-size-calculator.htm) which found (223). The research questionnaire was administered to (250) respondents, 230 questionnaires representing 92% were returned, and 7 questionnaires representing 2.8% were

incomplete or ineligible or refusals and 20 (8%) were not reached. There were 223 acceptable responses, a response rate 97% from the returned questionnaires, which is highly adequate for the nature of this research, table (3) describe this study's sample according to demographic variables:

Table (3): Descriptive of the demographic variables of the study's sample

Variables	Categorization	Frequency	Percent
Gender	Female	123	%55.2
	Male	100	%44.8
Age	Less than 30 Years	27	%12.1
	From 31 to 40 Years	80	%35.9
	From 41 to 50 Years	91	%40.8
	51 Years or greater	25	%11.2
Scientific Specialization	Engineering Sciences	130	%58.3
	Geological Sciences	50	%22.4
	Human Sciences	23	%10.3
	Others	20	%9
Professional Experience	Less than 5 Years	25	%11.2
	From 5 to 10 Years	33	%14.8
	From 11 to 15 Years	75	%33.6
	16 Years or greater	90	%40.4
Qualification	High School or less	23	%10.3
	Graduate	150	%67.3
	Postgraduate	50	%22.4
Training Courses	Internal	140	%62.8
	Internal & External	50	%22.4
	External	10	%4.5
	No	23	%10.3

Source: Field Study Data, 2024, Dongola.

Construct Validity:

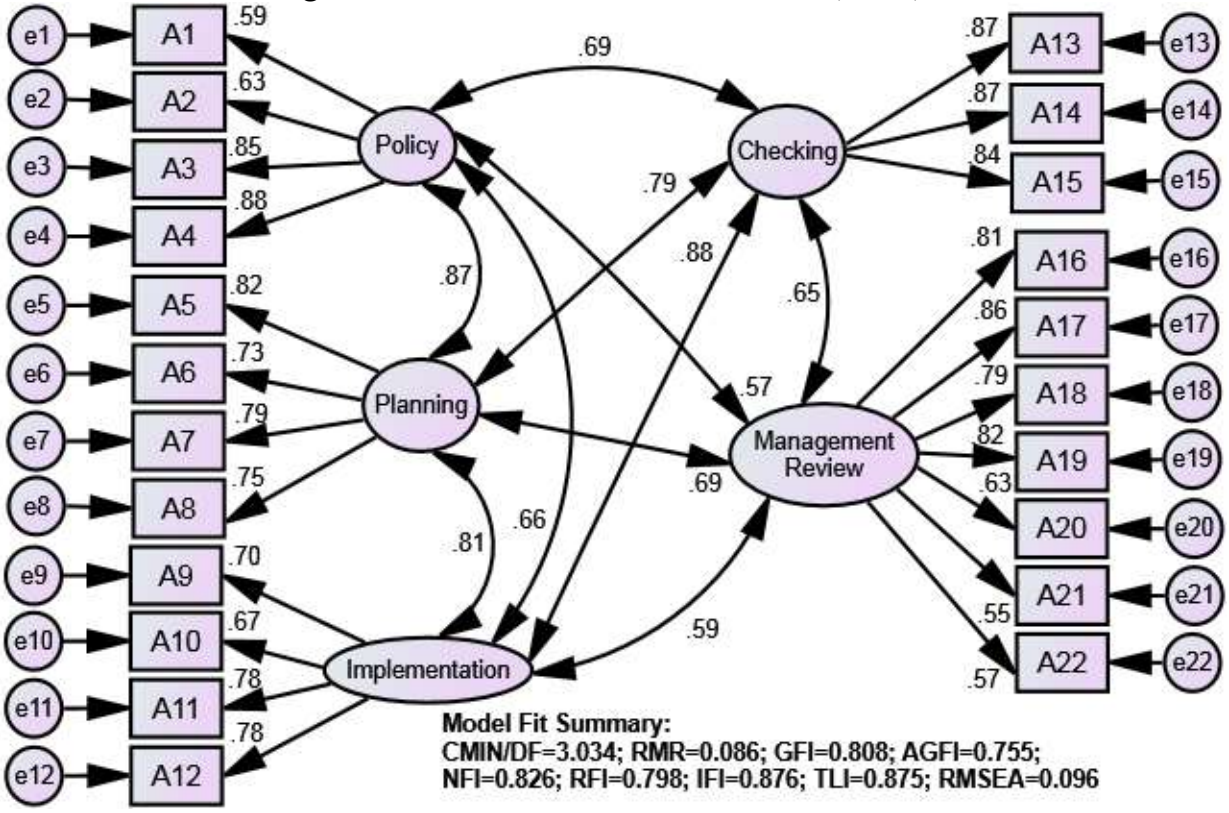
Confirmatory Factor Analysis (CFA) is used to measure the construct validity in the measurement model for each variables of this study. Table (4) shows the conformity indicators and its significance quality:

