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Green intellectual capital and its role in achieving sustainable quality: A survey study of a sample of employees in health departments/Baghdad

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Abstract
The study aims to verify the role played by green intellectual capital with its dimensions (green hu-man capital, green relational capital, green structural capital) in sustainable quality. The study at-tempts to answer the questions that express the problem of the study, including whether the admin-istration in the Health departments/Baghdad. In Baghdad is aware of the impact of green intellectual capital on sustainable quality. The study relied on the descriptive analytical approach and the ques-tionnaire was used as a measure of its variables. The relationship between them was tested by se-lecting a purposive sample of (90) employees in the Iraqi Health departments/Baghdad. Some statis-tical methods were used for the two ready-made programs (AOMS.V.25, 25. SPSS v). The results of the study showed a correlation and a statistically significant effect between (green intellectual capi-tal and sustainable quality). The results indicated that green intellectual capital had an effect and its dimensions (green human capital, relational capital, structural capital) in achieving sustainable qual-ity. The study's most important recommendations focused on the decisive need for institutions to grow green intellectual capital through: comprehensive environmental education and training pro-grams, and the implementation of sustainable quality practices to enhance economic efficiency while reducing the environmental impact.

Keywords: Green intellectual capital, sustainable quality, health departments/Baghdad.

1. Introduction
Amid rapid environmental and societal changes, organizations face a significant challenge in balancing economic efficiency and environmental sustainability. To achieve this balance, the concept of Green Intellectual Capital has emerged as a vital tool for developing innovative strategies that preserve natural resources and enhance institutional performance. Green Intellectual Capital is not merely a theoretical concept but a practical pillar that supports organizations in achieving sustainable quality objectives. It focuses on utilizing environmental knowledge and expertise to improve processes, reduce waste, and increase the value of products and services. In a world witnessing a swift shift toward sustainable development, Green Intellectual Capital (GIC) has become one of the key tools for promoting sustainable quality. This concept integrates knowledge and innovation aimed at achieving a balance between economic progress and environmental protection. It serves as a fundamental foundation for transforming organizations into eco-friendly entities that rely on the principles of sustainable innovation and environmental efficiency. In light of the above, this research focuses on analyzing the role of financial information technology in enhancing green intellectual capital in Iraq within the knowledge economy, highlighting its impact on sustainable quality. To achieve the research objectives, the research was organized according to the following structure: The first axis included the research methodology, while the second axis dealt with the theoretical framework, the third axis was devoted to the applied aspects, and finally, the fourth axis presented the results and recommendations extracted.

First Topic: Methodological Framework
1. Research Problem
Given the increasing demands for sustainable quality and environmental innovation, organizations face significant challenges in achieving these goals while maintaining their

competitiveness in dynamic markets. Green intellectual capital including knowledge, expertise, and relationships is a pivotal factor in enabling these organizations to meet these challenges and enhance their sustainable quality. However, current studies demonstrate a clear shortcoming in exploring the mechanisms for utilizing this green intellectual capital to achieve sustainable quality, especially in light of practical challenges such as a lack of environmental awareness, weak green strategies, and a lack of adoption of environmental innovation methodologies. From this perception,

Hence, most of the Iraqi ministries, including the Health departments/Baghdad. in Baghdad Governorate, have resorted to stimulating green intellectual capital because it is an important tool for achieving sustainable quality due to its important role in the stability of the country's economy. The problem of the study lies in the existence of a gap to measure the extent of the impact of green intellectual capital in achieving sustainable quality. During the current study, to fill this gap through the study problem, questions are formulated according to the following: How can organizations employ green intellectual capital to achieve sustainable quality in the organization under study?

1. To what extent are employees in the ministry under study possessing green intellectual capital?
2. What is the level of management's interest in empowering Iraqi women working in the ministry under study?
3. What is the relationship between green intellectual capital and sustainable quality in the ministry under study?
4. Does green intellectual capital influence sustainable quality in the ministry under study?

