Al-Furat Journal of Innovations in Management Sciences

ATU- AFJIMS, Volume: XX, Issue: XX,
MMM, DD, YYYY,

The role of strategic performance indicators in enhancing water security governance (an analytical study of the opinions of a sample of leaders in the Ministry of Water Resources)

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Abstract *:The objective of this study was to determine the role of strategic performance indicators (KPIs) in the improvement of water security governance, which is characterized by five dimensions: adaptive governance, multi-level governance, social learning, polycentric governance, and social power. These dimensions include efficiency in water resource management, level of institutional integration, response to water risks, transparency in water decision-making, and effectiveness of investments in the water sector. The study's issue is rooted in a clear gap in the Iraqi Ministry of Water Resources' ability to achieve sound governance of water security, despite the escalating existential challenges, such as climate change and the impact of upstream countries. This raises questions about the pivotal role of these indicators in addressing the issue. The study was conducted on a community and a sample of senior and intermediate management in the ministry, utilizing the descriptive-analytical method. A total of 409 valid questionnaires were utilized.*

The hypotheses were investigated through structural equation modeling, and the data were analyzed using SPSS V.29 and AMOS V.26 software. The results confirmed a statistically significant and extremely strong positive impact of strategic performance indicators on water security governance, with the indicators collectively explaining 64.7% of the variance. The most significant conclusion of the changes in water governance that resulted in the acceptance of the primary alternative hypothesis was that the ministry's effectiveness in resource use and the adoption of rationalization policies and modern technologies are fundamental pillars that contribute to a comprehensive and sustainable improvement in the water security governance system. Based on this, the most critical recommendation is the imperative necessity of investing in advanced technologies to reduce water waste and implement strict consumption rationalization policies. Additionally, institutional coordination should be strengthened and transparency should be improved to ensure sustainable water security.

Keywords: *Strategic performance indicators, water security governance, Iraqi Ministry of Water Resources*

1. INTRODUCTION

Water security in Iraq is confronting a growing existential threat due to the ongoing depletion of finite water resources, heightened consumption driven by population growth and urbanization, and the aggravation of external factors such as climate change and the influence of upstream nations on

the Tigris and Euphrates rivers. All these elements have contributed to the issue. To resolve these problems, the notion of water security governance becomes essential. This principle embodies a framework of procedures that govern decision-making about the management and allocation of water resources in a transparent and accountable manner.

The employment of Key Performance Indicators (KPIs) as a fundamental tool for evaluating and achieving governance objectives is crucial to the success of an organizational governance initiative.

The Iraqi Ministry of Water Resources utilizes performance metrics; yet, there exists a substantial deficiency in the organization's capacity to establish effective control of water resources, which is the fundamental cause of the conflict. Mismanagement, disobedience, and the impacts of climate change are among the internal and external factors that exacerbate this inequality.

The research gap can be highlighted by the existence of general references that address performance indicators and water security governance, but they often lack a specialized analytical framework that directly links these indicators to the perspective of water security governance in the Iraqi context. Your study aims to bridge this gap by providing new knowledge that involves identifying and analyzing the role of specific strategic performance indicators in enhancing effective water security governance, based on the opinions of leaders in the Iraqi Ministry of Water Resources, which has not been examined with such depth and specialization locally before.

Consequently, the paramount inquiry is as follows: What role do strategic performance indicators serve in enhancing the governance of water security within the Iraqi Ministry of Water Resources? Issues concerning policies and procedures originate from this, and the study's significance is generated from two distinct axes:

1. Theoretical significance: bridging the knowledge gap in the Arab library by linking strategic performance indicators with water security governance in the context of Iraq, a sensitive environment. The theoretical importance of Iraq resides in the potential to close the knowledge gap in the Arab library by linking strategic performance indicators with water security governance.

2. The practical implication is that it furnishes decision-makers in the ministry with data grounded in performance indicators and principles of sound governance, so directly contributing to the goal of achieving national sustainable development and ensuring water security. This is practically relevant since it supplies decision-makers in the ministry with data grounded in performance metrics and principles of effective governance. This directly aids in achieving national sustainable development and securing water resources.

- ***Study hypotheses***

The study was based on a set of hypotheses as follows:

The main hypothesis: There is no statistically significant impact of strategic performance indicators on water security governance, from which the following sub-hypotheses branch out:

The first sub-hypothesis: There is no statistically significant impact of the water resource management efficiency indicator on water security governance.

The second sub-hypothesis: There is no significant impact of the institutional integration level indicator on water security governance.

The third sub-hypothesis: There is no significant impact of the water risk response index on water security governance.

The fourth sub-hypothesis: There is no significant impact of the transparency index in water decision-making on water security governance.

Fifth sub-hypothesis: There is no significant impact of the investment efficiency index in the water sector on water security governance.

- ***Hypothetical Study Framework***

The study model is the statistical analytical framework of the subject variables and their dimensions, which explain the statistical correlation and impact relationship and the extent of their effect on the study sample. It includes the following variables:

1. The independent variable (strategic performance indicators): It includes a set of indicators (efficiency in water resource management, level of institutional integration, response to water-related risks, transparency in decision-making, effectiveness of investments in the water sector).
2. The dependent variable (water security governance): It includes a set of dimensions: (adaptive governance, multi-level governance, social learning, polycentric governance, social power). The dependent variable (water security governance): It includes a set of dimensions, which are: (adaptive governance, multi-level governance, social learning, polycentric governance, social power).