Table (4): The conformity indicators and its significance quality

Indicators	CMIN/DF	RMR	GFI	AGFI	NFI	RFI	IFI	TLI	CFI	RMSEA
Acceptable Value	<5	0.06 to 0.1	0 to1	0 to1	0 to1	0 to1	0 to1	0 to1	0 to1	0.05 to 0.08
Excellent	<2	<0.06	≤0.90	≤0.80	≤0.90	≤0.90	≤0.90	≤0.90	≤0.90	<0.05

Source: (Kim et al, 2015), (Abo El-Dahab, 2024) & (Al-Samawi & Al-Sayaghi, 2024).

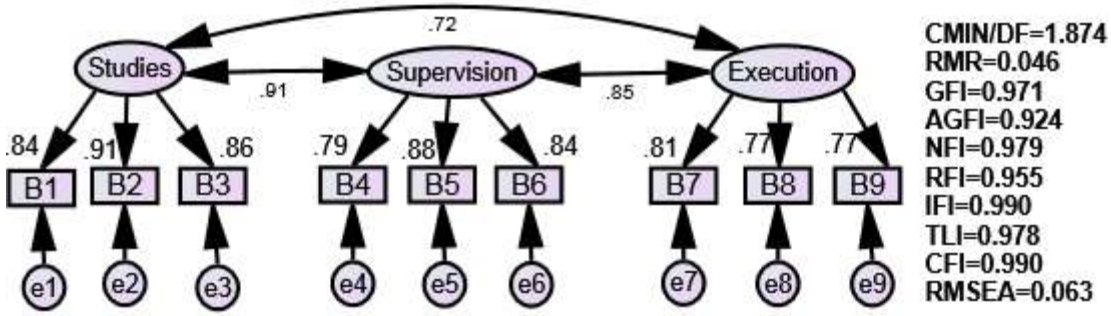
Figure (2): The Measurement Model of (QMS)



Source: Field Study Data, 2024, Dongola.

It is clear from Figure (2): model fit summary indicating that the measurement models provide good support for the factor structure determined through the (CFA), and measurement items have standardized loading estimates of 0.5 or higher (ranging from 0.55 to 0.88) at the 0.001 level (two-tailed), indicating the convergent validity of the measurement model. Discriminant validity shows the degree to which a construct is actually different from other constructs.

Figure (3): Measurement Model of (CEW)

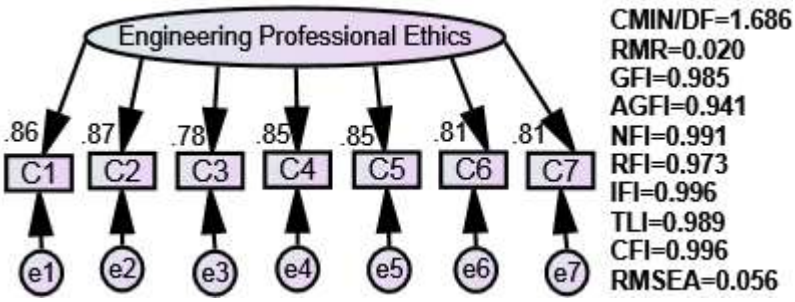


Source: Field Study Data, 2024, Dongola.

It is clear from Figure (3): model fit summary indicating that the measurement models provide good support for the factor structure determined through the (CFA), and

measurement items have standardized loading estimates of 0.5 or higher (ranging from 0.77 to 0.91) at the 0.001 level (two-tailed), indicating the convergent validity of the measurement model. Discriminant validity shows the degree to which a construct is actually different from other constructs.