2. The importance of the Research

This study seeks to deepen the scientific understanding of the interrelationship between green intellectual capital and sustainable quality requirements. It highlights how this type of capital can form a fundamental pillar for building an organizational system that supports sustainability principles. It also analyzes ways to develop green innovation capabilities among human resources, contributing to the adoption of innovative practical solutions that mitigate negative environmental impacts. The scientific importance of this research lies in its contribution to the field of studies that address the interaction between green intellectual capital and sustainable quality standards.

3. Research Objectives

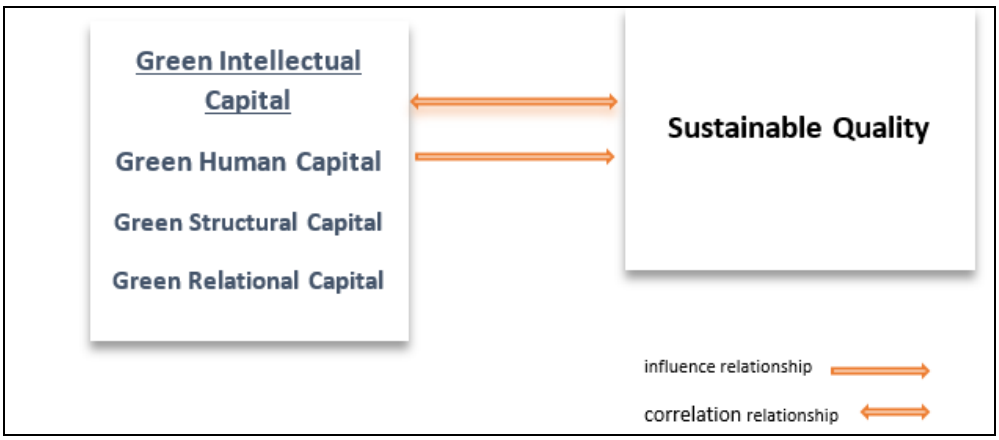
The current study seeks to achieve a set of main objectives, including:

1. Diagnose the level of availability of green intellectual capital in the Health departments/Baghdad..
2. Clarify the level of availability of sustainable quality in the Health departments/Baghdad..
3. Analyze the impact of green intellectual capital on sustainable quality.
4. Present a set of proposals based on the study results that will develop the study variables.

4. Research Community and Sample

A selected sample of health departments in Baghdad (Karkh Department, Rusafa Department) was chosen as the research area. A purposive sample of (90) employees was selected from the total population

5. The Hypothetical Framework of the Research



Source: elaborated by the author

Fig 1: Research model

Correlation & Regression Analysis

Through the questionnaire consisting of two interlocutors, we will analyze the correlation between the results of the questionnaire and the regression analysis to measure the impact of (Green Intellectual Capital), as an independent variable, on the dependent variable (sustainable Quality), according to the hypotheses:

1. The first main hypothesis (H1) states, "There is a significant correlation between green intellectual capital and sustainable quality." The following sub-hypotheses branch out from it:

- The first sub-hypothesis states, "There is a significant correlation between green human capital and sustainable quality."
- The first sub-hypothesis states, "There is a significant correlation between green structural capital and sustainable quality."
- The first sub-hypothesis states, "There is a significant correlation between green relational capital and sustainable quality."

2. The second main hypothesis (H2) states, "There is a significant effect of green intellectual capital on achieving sustainable quality." The following sub-hypotheses branch out from it:

- The first sub-hypothesis states, "There is a significant effect of green human capital on sustainable quality."
- The first sub-hypothesis states, "There is a significant effect of green structural capital on sustainable quality."
- The first sub-hypothesis states, "There is a significant effect of green relational capital on sustainable quality."