As shown in the figure (1)

- ***Study Limits:***

The study was based on a set of boundaries, which are:

A. ***Temporal boundaries*:** This is the period for completing the work of documenting and analyzing the study axes and the procedures of the analytical framework in the researched community, which starts from (22/10/2024) until (30/9/2025), interspersed with the procedures for submitting the thesis to the academic department at the university.

B. ***Spatial boundaries*:** The Ministry of Water Resources in Baghdad Governorate was chosen for purposes related to the study's objectives. Spatial boundaries: The Ministry of Water Resources in (Baghdad Governorate) was chosen for purposes related to the objectives of the study topic.

C. ***The study adopted two variables*:** (the independent variable being strategic performance indicators, the dependent variable being water security governance). Subjective boundaries: The study relied on three variables: (the independent variable, strategic performance indicators, the dependent variable, water security governance,

D. ***Human boundaries*:** They are a group of relevant responsible individuals and the subject of the study who hold leadership positions, whether at the senior leadership level such as deputy and technical and administrative advisors to the minister, general directors in the formations affiliated with the ministry, or at the middle leadership level such as assistants to the general directors, department heads, section heads, and specialized experts in the Ministry of Water Resources, numbering (409) employees out of the total community of (22,300) employees in the ministry. Human boundaries: They are a group of responsible individuals related to and

subject of the study, who hold leadership positions either at the senior leadership level, such as deputy ministers and technical and administrative advisors to the minister, and general directors in the formations affiliated with the ministry, or at the middle leadership level, such as deputy general directors, department heads, section heads, and specialized experts in the Ministry of Water Resources, whose number is (409) employees out of the total community size of (22,300) employees in the ministry.

- The most important research shortcomings revealed by previous studies:

The literature review reveals a number of shortcomings, most notably:

1. The scarcity of studies examining the relationship between water security governance and strategic performance indicators in the context of an Arab governmental environment.
2. The limited research addressing water security governance as an institutional variable measurable using quantitative performance indicators.
3. The absence of models linking institutional excellence and water resources management in Arab ministries, particularly in Iraq.

- The current study's position in relation to previous studies:

My study responds to these gaps, as it seeks to construct a model that combines strategic performance indicators and water security governance within an applied framework within the Iraqi Ministry of Water Resources. This study represents a scientific attempt to explain how a model can be employed to enhance the relationship between institutional performance and water resources governance, thus contributing to bridging the knowledge gap in the Arab literature related to water governance and institutional excellence.

It can be argued that the comparative analysis of previous studies confirms the need for a new research approach that goes beyond traditional descriptive studies, toward an integrative model that links performance, excellence, and governance. The expected scientific contribution of my study is to reformulate the relationship between institutional efficiency and water security, thus enhancing the strategic decision-making system in governmental water institutions. This study also provides an empirical framework that can be generalized to other Arab environments facing similar challenges in water management and good governance.

Methodology

The study adopted the descriptive-analytical approach in explaining and interpreting the scientific concepts related to the variables of the study topic, namely (independent variable: strategic performance indicators) and (dependent variable: water security governance), within the study community (Iraqi Ministry of Water Resources).

- **Reliability of the Scale and the structure of the questionnaire**

For ease of data handling in SPSS and Amos programs, version 26, the coding of the study scale highlights the necessity of ensuring the tool's reliability, meaning its ability to yield consistent

results when applied to the same group at different times. This concept includes the comprehensiveness of the research and the stability of the obtained results. The reliability of the scale is measured by an index ranging from 0 to 1, where higher values reflect a greater level of reliability. Study variables and indicators often use Cronbach's alpha coefficient, with values above 0.70 considered acceptable in administrative and behavioral [1]. According to the tests conducted, all the scales used showed satisfactory results at both the individual and collective levels, as will be shown in the following table.

The results clearly indicate that the Cronbach's alpha values for all dimensions and variables range between 0.796 and 0.962. These values, which exceed the generally accepted standard (0.70), confirm the high reliability of the tool, meaning it provides consistent and stable results if applied again to the same sample under similar conditions.

2. LITERATURE REVIEW .

2.1. Definition of Strategic Performance Indicators (SPIs):

Despite the extensive body of knowledge surrounding the concept of strategic performance indicators, it is difficult to define a comprehensive concept for them due to the diversity of philosophies, approaches, and interests. They are used to assess the extent to which infrastructure contributes to achieving desired societal outcomes. These indicators focus on long-term goals rather than past performance and provide a transparent framework to support strategic decision-making [2]. Therefore, strategic performance indicators are defined as: "A vital tool for directing infrastructure investments toward achieving societal goals, with a focus on environmental, economic, social, and safety dimensions. Research calls for the development of comprehensive indicators that take into account the interconnectedness of sectors to achieve integration and sustainability." Some views agree that they represent an organization's ability to effectively achieve objectives. Despite this general consensus, the methodological and procedural frameworks for the concept are unclear, as goals and objectives vary depending on the organization's strategic orientations, its management's vision, and the dynamics of its environment [3].

Strategic performance indicators are used to assess the extent to which infrastructure contributes to achieving desired societal outcomes. These indicators focus on long-term goals rather than past performance, and provide a transparent framework to support strategic decision-making [2].

2.2. Strategic Performance Indicators:

These are used to assess the extent to which infrastructure contributes to achieving desired societal outcomes.

2.2.1. Water Resources Management Efficiency:

This indicator indicates the effectiveness and efficiency of using available water resources to balance supply and demand and achieve environmental, economic, and social sustainability goals. Water efficiency is one of the pillars of the Sustainable Development Goals (SDG 6.4.1), as studies confirm that inefficient water use threatens environmental and economic security and leads to the depletion of natural resources. [4]

2.2.2. *Institutional Integration Index*:

This indicator measures the ability of institutions and bodies operating in the water sector to coordinate and integrate with each other to ensure efficient governance and reduce institutional fragmentation. Recent literature indicates that institutional integration is based on engaging stakeholders and formulating coherent policies that promote effective water governance [3].