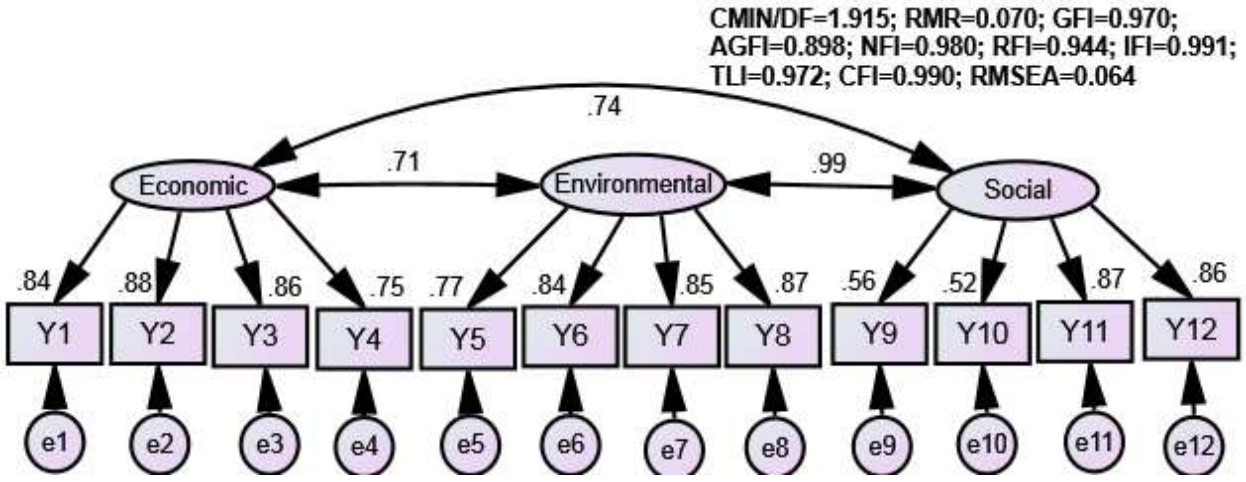
Figure (4): Measurement Model of (EPE)



Source: Field Study Data, 2024, Dongola.

It is clear from Figure (4): model fit summary indicating that the measurement models provide good support for the factor structure determined through the (CFA), and measurement items have standardized loading estimates of 0.5 or higher (ranging from 0.78 to 0.86) at the 0.001 level (two-tailed), indicating the convergent validity of the measurement model. Discriminant validity shows the degree to which a construct is actually different from other constructs.

Figure (5): Measurement Model of (MS)



Source: Field Study Data, 2024, Dongola.

It is clear from Figure (5): model fit summary indicating that the measurement models provide good support for the factor structure determined through the (CFA), and measurement items have standardized loading estimates of 0.5 or higher (ranging from

0.52 to 0.88) at the 0.001 level (two-tailed), indicating the convergent validity of the measurement model. Discriminant validity shows the degree to which a construct is actually different from other constructs.

Reliability:

Cronbach's alpha indicators, Composite Reliability (CR), and the Average Variance Extracted (AVE) are used to measure the reliability of a construct in the measurements models. The results of these tests are shown in Table (5):

Table (5): Reliability of Study's Variables

Variable	Dimension	Cronbach's alpha value	(CR)	(AVE)
Quality Management System	Policy	0.837	0.832	0.560
	Planning	0.857	0.855	0.597
	Implementation	0.823	0.825	0.542
	Checking	0.892	0.893	0.735
	Management Review	0.883	0.885	0.531
Consulting Engineering works	Studies	0.899	0.901	0.751
	Engineering Supervision	0.873	0.874	0.699
	Manage Project Execution	0.824	0.822	0.606
(EPE)	Engineering Professional Ethics	0.940	0.940	0.693
Ministries' Sustainability	Economic	0.898	0.906	0.706
	Environmental	0.899	0.898	0.688
	Social	0.806	0.798	0.515

Source: Field Study Data, 2024, Dongola.

Table (5) shows all results of Cronbach's alpha indicators are greater than (0.70), (CR) are greater than (0.60), and (AVE) are greater than (0.50). So, it clearly identified that in measurements models (Figures 2, 3, 4 and 5) all construct have good reliability (Fornell & Larcker, 1981) and (Bagozzi & Yi; 1988),

Descriptive Analysis of Study's Variables:

To determine the level of response of the sample individuals regarding their variables, the category length equation was used (Hair, et al., 2023):

Application Range = (Upper Alternative Limit - Lower Alternative Limit) / Number of Levels (High; Moderate; Low) = (5 - 1) / 3 = 1.33. Based on this, the significance decision is as: Low significance ranges from 1 - less than 2.33; Moderate significance ranges from 2.33 - up to 3.66; High significance is from 3.67 onwards.