According to the equation:

Y: Sustainable Quality

X_1: Green Relationship Capital

X_2: Green Structural Capital

X_3: Green Human Capital

$$\hat{Y} = \beta_0 + \beta_1 X_i$$

Table (1) shows the correlation between the independent variable and the dependent variable, since the value of the correlation coefficient (0.774**) was positive at a significant level (0.000)

Table 1: Correlation Matrix

Correlations					
		Sustainable Quality	**Green Relationship Capital**	**Green Structural Capital**	**Green Human Capital**
Sustainable Quality	Pearson Correlation	1	0.774**	0.797**	0.706**
	Sig. (2-tailed)		0.000	0.000	0.000
	N	90	90	90	90
Green Relationship Capital	Pearson Correlation	0.774**	1	0.620**	0.631**
	Sig. (2-tailed)	0.000		0.000	0.000
	N	90	90	90	90
Green Structural Capital	Pearson Correlation	0.797**	0.620**	1	0.776**
	Sig. (2-tailed)	0.000	0.000		0.000
	N	90	90	90	90
Green Human Capital	Pearson Correlation	0.706**	0.631**	0.776**	1
	Sig. (2-tailed)	0.000	0.000	0.000	
	N	90	90	90	90
**. Correlation is significant at the 0.01 level (2-tailed).					

Source: SPSS outputs, elaborated by the authors

From the foregoing, it is possible to reject the hypothesis of nothingness and accept the alternative hypothesis in the following form:

There is a statistically significant relationship to the impact of the q_Green Intellectual Capital
e on Sustainable Quality at the level of significance (0.05).

Chapter Two: Theoretical Framework

Section One: Intellectual Capital and Sustainable Quality:

Before delving into the significance of green intellectual capital, it is essential to understand the precise definitions of this concept and of sustainable quality. This definition is the foundation upon which researchers build their vision for analyzing the relationship between green intellectual capital and sustainable quality.

1. The Concept of Green Intellectual Capital

According to a research by Alexandra Smith, it is defined as: "The combination of environmental information and experiences employed within organizations to promote innovation and achieve sustainability goals" (Smith, 2021, p. 47) [14].

Dr. Mahmoud Abdullah Al-Rifai (2020) [1] defined green intellectual capital as: "The creative cognitive energy that combines innovation and environmental awareness to ensure corporate sustainability." (Al-Rifai, 2020, p. 37) [1].

Green intellectual capital is the combination of environmentally sound knowledge, expertise, and experiences possessed by an organization, which contribute to enhancing environmental performance and achieving sustainability through innovation and creativity in resource management and operations. (Brown, 2020, p. 35) [3].

Green intellectual capital refers to intangible assets, including human capital, structural capital, and institutional relationships, which are used to achieve environmental goals and reduce negative environmental impacts.

2. Green Intellectual Capital Objectives

Green intellectual capital has strategic objectives that enhance its role in supporting sustainability and quality. These objectives make organizations view green intellectual capital as a vital investment rather than an additional cost (Lopez, 2018, p. 120) [10, 11].

The main objectives of green intellectual capital include:

1. Promoting environmental innovation: Using skills and expertise to develop environmentally friendly crops.
2. Ensuring environmental efficiency: Improving operations to reduce resource depletion and lower emissions.
3. Building a sustainable reputation: Strengthening the organization's image as a sustainability-oriented entity.
4. Responding to global challenges: Supporting efforts to achieve the United Nations Sustainable Development Goals (SDGs).

According to a study by Michael Johnson, organizations that rely on green thinking increase their capacity for innovation by 25% compared to traditional organizations (Johnson, Michael, 2019, p. 98) [7].

3. Dimensions of Green Intellectual Capital: Green intellectual capital consists of three main, interconnected dimensions, each representing a fundamental aspect of achieving sustainable quality. (Chen, 2008, p. 286) [4].

4. **Green Human Capital**

- Includes individuals' environmentally-related skills and knowledge.
- A study by Li Chao-Ping (2008, p. 50) confirmed that training employees in environmental skills increases their productivity by 20% (Li and Chao-Ping, 2022, p. 50) [9].

2. Green Structural Capital

- Includes institutional policies and systems that support sustainability.
- Such as implementing environmental quality standards such as ISO 14001.

3. Green Relational Capital

- Reflects relationships with customers, partners, and the community, which reinforces commitment to sustainability.

4. Challenges of Green Intellectual Capital

Despite the benefits, green intellectual capital faces challenges that require organizations to develop strategies to overcome them.