2.2.3. Water Risk Preparedness Index (W-ScaRI)

This index assesses the preparedness of water systems to confront natural hazards such as drought and floods. Modern tools have been developed, such as the Water Scarcity Risk Index (W-ScaRI), which combines elements of risk, fragility, and socio-economic exposure to quantify risks and take proactive measures. [5]

2.2.4. Water Decision-Making Transparency Index (W-DTI)

This index aims to measure the clarity and transparency of decisions related to water resource management and the availability of information to the public and stakeholders. Studies have indicated that digital transformation and e-governance contribute to enhancing transparency by enabling access to data and facilitating its sharing. [6]

2.2.5. Water Sector Investment Effectiveness (W-SCI)

This index relates to the effectiveness of investments directed to the water sector in achieving economic and social returns and reducing future risks. Studies confirm that investments in water infrastructure contribute to enhancing the ability to adapt to climate change and achieving water security. [7]

These indicators focus on long-term goals rather than past performance, and provide a transparent framework to support decision-making.

Strategic performance indicators are a vital tool for guiding infrastructure investments toward achieving societal goals, with a focus on environmental, economic, social, and safety dimensions. Research calls for the development of comprehensive indicators that consider the interconnectedness of sectors to achieve integration and sustainability. They aim to:

4. Link performance to outcomes: Demonstrate the extent to which systems are able to achieve the desired societal benefits.
5. Analyze performance across sectors: Instead of assessing performance within a single sector alone, they are used to assess integrated performance across sectors.
6. Foresight: Designing Indicators in Line with Future Challenges [2]

2.3. Defining Water Security Governance

After reviewing the concept of governance in general, it became necessary to define water security as: "An acceptable level of water-related risks affecting people and ecosystems, coupled with the availability of sufficient water in quantity and quality to support livelihoods, national security, human health, and ecosystem services. Water security requires a focus on adapting to water-related risks and changes to achieve a balance between human and environmental needs." [8] Water security was also defined as: "The ability of societies to ensure sustainable access to sufficient quantities of water of acceptable quality to meet basic life needs, support social and economic development, protect ecosystems, and address climate challenges such as floods, drought, and pollution." [9] Water security today depends on ensuring the availability of water resources for important uses, whether agricultural, industrial, technical, etc., in a manner commensurate with the size of these current and future uses and in a sustainable manner. This means that water security is: ensuring the availability of the required quantities of water, both qualitatively and quantitatively, in a manner that meets the needs of the population, on a continuous basis, for drinking purposes. And various uses, industrial growth, agricultural production and environmental balance, or it is “a set of procedures and measures that official and unofficial bodies rely on, and the concept of water security is linked to two variables, the first of which is the variableThe first is (security) and the

second is (water). Water security, development, and stability are achieved when water is available in a manner that meets society's needs [10].

2.4. Dimensions of Water Security Governance

2.4.1. ***Adaptive Governance*****:** This approach relies on social coordination networks that bring together individuals and institutions at multiple organizational levels, with an emphasis on flexibility and shared learning in management. It encourages cooperation and the learning of new approaches to water resource management. It relies on flexible networks of individuals and institutions that work to adapt to ongoing climate change and water-related risks [11].

2.4.2. ***Multi-Level Governance*****:** This approach focuses on future direction and sustainability. It includes negotiations between institutions at the global, national, regional, and local levels, and enhances coordination between governance processes at these different levels, with an emphasis on non-hierarchical interactions between these levels. It includes coordination between the local, national, and transboundary levels to achieve administrative integration. This dimension focuses on the consistent implementation of policies to achieve sustainable goals [12].

2.4.3. ***Social Learning:*** An iterative, exploratory process based on "learning by doing," where stakeholders share their experiences to solve complex issues. Iterative learning by doing, where stakeholders contribute their experiences and observations to find solutions to complex water challenges [9].

2.4.4. ***Polycentric Governance*****:** Involves multiple independent centers and actors in decision-making, enhancing the system's ability to respond to change and increasing resilience. It emphasizes the sustainability of water resources for future generations, taking into account long-term climate impacts and adaptive policies [9].

2.4.5. ***Social Power:*** Also known as social and political diversity, it is an important dimension in water security discussions, as it addresses the impact of social and political power on the distribution of water resources and the management of conflicts between users and different interests. It discusses how social and political power influences the distribution of water resources and the resolution of conflicts between different parties and interests. [8] This dimension addresses social and political inequalities in water resources management, where direct and indirect impacts on communities are dealt with in a balanced manner [11].

3. "MATERIALS AND METHODS"

3.1. MATERIALS

In this study, the researcher employed descriptive-analytical methods to gather variable data. He used proper instruments and approaches. The researcher reviewed master's and doctorate theses, research, books, magazines, and online resources to create the study's theoretical framework. The researcher relied on a questionnaire to test the study's hypotheses and realistically fulfill its goals. After several expert sector referees reviewed it, this was completed. The survey has 50 paragraphs. Twenty-five pages discuss strategic performance indicators and twenty-five paragraphs address water security governance. As indicated, the researcher interviewed some of the ministry's administrative leaders during his field visit. By verifying data and highlighting flaws, this made the questionnaire more valuable in real life. The researcher used statistical analysis to get accurate, dependable data for the study. The researcher analyzed questionnaire data in SPSS 29.