Table (6): Descriptive Analysis of Study's Variables

#	Dimension/ Variable	N	Mean	S.D.	Level	Ranking
1	Policy	223	3.96	0.945	High	1
2	Planning	223	3.55	0.993	Moderate	5
3	Implementation	223	3.72	0.894	High	2
4	Checking	223	3.70	1.084	High	3
5	Management Review	223	3.63	0.899	Moderate	4
6	Quality Management System	223	3.71	0.807	High	1
7	Studies	223	3.44	1.194	Moderate	1
8	Engineering Supervision	223	3.40	1.102	Moderate	2
9	Manage Project Execution	223	3.36	1.122	Moderate	3
10	Consulting Engineering works	223	3.40	1.028	Moderate	4
11	Engineering Professional Ethics	223	3.62	1.071	Moderate	2
12	Economic	223	3.56	1.037	Moderate	1
13	Environmental	223	3.56	1.117	Moderate	2
14	Social	223	3.41	1.041	Moderate	3
15	Ministries' Sustainability	223	3.51	0.976	Moderate	3

Source: Field Study Data, 2024, Dongola.

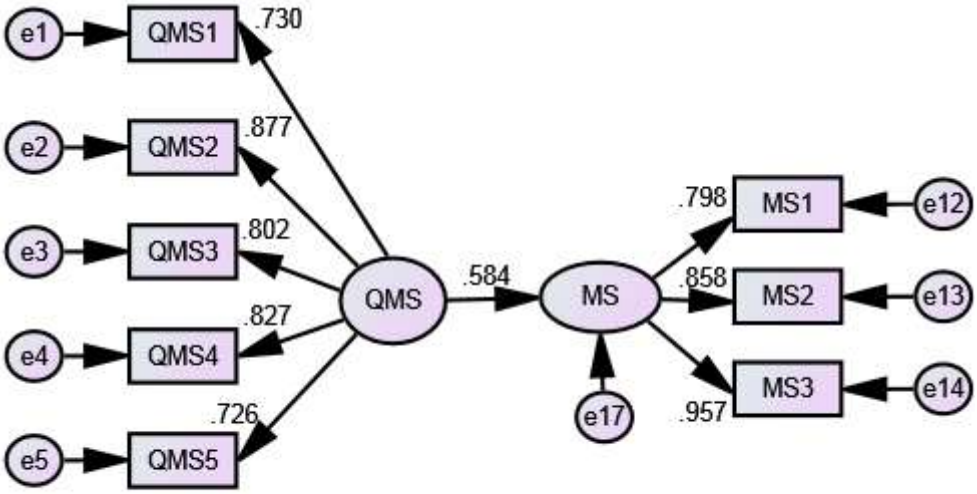
Table (6) shows the arithmetic means of the study variables, with the highest mean being for the independent variable (Quality Management System), followed by the second mediator variable (Engineering Professional Ethics) followed by the dependent variable (Ministries' Sustainability) and the lowest mean for the first mediator variable (Consulting Engineering Works). All of these arithmetic means have a moderate level of significance except (QMS). These results agreed with (Daas, 2019) in high importance level of Integrated Management System Quality, Environment and Health, agreed with (Abdullah, 2021) in medium importance level of work ethics, disagreed with (Abdelhameed, 2024) which found high importance level of Consulting Engineering Services, and disagreed with (Al-Mansour, et al, 2023) which found High importance level of Sustainable Development. This can be attributed to the fact that the vast majority of the researchers agree that the study variables are moderate important. Decision-makers who play a role in the (MIUD) business planning should consider all of these variables.

Hypotheses Testing:

First Hypothesis: There is a statistically significant impact for (QMS) on (MS):

To test the first hypothesis build structural model between (QMS) and (MS):

Figure (6): The First Structural Model of the Study



Source: Field Study Data, 2024, Dongola.

It is clear from Figure (6): model fit summary indicating that the measurement models provide good support for the factor structure determined through the (CFA), and there is positive significance direct impact for (QMS) on (MS) with standardized regression weight of (0.584) at the 0.001 level, which requires acceptance of the first hypothesis (There is a statistically significant impact for (QMS) on (MS)). This result agreed with results of these studies: (Al-Zayadi, 2019), (Abdelhameed, 2021) and (Musleh & Hasan, 2022).