High initial costs

1. A study by Jonathan Morris showed that the shift toward sustainability may require significant investments. (Morris, Jonathan, 2018, p. 215) [12, 13].
2. Lack of peripheral talent: Human resources trained in sustainability are not always available, presenting a challenge for organizations.
3. High competition: Standing out in a crowded market requires exceptional effort. (Al-Haidari, 2019, p. 276) [6].

Section TWO: Sustainable quality

1. The concept of sustainable quality

- Michael Johnson defined it as: an integrated system for operations and resources management in a manner that achieves the efficiency of institutional performance and reduces the environmental impact. "(Johnson, Michael, 2019, P215) [7].
- While he described it d. Ali Hassan Al -Shammari as: Application of comprehensive standards to improve institutional performance in a way that is compatible with sustainable development goals. "(Al -Shammari, 2021, p. 165) [2].
- Permanent quality is the ability of the institution to give high quality products or services that match environmental and social standards, while committing to responding to the needs of present and future generations.
- Sustainable quality is defined as an integration between quality practices and environmental and social considerations, which ensures the provision of long - term value to the institution and customers while reducing the environmental impact.

2. The importance of sustainable quality

Sustainable quality is one of the new concepts that contribute to securing moderation between efficiency in economics and environmental and social authority, which makes it of great importance in institutions: (Wang, 2005, P236) [15].

- Promote competitiveness: In terms of offering innovative and quality products and services that require customer needs, taking into account environmental and social responsibilities.
- Achieving customer and society satisfaction: enhancing customer confidence in the institution as a result of its commitment to quality and sustainability at the same time. (Lopez, 2018, P216) [10, 11].
- Undergoing environmental laws and regulations: Reducing the legal and socially related risks.

Dimensions of sustainable quality

- Environmental dimension: includes emissions reduction, waste management, and clean energy use.
- The economic dimension: indicates improving economic effectiveness in terms of resource management effectively and reducing the costs related to environmental waste.
- Social dimension: improving working conditions, adhering to ethical practices, and enhancing the welfare of society. (Delgado, 2014, P293) [5].

4. The relationship between green intellectual capital and sustainable quality

The link between the head of green intellectual wealth and permanent quality is an integral relationship. As the first supports the provision of sustainable quality in terms of developing strategies based on improving effectiveness and reducing the environmental impact. For example, Michael Johnson's study (2019) [7] showed that organizations that are employed in green intellectual capital achieve a 30% improvement in their product quality while reducing production costs by 20%. So that the link between them is an interactive and mutual relationship. (Zhang, 2017, P223) [16].

Michael Johnson's study (2019) [7] confirmed that the facilities that invest in green intellectual capital achieve an improvement in the quality of their products by 30%.

Green intellectual capital supports sustainable quality on the one hand:

1. Developing innovative environmentally friendly solutions.
2. Improving the efficiency of operations.
3. Achieving integration between economic and environmental performance.

Chapter Three: Field Aspect First: Description of the study population and sample

A. Honesty and consistency of the questionnaire

Cronbach's Alpha test & Gutman Split - Half Coefficient

The stability of the questionnaire paragraphs was performed on the examined sample using the Cronbach's Alpha coefficient, table (2) shows the values of the Cronbach's Alpha coefficient, which were all greater than the minimum (0.70) for the two interlocutors, this indicates the stability of the questionnaire and its dependence on measurement and analysis and applicable to the study sample. This suggests that the respondents ' answers are valid for statistical analysis. The value of the Gutman Split - Half Coefficient was also high

Table 2: Evaluate the stability of the questionnaire by the interlocutor

Interlocutor	Cronbach's Alpha	Gutman Split - Half Coefficient	No. Items
Green Intellectual Capital			
Green Relationship Capital	0.791	0.700	5
Green Structural Capital	0.902	0.839	5
Green Human Capital	0.880	0.814	5
Sustainable Quality			
Social Sustainability	0.897	0.878	5
Economics Sustainability	0.898	0.827	5
Environmental Sustainability	0.883	0.802	5

Source: SPSS outputs, elaborated by the authors

Sample sufficiency: Table (3) showed that all the results fit the required standards. Based on these results, it is possible to rely on the sample and the extracted statistical results to generalize the findings to the broader research community, thereby increasing the study's strength and reliability, as well as its practical applications