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3.2. METHODS

The researcher identified the target population as the administrative and technical leaders at all levels in the studied ministry, as detailed in the table below, considering them the most suitable individuals for the study variables and directly related to the study's problem and objectives. Their number exceeded 22,300 individuals.
In order to determine the appropriate sample size, the following equation was used, as mentioned by Steven K. Thompson[13] for determining the sample size

$$n = \frac{N \times p(1-p)}{[[N-1 \times (d^2 \div z^2)] + p(1-p)]} \quad (1)$$

p=	**Property availability and neutrality ratio = 0.50**
d=	**Error ratio = 0.05**
z=	**Standard score corresponding to a significance level of 0.95 = 1.96**
N =	**Population size**

Based on it, the optimal sample size was found to be at least 278 managers. Accordingly, the researcher decided to choose a larger sample than the optimal number to ensure broader coverage of administrative leaders and better representation of the study population. The number of questionnaires valid for statistical analysis exceeded the required amount, which enhances the reliability of the results and their research value. Therefore, (420) questionnaires were distributed to a simple random sample, and after (409) questionnaires were retrieved, it was found that the number of questionnaires valid for statistical analysis reached (409), which is greater than the required number, to represent the community well with a response rate of (97.4%).

3. RESULTS AND DISCUSSION

3.1. RESULTS

3-1-1- ***Descriptive Analysis of Study Variables***

This section focuses on describing the study results by reviewing the opinions and preferences of employees (in the studied ministry) from the study sample of (409) respondents, and determining the level of agreement on the suitability of the measurement tool items towards them by focusing on descriptive statistical analyses represented by (mean, standard deviation, relative importance, coefficient of variation, and response level and direction) for each item of the variables under study, which are represented in:
The ranking and preference of the indicators were interpreted based on the highest relative importance, which indicates the highest level of agreement among the sample members that the studied ministry gives significant attention to this dimension.
As for the standard deviation of less than 1, it indicates a significant convergence of responses around the mean, meaning that most participants agree on almost the same point on the scale. This indicates a high degree of homogeneity or agreement in the opinions of the participants regarding this dimension, according to Tabachnick & Fidell [14].

3-1-1-1- ***Descriptive analysis of the variable of strategic performance indicators***

The overall results, as shown in Table (2) for the variable of strategic performance indicators, indicate that it achieved an average of (3.85) and a standard deviation of (0.834), with a relative importance of (77.1%). This indicates that the level of interest of the studied ministry in strategic performance indicators was high. As for the indicators, the results were as follows:

7. Water risk response: It ranked first with an average of (3.98), a standard deviation of (0.847), and a relative importance of (79.5%).
8. Institutional integration level: It ranked second with an average of (3.92), a standard deviation of (0.785), and a relative importance of (78.5%).
9. Efficiency of water resource management: It ranked third with an average of (3.88), a standard deviation of (0.849), and a relative importance of (77.5%).
10. The effectiveness of investments in the water sector: It ranked fourth with an average of (3.85), a standard deviation of (0.814), and a relative importance of (77.1%).
11. Transparency in water decision-making: It ranked fifth and last with an average of (3.64), a standard deviation of (0.877), and a relative importance of (72.9%).

3.1.1.2. Descriptive Analysis of the water security governanceVariable

The overall results, as shown in Table (3), for the variable of water security governance, indicate that it achieved an average of (3.87) and a standard deviation of (0.825), with a relative importance of (77.3%). This indicates that the level of availability of strategic performance indicators in the ministry was high. As for the dimensions, the results were as follows:

12. Social learning: It ranked first with an average of (3.95), a standard deviation of (0.789), and a relative importance of (78.9%).
13. Multi-level governance: It came in second place with an average of (3.93), a standard deviation of (0.765), and a relative importance of (78.6%).
14. Adaptive governance: It ranked third with an average of (3.92), a standard deviation of (0.854), and a relative importance of (78.4%).
15. Polycentric governance: It ranked fourth with an average of (3.78), a standard deviation of (0.788), and a relative importance of (75.6%).
16. Social power: It ranked fifth and last with an average of (3.75), a standard deviation of (0.928), and a relative importance of (75.0%).

3-1-2- Testing the main hypothesis:

3-1-2-1- Analysis of the correlation between strategic performance indicators and water security governance

The results of the correlation analysis, as shown in Table (4) using the Pearson correlation coefficient (R), confirm the existence of a strong positive correlation with high statistical significance between all five dimensions of the strategic performance indicators and water security governance. This indicates that improving the performance of these indicators is closely and directly related to enhancing the level of governance in water resource management at the ministry. The alternative hypotheses for all dimensions were supported, as the significance levels (Sig.) For all dimensions and the total variable, 0.001 or 0.000, which are much lower than the standard significance level (0.01).

Considering the overall variable, the correlation coefficient between strategic performance indicators and water security governance was R=0.804, a value that indicates a very strong and significant relationship, confirming the inevitable connection between effective strategic planning and water governance objectives.