Second, Third & Fourth hypotheses:

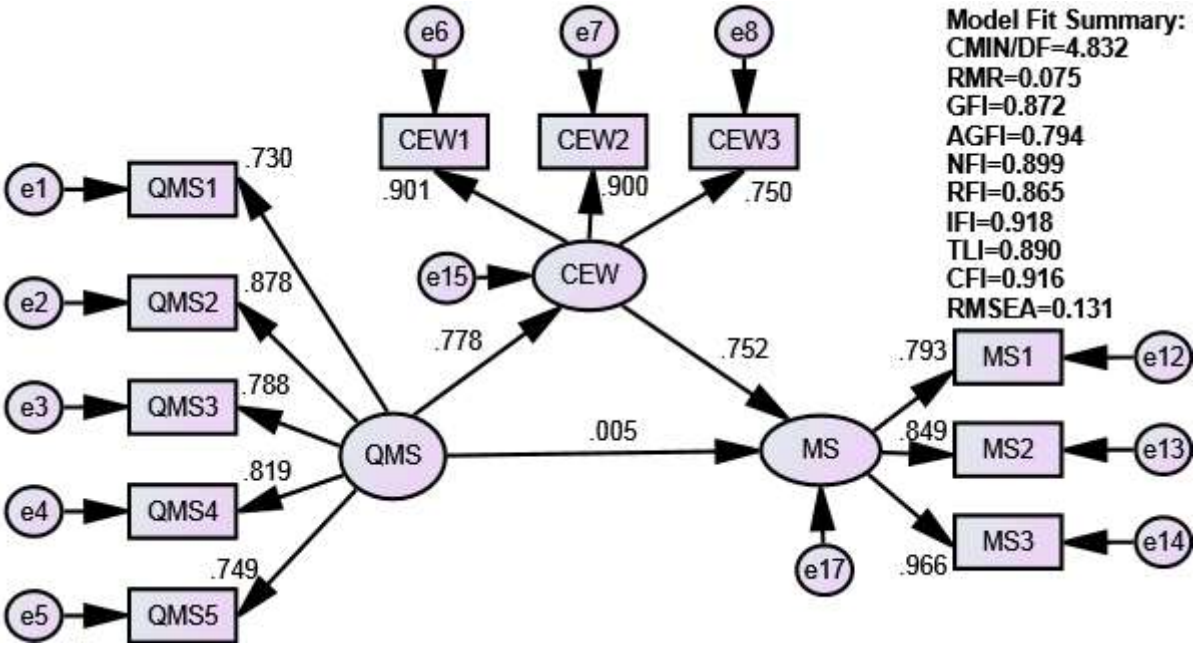
To test (Second, Third & Fourth) hypotheses, the researcher build structural model between (QMS), (CEW) and (MS), and uses Structural Equation Model analyses (SEM) using Analysis Moment of Structures (AMOS) software to analyze the hypothesized model, also implementing Sobel Test (Sobel, 1986) to checking significance mediating of the first mediator variable (CEW) as in Table (7) and Figure (7) below:

Table (7): Direct Effect, Indirect Effect and Total Effect

Independent	Mediator	Dependent	Estimate	S.E.	C.R.	P	Direct	Indirect	Total
(QMS)	(CEW)	-	0.942	0.081	11.60	***	0.778	-	0.778
-	(CEW)	(MS)	0.574	0.081	7.104	***	0.752	-	0.752
(QMS)	(CEW)	(MS)	0.005	0.088	0.054	0.96	0.005	0.585	0.590
*** C.R. is significant at the 0.001 level (two-tailed)									

Source: Field Study Data, 2024, Dongola.

Figure (7): The Second Structural Model of the Study



Source: Field Study Data, 2024, Dongola.

It is clear from Table (7) and Figure (7) these results below:

1) All (CFA) indicators came nearly to Excellent Value and in range of Acceptable Value Except (RMSEA) which equal (0.131), which refer to The Second Structural Model of the Study is good.
2) There is positive significance direct impact for (QMS) on (CEW) with standardized regression weight of (0.778) at the 0.001 level, which requires acceptance of the second hypothesis. Agreed with (Osman, 2010); (Ahmad, 2011).
3) There is positive significance direct impact for (CEW) on (MS) with standardized regression weight of (0.752) at the 0.001 level, which requires acceptance of the third hypothesis. Agreed with (Abdelhameed, 2024); (Al-Mansour, et al, 2023).

4) There is no positive significance direct impact for (QMS) on (MS) with standardized regression weight of (0.005) at the 0.96 level.
5) There is positive significance indirect effect of (0.585) for (QMS) on (MS) through mediating (CEW). Partial agreed with (Abdelhameed & Mahmoud, 2023).
6) Total effect (Direct & Indirect) for (QMS) on (MS) equal (0.590), it's clear (CEW) has full mediator role in the relation between (QMS) & (MS), because the direct effect between (Independent variable) & (Dependent variable) isn't significant.
7) Sobel test result: (Z-Test = 6.051472132; P-Value = 0.00000000143528). The mediating effect is supported (accepting the fourth hypothesis).