Table 3: KMO & Bartlett Tests

Interlocutor	KMO	Bartlett	Sig.	No. Items
Green Intellectual Capital				
Green Relationship Capital	0.770	157.039	< 0.001	5
Green Structural Capital	0.884	265.586	< 0.001	5
Green Human Capital	0.861	227.009	< 0.001	5
Sustainable Quality				
Social Sustainability	0.838	270.788	< 0.001	5
Economics Sustainability	0.788	279.486	< 0.001	5
Environmental Sustainability	0.851	232.510	< 0.001	5

Source: SPSS outputs, elaborated by the authors

B. Weighted mean, standard deviation, t - t-statistics, normality test, weight percentage, and agreement level.

First Interlocutor

The results of Axis One are normally distributed within the limits of the distribution, as determined using the Kolmogorov-Smirnov test. The t-test values for the questionnaire were very high, with significance levels less than 0.001, indicating a statistically significant relationship at the 0.000 level for the impact of green intellectual capital on sustainable quality. These results indicate respondents' agreement with the items included in Axis One (green intellectual capital). The analysis results in Table (4) indicate that all respondents' answers were positive (>3), which is the primary measure of the weighted mean. The highest weighted mean was for TMC1 question (Our employees excel in implementing sustainability practices more than employees of competing organizations), with a mean of 4.02 and a weight of 0.80%). This was followed by GPD5 question (We work together with our strategic partners to implement innovative environmental solutions), with a mean of 3.88 and a weight of 0.77, and then GPD3 question (We enjoy long-term strategic partnerships with suppliers committed to environmental standards), with a mean of 3.83 and a weight of 0.76. The lowest mean was for EP5 question (Our employees report higher rates of participation in environmental programs than employees of similar organizations), with a mean of 3.41 and a weight of 0.68. All questions had strong levels of agreement, indicating that respondents' answers strongly agreed with the first interviewer's questions. All standard deviations were within the range, indicating that respondents' answers were not scattered.

Table 4: Green Intellectual Capital Statistical Measurements

Question		Mean	S.D	t	Normality	%	Level
Green Intellectual Capital							
Green Relationship Capital							
GPD1	We develop our green services based on the needs and environmental preferences of our customers	3.55	0.79	42.43	0.052	0.71	Agree
GPD2	Our clients register higher ratings of our environmental policies compared to competitors	3.80	0.78	46.11	0.093	0.76	Agree
GPD3	We enjoy long-term strategic partnerships with suppliers committed to environmental standards	3.83	0.62	58.40	0.074	0.76	Agree
GPD4	We maintain a constant dialogue with our employees to promote environmental awareness and sustainable practices	3.76	0.91	39.16	0.077	0.75	Agree
GPD5	We work jointly with our strategic partners to implement innovative environmental solutions	3.88	0.75	48.79	0.062	0.77	Agree
Green Structural Capital							
EP1	Our ecosystem achieves more outstanding results compared to competitors ' systems	3.76	0.86	41.46	0.094	0.75	Agree
EP2	We are considered leaders in the field of environmental innovation compared to similar enterprises in our field	3.68	0.95	36.61	0.054	0.73	Agree
EP3	Our environmental initiatives achieve higher financial returns compared to competing organizations	3.54	0.95	35.39	0.015	0.70	Agree

EP4	We invest more in research and development of environmental projects than competitors	3.48	0.96	34.38	0.067	0.69	Agree
EP5	Our employees record higher participation rates in environmental programs compared to employees of similar enterprises	3.41	1.02	31.52	0.037	0.68	Agree
Green Human Capital							
TMC1	Our employees stand out in the implementation of sustainable practices in a way that surpasses the employees of competing organizations	4.02	0.93	40.77	0.038	0.80	Agree
TMC2	Our services achieve a positive impact on the environment beyond what is offered by competing institutions	3.60	0.87	39.18	0.033	0.72	Agree
TMC3	We make sure that our services are more environmentally friendly than those offered in competing institutions	3.73	0.74	47.44	0.098	0.74	Agree
TMC4	Our team is characterized by a higher level of cooperation in environmental initiatives compared to competing organizations	3.71	0.78	44.99	0.058	0.74	Agree
TMC5	Managers provide the supportive environment for the success of employee-led environmental initiatives	3.74	0.89	39.73	0.026	0.74	Agree