In detail, the strength of the correlation between the sub-dimensions and water security governance can be arranged as follows:

1. The effectiveness of investments in the water sector: It recorded the highest correlation coefficient (R=0.728), confirming that efficiency and transparency in directing spending and investments are the strongest and most decisive indicators in supporting the principles of water governance.
2. Transparency in water decision-making: It ranked second with a correlation coefficient (R=0.703), indicating that disclosure and clarity in water decisions are essential factors for enhancing polycentric governance and social power. Transparency in water decision-making: It ranked second with a correlation strength of (R=0.703), indicating that disclosure and clarity in water decisions are essential factors for enhancing polycentric governance and social power.
3. Water risk response: It achieved a strong correlation (R=0.684), indicating that the system's resilience and speed in dealing with environmental and climatic challenges (such as drought and flooding) are a fundamental pillar of adaptive governance. Response to water risks: It achieved a strong correlation (R=0.684), indicating that the system's resilience and speed in dealing with environmental and climatic challenges (such as drought and flooding) are a fundamental pillar of adaptive governance.
4. Institutional integration level: A strong correlation coefficient of (R=0.652) was recorded, confirming that horizontal and vertical coordination between the ministry's departments and formations is not just an administrative efficiency, but a prerequisite for the success of multi-level governance. Institutional integration level: A strong correlation coefficient of (R=0.652) was recorded, confirming that horizontal and vertical coordination between the ministry's departments and formations is not just an administrative efficiency, but a prerequisite for the success of multi-level governance.
5. Efficiency of water resource management: A correlation strength of (R=0.647) was recorded, which is a strong correlation confirming that achieving efficiency in usage and operation forms the foundation upon which all other dimensions of water governance are built. Efficiency of water resource management: A correlation strength of (R=0.647) was recorded, which is a strong correlation confirming that achieving efficiency in usage and operation forms the foundation upon which all other dimensions of water governance are built.

In all cases, the calculated T-test values exceeded the tabulated value of 1.960, which supports the significance of these strong relationships and confirms that all these indicators play a tangible role in supporting and enhancing water security governance.

3-1-3- Impact Hypotheses

The direct impact analysis was conducted as shown in Table (5) and Figure (2) between strategic performance indicators as an independent variable and water security governance as a dependent variable using Structural Equation Modeling (SEM) through the AMOS.V.26 software. The analysis results confirmed the model's validity and reliability by exceeding the required fit quality standards, with a Goodness of Fit Index (GFI) value of (1.00), a Chi-square to degrees of freedom ratio of (2.281), and a Root Mean Square Error of Approximation (RMSEA) of (0.073).

Impact results:
The results showed a statistically significant and very strong positive impact of strategic performance indicators on water security governance, as follows:

1. The strength of the impact: The value of the standardized regression coefficient (β) reached 0.779. This means that an increase in strategic performance indicators by one unit will lead to a 77.9% increase in water security governance. It is a very high impact rate.
2. Statistical significance: The calculated (t) value (or critical value C.R.) For the variable of strategic indicators, the calculated (or critical C.R.) value was greater than the tabulated value (1.96), confirming the significance of this effect and its statistical acceptance.
3. The explanatory power (R2): The strategic performance indicators were able to explain up to 64.7% of the changes occurring in water governance. Explanatory power (R2): The strategic performance indicators were able to explain up to 64.7% of the changes occurring in water security governance. This indicates that the strategic indicators are the main and most effective driver in determining the level of water governance within the ministry.
4. Decision: Based on these results, the alternative hypothesis is accepted, which states that there is a significant impact between strategic performance indicators in water security governance. This indicates that the institutional performance measured by these indicators plays a crucial and direct role in enhancing the principles of water governance.

"And from the main hypothesis, the following sub-hypotheses emerge":

"To prove these hypotheses, a structural model was built as shown in Table (6) and Figure (3), which illustrate the nature of the relationship between strategic performance indicators and water security governance. The table and figure below show the reliability and validity of the model, based on fit quality criteria that exceeded the required indicators, according to: [15]."

The value of the Goodness of Fit Index (GFI) is (1.00), and the ratio of the chi-square to degrees of freedom reached (3.863). The Root Mean Square Error of Approximation (RMSEA) was (0.074), and the factor loadings exceeded (0.40), reflecting a high degree of fit. It indicates that the model is significant based on the calculated (F) value of (261.178), which appeared to be significant and greater than its tabulated value of (3.86).

The results showed a variation in the strength of the impact of each indicator individually, with the values of the standardized regression coefficient (β) ranging between 0.159 and 0.476. The strength of the impact comes in the following order:

1. The effectiveness of investments in the water sector (β=0.476): This indicator recorded the strongest impact, as its value indicates that an increase in investment effectiveness by one unit leads to a 47.6% increase in water security governance. This confirms that linking water projects to economic feasibility standards and financial performance indicators is the most decisive factor in supporting governance.
2. Transparency in water decision-making (β=0.452): It represents the second strongest influence, with a 45.2% increase in governance for each unit increase in transparency. Transparency in water decision-making (β=0.452): It represents the second strongest influence, with a 45.2% increase in governance for each unit increase in transparency. This highlights the utmost importance of disseminating reports and involving stakeholders in the formulation of water-related decisions.

3. Water resource management efficiency (β=0.222): This indicator has a strong and positive impact, with a 22.2% increase in governance for each unit increase in efficiency. This indicates that the use of advanced technologies to rationalize consumption and reduce waste directly supports the improvement of governance.
4. Water risk response (β=0.192): This indicator contributes to enhancing governance by an increase of 19.2%, confirming that the ministry's readiness and emergency plans to deal with flood and drought crises are the foundation of adaptive governance resilience.
5. Institutional integration level (β=0.159): It shows a significant impact with an increase of 15.9% in governance. Institutional integration level (β=0.159): It shows a significant impact with an increase of 15.9% in governance. It indicates that effective coordination and data sharing among different governmental formations are essential for the success of multi-level governance.
6. It is worth noting that the constant (α=0.354) indicates that there is a baseline level of water security governance attributable to factors beyond these five indicators, such as laws and general regulatory conditions. In general, all calculated T-test results (which exceeded the tabulated value of 1.96) confirm the strong statistical significance of this positive impact of strategic performance indicators in advancing water security governance.