Fifth, Sixth & Seventh hypotheses:

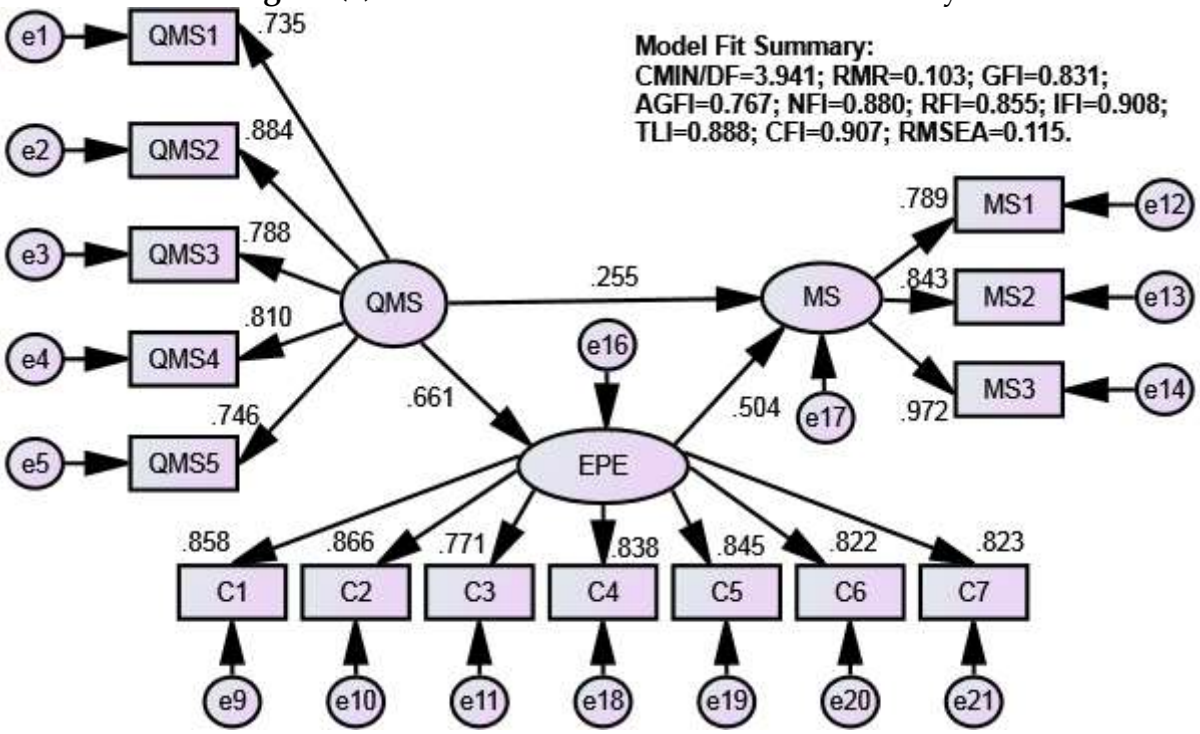
To test (Fifth, Sixth & Seventh) hypotheses, the researcher build structural model between (QMS), (EPE) and (MS), and uses (SEM) analyses using (AMOS) software to analyze the hypothesized model, also implementing Sobel Test (Sobel, 1986) to checking significance mediating of second mediator variable (EPE) as in Table (8) & Figure (8):

Table (8): Direct Effect, Indirect Effect and Total Effect

Independent	Mediator	Dependent	Estimate	S.E.	C.R.	P	Direct	Indirect	Total
(QMS)	(EPE)	-	0.663	0.075	8.811	***	0.661	-	0.661
-	(EPE)	(MS)	0.468	0.078	5.997	***	0.504	-	0.504
(QMS)	(EPE)	(MS)	0.238	0.073	3.278	0.01	0.255	0.333	0.588
*** C.R. is significant at the 0.001 level (two-tailed)									

Source: Field Study Data, 2024, Dongola.

Figure (8): The Third Structural Model of the Study



Source: Field Study Data, 2024, Dongola.