Source: SPSS outputs, elaborated by the authors

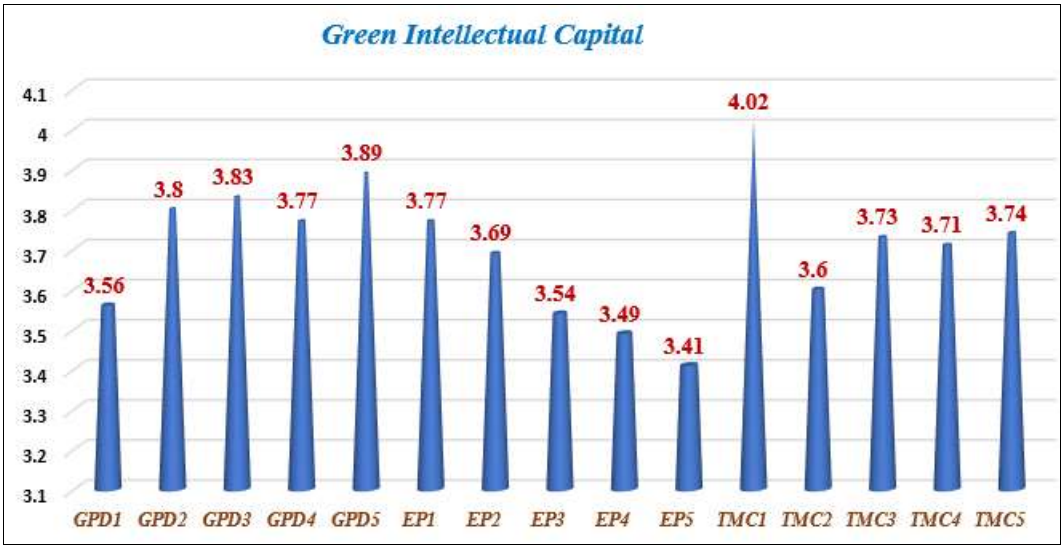


Fig 2: Green intellectual capital weighted means

b. Weighted mean, standard deviation, t-statistic, normal distribution test, likelihood ratio, and level of agreement.

Second Interlocutor

The results of the second **I**nterlocutor are normally distributed within the distribution limits, as determined using the Kolmogorov-Smirnov test. The t-test values for the questionnaire were very high, with a significance value less than (0.001), indicating a statistically significant relationship at the (0.000) level for the impact of green intellectual capital on sustainable quality. These results indicate participants' agreement with the items of the second axis (sustainable quality). The analysis results in Table (5) indicate that all participants' answers were positive (>3), which is the main measure of the weighted mean. The highest weighted mean was for SOR1 (The organization provides a safe working environment for employees (protective equipment, safety training), with a mean of 3.92 and a weight of 0.78. This was followed by ENR5 (The organization encourages a transition from paper to electronic records to reduce waste), with a mean of 3.84 and a weight of 0.76, and then ENR2 (Energy-efficient medical technologies or devices are used (e.g., energy-efficient anesthesia machines, LED lighting), with a mean of 3.78 and a weight of 0.75. The lowest mean was for SOR3 (Involves patients and families in treatment decisions while ensuring confidentiality and respect), with a mean of 3.36 and a weight of 0.67. All questions had strong levels of agreement, indicating that respondents' answers strongly agreed with the first interviewer's questions. All standard deviations were within the range, indicating that respondents' answers were not scattered.