3.2. DISCUSSION

"A study conducted on the Iraqi Ministry of Water Resources revealed significant interest among administrative leaders in strategic performance indicators (SPIs) and water performance governance. This is evident in the high arithmetic averages and consistent levels of alignment among leaders. Creativity, innovation, and leadership engagement were among the most important factors. The results show that SPIs have a very strong direct relationship and a statistically significant impact on improving water performance governance".

5. CONCLUSIONS AND RECOMMENDATIONS

In this paragraph, a series of conclusions reached by the researcher through the practical framework of the study will be mentioned in light of the results obtained through the analysis of data and information according to the statistical methods used. These conclusions can be summarized in the following points: -

- The responses showed that the attention to both strategic performance indicators (with their five components) and the components of water security governance (such as adaptive and multi-level governance) is characterized by a high level but is close to average. This indicates that the ministry has an awareness and initial application of these concepts, but it is not at the required level to achieve full efficiency or sustainability. Although this availability is a positive indicator, it confirms the need to enhance and intensify efforts to elevate these components above the average threshold.
- The results have proven a positive and significant correlation between strategic performance indicators and water security governance. This clearly means that any increase in attention and application of the strategic performance components in the ministry directly leads to a corresponding and tangible rise in the level of water security governance.
- The results revealed a positive and statistically significant impact of water resource management efficiency on water security governance. This concludes that increasing the

ministry's efficiency in resource utilization, adopting rationalization policies, and using modern technologies are fundamental pillars that lead to a comprehensive and sustainable improvement in the water security governance system.

Recommendations

After reaching a set of conclusions, recommendations related to the study variables will be developed.

- Using new technologies and strict rules to make management more effective: This suggestion is in line with what (name a prior study about waste and technology) said about how important it is to invest in new technologies to cut down on waste and make rigorous rules for how to use them. The findings of our study, which emphasized the inadequate performance indicators in usage efficiency, indicate that the primary variation stems from the need to tailor these technologies, such as smart monitoring systems, to the unique characteristics of the Iraqi distribution networks, a factor that general studies have not thoroughly examined. Impact: This makes sure that supply and demand stay in balance over the long term by changing strategic indicators from just assessing the amount of loss to monitoring how well investments are made to reduce it.

- Improving institutional integration to bring together different administrative visions: The study's recommendations to improve coordination and cooperation with other government agencies (by setting up joint committees and making data exchange protocols work) are in line with the suggestions of (insert the name of a previous study on inter-agency coordination) to make sure that water policies are carried out properly. However, our findings indicate that the inadequacy of strategic performance measures in the Iraqi context arises especially from the lack of consensus on cross-ministerial performance indicators to assess the degree of coordination, rather than merely from the absence of committees. Impact: This means that "integration performance indicators" need to be created to make sure that the move from formal collaboration to the real unified implementation of water security regulations goes well.

- Enhancing crisis readiness by associating plans with reaction metrics: The need for regular drills and updates to emergency plans is a general path that agrees with what was said in (name of a previous study on water risk management). But our study shows a big problem: the present emergency plans don't include strategic performance indicators to monitor how ready the infrastructure is (such preventive maintenance) and how quickly the reaction is after the disaster. Impact: The Ministry of Water Resources needs to come up with performance measures for preparation and recovery, like response time and the proportion of essential infrastructure that is ready. This will help them respond to risks better and go beyond just theoretical training.

- Linking performance metrics to public accountability to make things more open: The necessity for thorough reporting and stakeholder involvement corresponds with the overarching concepts of water governance promoted by (insert the name of an international publication or organization). The study shows a big difference: in Iraq, being open requires more than just publishing information. It also requires connecting the announced strategic performance indicators to clear accountability mechanisms that let civil society look at options and make decisions based on how

well projects are actually doing, not just what they say they will do. This builds more trust in the government and makes sure that its priorities are in line with the demands of the community.

- This recommendation stresses the importance of getting the most out of the budget, which is in line with the economic principles of resource management that were mentioned (a previous study on the economic feasibility of water projects is referenced). The findings of our study indicated that the most significant deficiency is the lack of a systematic connection between the strategic performance indicators for water security (e.g., water quality) and financial objectives (e.g., project budgets). Impact: Performance metrics should be explicitly matched with the economic feasibility requirements to transition from merely tracking achievement rates to ensuring that every dinar spent contributes measurably and tangibly to strengthening water security.