It is clear from Table (8) & Figure (8) these results below:

1) All (CFA) indicators came nearly to Excellent Value and in range of Acceptable Value Except (RMSEA) which equal (0.115), which refer to The Third Structural Model of the Study is good.
2) There is positive significance direct impact for (QMS) on (EPE) with standardized regression weight of (0.661) at the 0.001 level, which requires acceptance of the fifth hypothesis. This result agreed with finding of (Daas, 2019) and (Al-Janabi, 2020).
3) There is positive significance direct impact for (EPE) on (MS) with standardized regression weight of (0.504) at the 0.001 level, which requires acceptance of the sixth hypothesis. This result agreed with (Baves, 2012) and (Abdullah, 2021).
4) There is positive significance direct impact for (QMS) on (MS) with standardized regression weight of (0.255) at the 0.001 level.

5) There is positive significance indirect impact of (0.333) for (QMS) on (MS) through mediating (EPE). This result partial agreed with finding of (Abdelhameed & Abu-Salih, 2022).
6) Total effect (Direct & Indirect) for (QMS) on (MS) equal (0.588), it's clear (EPE) has partial mediator role in the relation between (QMS) & (MS), because both direct, indirect and total effect is significance.
7) Sobel test result: (Z-Test = 4.964481856; P-Value = (0.00000068884697). The mediating effect is supported (accepting the seventh hypothesis).

The main hypothesis of the study:

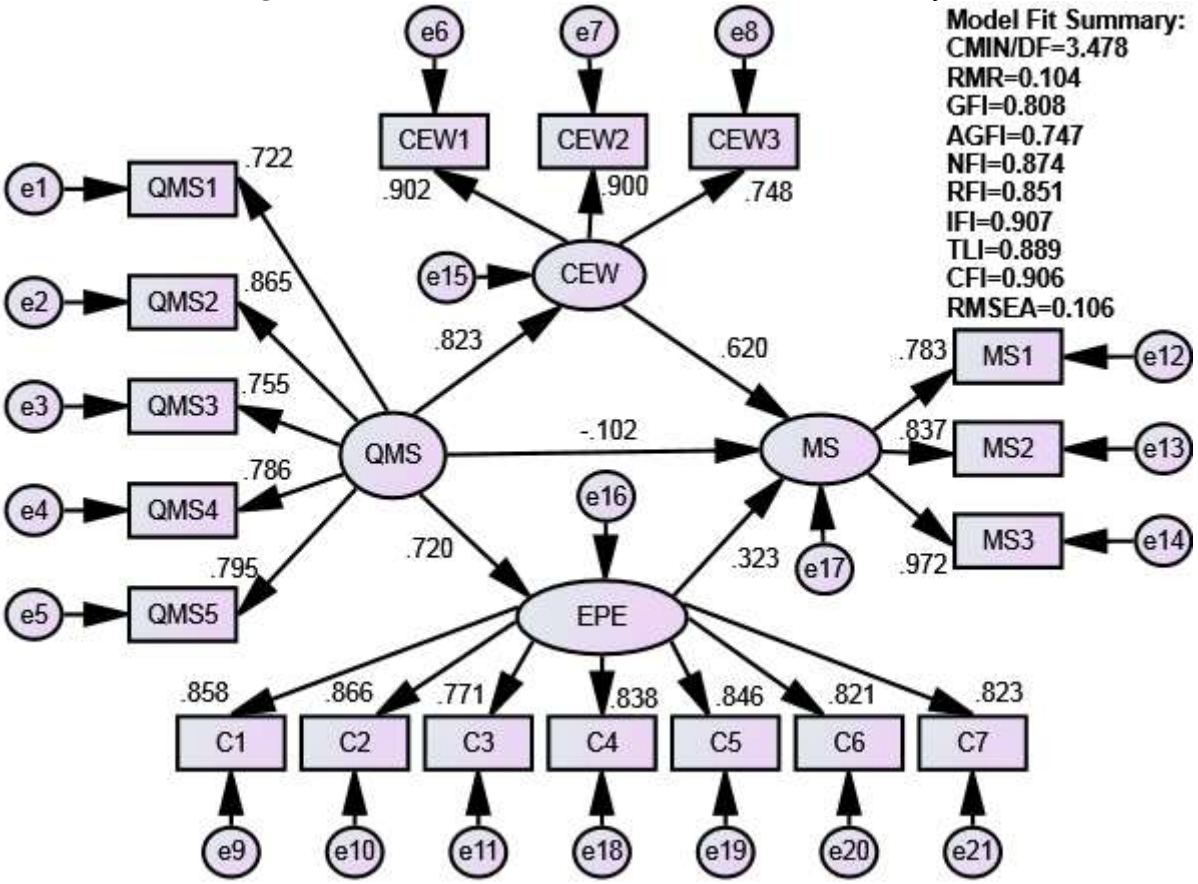
To test main hypothesis of the study, the researcher build structural model between (QMS), (CEW) and (MS), and uses Structural Equation Model analyses (SEM) using Analysis Moment of Structures (AMOS) software to analyze the hypothesized model, also implementing Sobel Test (Sobel, 1986) to checking significance mediating of first mediator variable (CEW) and second mediator variable (EPE) together as in Table (9), Figure (9), and Table (10) below:

Table (9): Direct Effect, Indirect Effect and Total Effect (Standardized)

Independent	Mediator	Dependent	Direct	Indirect	Total
(QMS)	(CEW)	(MS)	-0.102	0.510	-
(QMS)	(EPE)	(MS)		0.233	-
(QMS)	(CEW) & (EPE)	(MS)		0.743	0.641

Source: Field Study Data, 2024, Dongola.

Figure (9): The Main Structural Model of the Study



Source: Field Study Data, 2024, Dongola.

Table (10): Sobel Test

Hypothesis	Independent	Mediator	Dependent	Estimate	S.E.	Z-Test	P-Value
Forth	(QMS)	(CWE)	-	1.041	0.087	4.939783	0.00000078
	-	(CWE)	(MS)	0.461	0.085		
Seventh	(QMS)	(EPE)	-	0.468	0.078	5.060288	0.00000042
	-	(EPE)	(MS)	0.744	0.079		
Main	(QMS)	(CWE) & (EPE)	(MS)	-0.096	0.120	10.000071	0.0000012
				(C.R.= -0.096; P = 0.424)			

Source: Field Study Data, 2024, Dongola.

It is clear from Table (9), Figure (9) and Table (10) these results below:

1) All (CFA) indicators came nearly to Excellent Value and in range of Acceptable Value Except (RMSEA) which equal (0.106), which refer to The Main Structural Model of the Study is good.
2) There is no positive significance direct impact for (QMS) on (MS) with regression weight (C.R) of (-0.096) at the 0.424 level.
3) There is positive significance indirect impact for (QMS) on (MS) through mediating (CEW) & (EPE) together with standardized indirect effect of (0.743).
4) Standardized total effect (Direct & Indirect) for (QMS) on (MS) equal (0.641), it's clear (CEW) & (EPE) has full mediator role in the relationship between (QMS) & (MS), because the direct effect between (QMS) & (MS) isn't significant.
5) Sobel test result: (Z-Test = 10.000071; P-Value = 0.0000012). The mediating effect is supported (accepting the main hypothesis).

Conclusion:

Based on the above analysis and discussion, the conclusion of this study is drown as follows: the importance level of (QMS) is high, the importance level of (EPE), (MS) and (CEW) is moderate, the direct effect between (QMS) and (MS) is statistically significant, the direct effect between (QMS) and (CEW) is statistically significant, the direct effect between (CEW) and (MS) is statistically significant, there is full mediation effect of (CEW) between the relationship of (QMS) and (MS), the direct effect between (QMS) and (EPE) is statistically significant, the direct effect between (EPE) and (MS) is statistically significant, there is partial mediation effect of (EPE) between the relationship of (QMS) and (MS), and finally, there is full mediation effect of (CEW) & (EPE) together between the relationship of (QMS) and (MS).

Contribution:

This study is an attempt to fulfill the research gaps regarding the Influence of (QMS), (CEW) and (EPE) on Sustainability in (MIUD). Results shows show that, estimated structural model corroborated the eight hypotheses, as (QMS) construct explained 58.4% of (MS) (Standardized direct effect = 0.584), Besides, QMS through (CEW) & (EPE) together explained 74.3% of (MS) (Standardized indirect effect = 0.743).

In addition, this study has shed the light on the crucial role of (QMS) on (CEW), (EPE) and (MS). The findings suggest that ethical behaviors should be developed and deployed with employees participation. Moreover, implementing quality management system in the ministry can improve (CEW) to ensure achieving the dimensions and goals of sustainability (EES) in the (MIUD) at The Northern State of Sudan.

Suggestions for Future Studies:

- ✓ Future studies can address this study using other fields of application and compare the results with the current study, which constitutes an addition to the research literature in this field.
- ✓ The current study focused on the mediating role of (CEW) & (EPE) in the relationship between (QMS) and Institution's Sustainability. The mediating role of (CEW) & (EPE) in the relationship between other variables that have not been addressed can be investigated.

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