Table 5: Statistical Measurements Sustainable Quality

Question		Mean	S.D	t	Normality	%	Level
Sustainable Quality							
Social Sustainability							
SOR1	The enterprise provides a safe working environment for employees (protective equipment, safety training)	3.92	0.73	50.42	0.026	0.78	Agree
SOR2	Provides equitable health care to all groups regardless of social or material status	3.74	0.72	48.81	0.021	0.74	Agree
SOR3	Involves patients and their families in treatment decisions while ensuring confidentiality and respect	3.36	0.99	31.95	0.016	0.67	Agree
SOR4	There are effective communication channels between management and employees to improve the work environment	3.43	0.88	36.70	0.051	0.68	Agree
SOR5	The foundation organizes awareness programs for the community about preventive	3.58	0.83	40.86	0.131	0.71	Agree

	health and sustainability						
Economics Sustainability							
ECR1	The financial resources of the institution are managed competently to avoid waste in medical supplies	3.67	0.84	41.25	0.025	0.73	Agree
ECR2	Apply regular maintenance programs for medical devices to avoid costly malfunctions	3.60	0.87	39.18	0.051	0.72	Agree
ECR3	There are policies for purchasing medicines and supplies at competitive prices while maintaining quality	3.64	0.87	39.37	0.082	0.72	Agree
ECR3	The enterprise invests in training personnel to use equipment correctly to reduce costs	3.55	0.83	40.34	0.047	0.71	Agree
ECR5	Provides health services at affordable prices compared to their quality for the private sector	3.51	0.87	37.97	0.113	0.70	Agree
Environmental Sustainability							
ENR1	The enterprise implements a strict separation of medical waste by their types (acute, infectious, chemical, etc.)	3.75	0.73	48.20	0.054	0.75	Agree
ENR2	Energy-saving medical technologies or devices are used (e.g. energy-saving anesthesia devices, LED lighting	3.78	0.80	44.91	0.086	0.75	Agree
ENR3	The enterprise minimizes the use of non-biodegradable plastics (such as bags, single-use tools	3.75	0.82	43.16	0.061	0.75	Agree
ENR4	There is a clear plan for the management and disposal of hazardous waste in an environmentally safe manner	3.75	0.75	47.24	0.021	0.75	Agree
ENR5	The foundation encourages a shift from paper records to electronic records to reduce waste.	3.84	0.81	44.48	0.019	0.76	Agree

Source: SPSS outputs, elaborated by the author

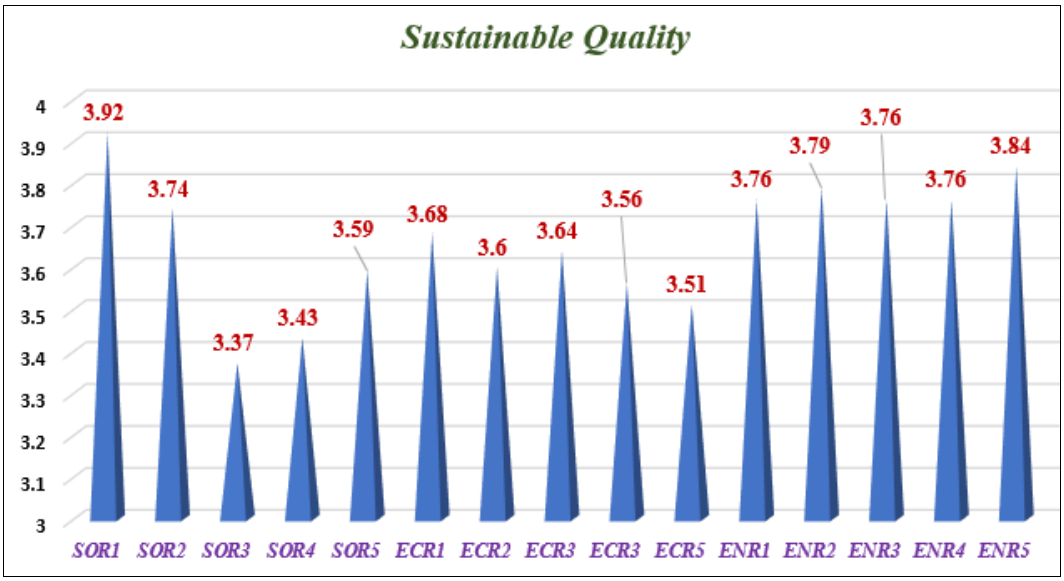


Fig 3: Sustainable quality weighted means

First Model

Sustainable Quality (Dependent variable), Green Relationship Capital (independent variable)