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Figure and tables

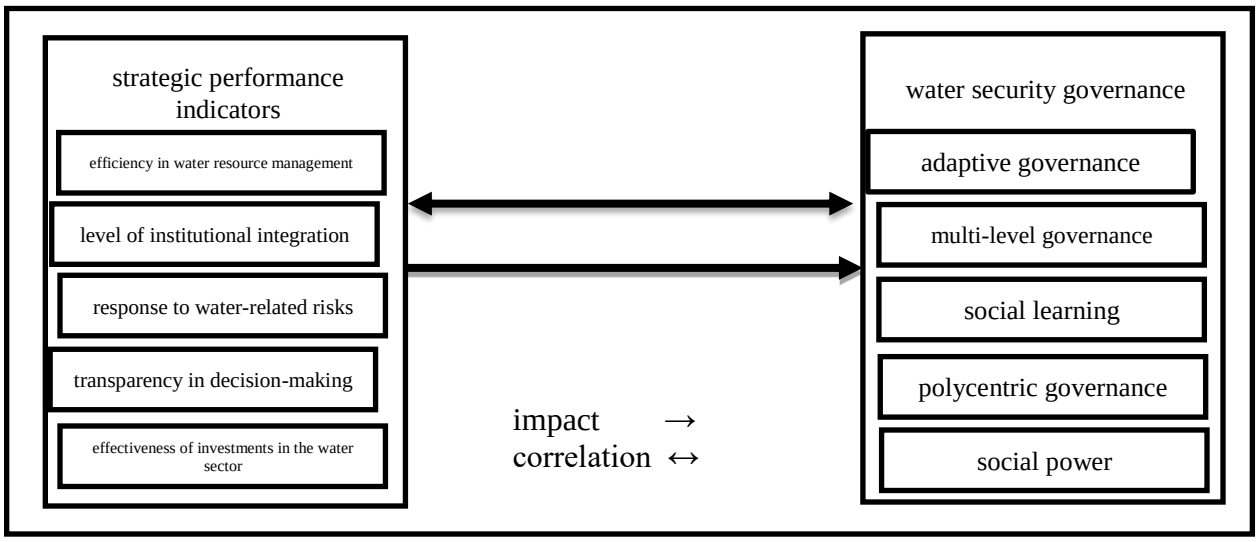

Figure (1) Hypothetical Study Plan
Source: "prepared by the researcher" based on sources and literature"

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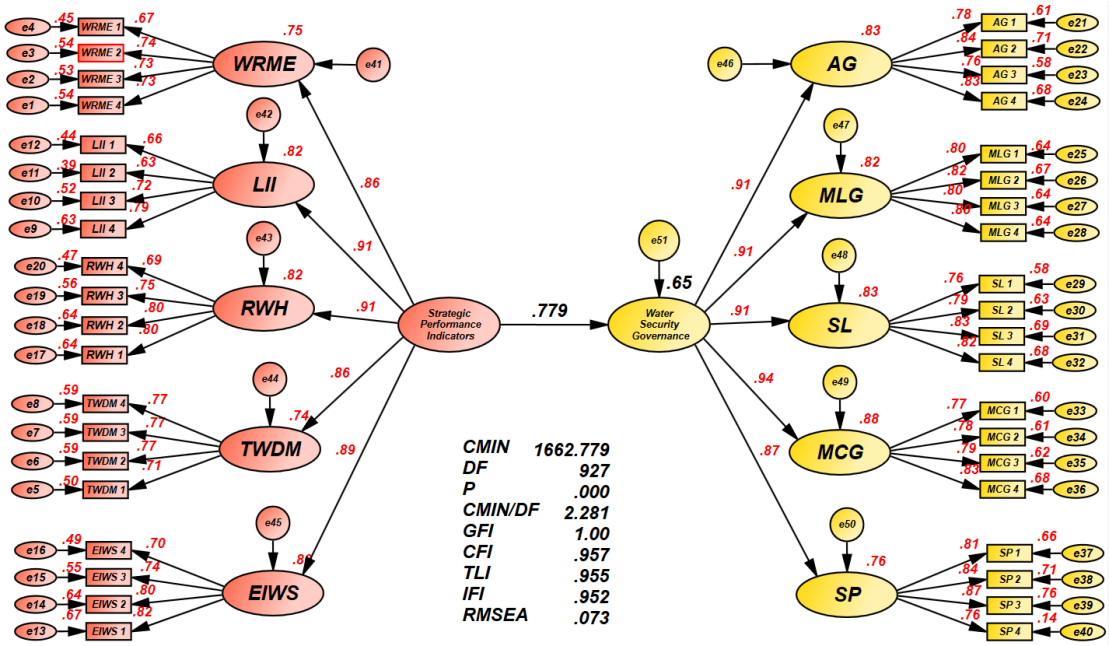

Figure (2) Impact analysis between strategic performance indicators in water security governance "Source: Prepared by the researcher based on the outputs of the statistical package "AMOS.V.26".

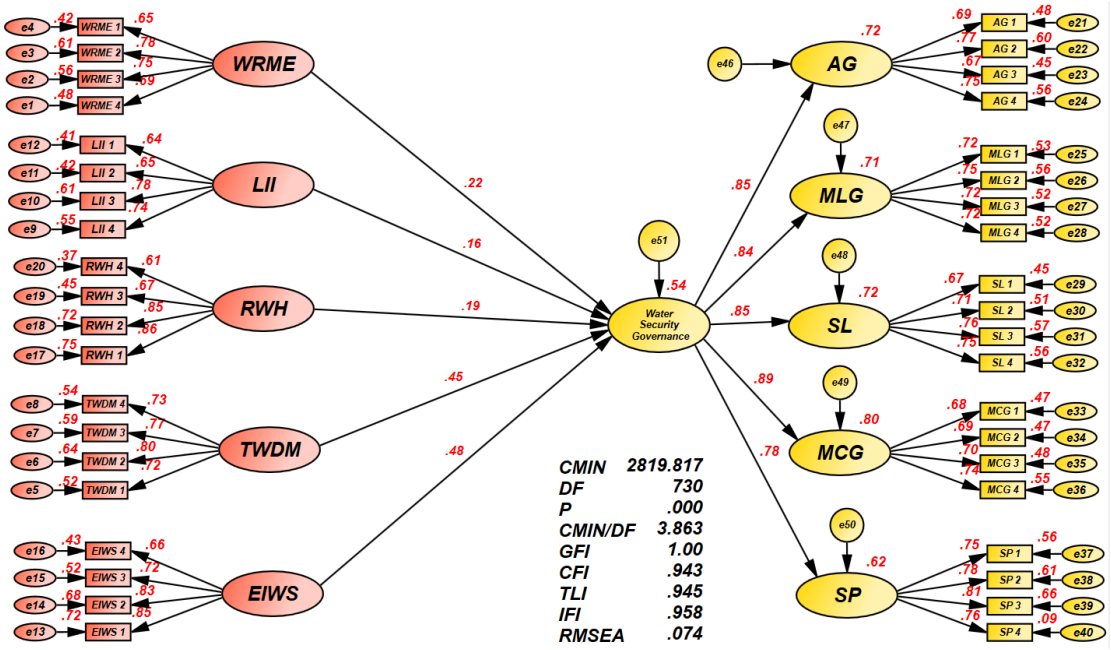

Figure (3) Impact analysis between strategic performance indicators in water security governance "Source: Prepared by the researcher based on the outputs of the statistical package "AMOS.V.26".

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Table (1) shows the reliability coefficient for each dimension and main variable:.

Variable	Dimension	Cronbach's alpha value	The symbol	(Cronbach's alpha) for the variable
strategic performance indicators	Efficiency of water resource management	0.808	WRME	0.821
	Level of institutional integration	0.796	LII	
	Response to water risks	0.841	RWH	
	Transparency in water decision-making	0.842	TWDM	
	Effectiveness of water sector investments	0.850	EIWS	
water security governance	Adaptive governance	0.877	AG	0.853
	Multi-level governance	0.881	MLG	
	Social learning	0.877	SL	
	Polycentric governance	0.870	MCG	
	Social power	0.804	SP	

Source: "prepared by the researcher".

Table (2) Summary of descriptive indicators for the dimensions of the Strategic Performance Indicators

	Strategic Performance Indicators	Arithmetic mean	Standard Deviation	Answer direction	Relative importance	Answer Level	Sequence
1	Water Resources Management Efficiency	3.88	0.849	Agreed	77.5%	High	3
2	Level of Institutional Integration	3.92	0.785	Agreed	78.5%	High	2
3	Response to Water Risks	3.98	0.847	Agreed	79.5%	High	1
4	Transparency in Water Decision-Making	3.64	0.877	Agreed	72.9%	High	5
5	Effectiveness of Investments in the Water Sector	3.85	0.814	Agreed	77.1%	High	4
Strategic Performance Indicators Variable		3.85	0.834	Agreed	77.1%	High	

"Source: SPSS V.29 output"

Table (3) "Summary of descriptive" indicators for the dimensions of the Water Security Governance variable

ت	Water Security Governance Variable Indicators	Arithmetic mean	Standard Deviation	Answer direction	Relative importance	Answer Level	Sequence
1	Adaptive Governance	3.92	0.854	Agreed	78.4%	High	3
2	Multi-Level Governance	3.93	0.765	Agreed	78.6%	High	2
3	Social Learning	3.95	0.789	Agreed	78.9%	High	1
4	Polycentric Governance	3.78	0.788	Agreed	75.6%	High	4
5	Social Power	3.75	0.928	Agreed	75.0%	High	5

Water Security Governance Variable	3.87	0.825	Agreed	77.3%	High	

Table (4) Correlation values between the variable of strategic performance indicators and water security governance.

	Strategic Performance Indicators	Correlation coefficient value and significance level		The intensity of the relationship .	Computed T-test	Direction of the relationship	Decision
Water Security Governance	Water Resources Management Efficiency	R	0.647**	Strong	5.003	Positively proportional	Accept the alternative hypothesis
		Sig.	.001				
	Level of Institutional Integration	R	0.652**	Strong	5.890	Positively proportional	Accept the alternative hypothesis
		Sig.	.001				
	Response to Water Risks	R	0.684**	Strong	6.144	Positively proportional	Accept the alternative hypothesis
		Sig.	.000				
	Transparency in Water Decision-Making	R	0.703**	Strong	6.543	Positively proportional	Accept the alternative hypothesis
		Sig.	.000				
	Effectiveness of Water Sector Investments	R	0.728**	Strong	7.207	Positively proportional	Accept the alternative hypothesis
		Sig.	.000				
	Strategic Performance Indicators	R	0.804**	very strong	7.865	Positively proportional	Accept the alternative hypothesis
		Sig.	.000				
Number of accepted hypotheses		6		**. Correlation is Significant at the 0.01 level (2-tailed) Table value of (T) = (1.962)			
Percentage		100%					

"Source: Researcher based on the outputs of the statistical program (SPSS V.29)"

Table (5) Regression model between strategic performance indicators and water security governance

	Independent Variable	α	B	(t)	F Calculated	R Square	Sig
water security gove	strategic performance indicators	0.469	0.779	3.737	744.785	0.647	0.000
	(F) Tabular	3.86					
	(t) Tabular	1.96					
	Sample Size	409					

rn an ce	Decision	Accept the hypothesis

"Source: Researcher based on the outputs of the statistical program (SPSS V.29)"

Table (6) Analysis of the impact of strategic performance indicators on water security governance

Indicator	strategic performance indicators					dependent variable
	Water Resources Management Efficiency	Level of Institutional Integration	Response to Water Risks	Transparency in Water Decision-Making	Effectiveness of Water Sector Investments	
(α)	0.354					
(β)	0.222	0.159	0.192	0.452	0.476	
(R2)	64.7%					
(t)	3.126	3.012	4.104	4.432	5.322	
P	0.000	0.000	0.000	0.000	0.000	
Extracted F	261.178					
Tabled (F)	3.86					
Tabled (t)	1.96					
Sample Size	409					
Decision	Accept the alternative hypothesis	Accept the alternative hypothesis	Accept the alternative hypothesis	Accept the alternative hypothesis	Accept the alternative hypothesis	

"Source: Prepared by the researcher based on the outputs of the statistical package "AMOS.V.26".