Table (6) shows the value of the simple correlation coefficient of (0.774) as we indicated in Table (1), a determination coefficient of (0.600) was produced, which explains (60%) of the explanatory variable, and the remaining percentage is due to external factors. The table also showed that there is no autocorrelation problem according to the Durbin-Watson Test value of (2.122), which is greater than the standard value of the test (1.3)

Table 6: Model Summary

Model Summary[b]					
Model	**R**	**R Square**	**F Change**	**Sig. F Change**	**Durbin-Watson**
1	0.774[a]	0.600	131.826	0.000	2.122
a. Predictors: (Constant), X					
b. Dependent Variable: Y					

Source: SPSS outputs, elaborated by the authors

The analysis proved that the model had a high morale (0.000) according to statistics (F = 131.826), and this indicates that there is an impact of the Green Relationship Capital on Sustainable Quality

Table 7: ANOVA Table

ANOVA[a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	4985.003	1	4985.003	131.826	0.000[b]
	Residual	3327.719	88	37.815		
	Total	8312.722	89			
a. Dependent Variable: Sustainable Quality						
b. Predictors: (Constant), Green Relationship Capital						

Source: SPSS outputs, elaborated by the authors

Table (8) shows that the value of (11.4827) was at a high moral level (0.000), with no problem of multicollinearity according to the value of the coefficient of variation inflation (VIF = 2.5), which is lower than the standard value of the test of (3). The marginal slope of the model was uniform (β_1 = 2.603), as it indicates that an increase of one unit in the independent variable leads to an increase in the mass of the dependent variable by the value of the marginal slope, the estimated linear regression equation:

Table 8: Model Coefficients

Coefficients[a]							
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**	**VIF**
		B	Std. Error	Beta			
1	(Constant)	5.896	4.321		1.364	0.176	
	X	2.603	0.227	0.774	11.4827	0.000	2.5
a. Dependent Variable: Y							

Source: SPSS outputs, elaborated by the authors

$$\hat{Y} = 5.896 + 2.603\ X_1$$

Second Model

Sustainable Quality (Dependent variable), Green Structural Capital (Independent variable) Table (9) shows the value of the simple correlation coefficient of (0.797[a]) as we indicated in Table (1), a determination coefficient of (0.635) was produced, which explains (63%) of the explanatory variable, and the remaining percentage is due to external factors. The table also showed that there is no autocorrelation problem according to the Durbin-Watson Test value of (2.103), which is greater than the standard value of the test (1.3)

Table 9: Model Summary

Model Summary[b]					
Model	**R**	**R Square**	**F Change**	**Sig. F Change**	**Durbin-Watson**
1	0.797[a]	0.635	153.044	0.000	2.103
a. Predictors: (Constant), X					
b. Dependent Variable: Y					

Source: SPSS outputs, elaborated by the authors

The analysis proved that the model had a high morale (0.000) according to statistics (F = 153.044), and this indicates that there is an impact of the Green Structural Capital on Sustainable Quality

Table 10: ANOVA Table

ANOVA[a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	5277.927	1	5277.927	153.044	0.000[b]
	Residual	3034.795	88	34.486		
	Total	8312.722	89			
a. Dependent Variable: Sustainable Quality						
b. Predictors: (Constant), Green Structural Capital						

Source: SPSS outputs, elaborated by the authors

Table (11) shows that the value of (12.371) was at a high moral level (0.000), with no problem of multicollinearity according to the value of the coefficient of variation inflation (VIF = 2.77), which is lower than the standard value of the test of (3). The marginal slope of the model was uniform (β_1 = 1.908), as it indicates that an increase of one unit in the independent variable leads to an increase in the mass of the dependent variable by the value of the marginal slope, the estimated linear regression equation

Table 11: Model Coefficients

Coefficients[a]							
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	VIF
		B	Std. Error	Beta			
1	(Constant)	20.795	2.829		7.351	0.000	
	X	1.908	0.154	0.797	12.371	0.000	2.77
a. Dependent Variable: Y							

Source: SPSS outputs, elaborated by the authors

$$\hat{Y} = 20.795 + 1.908\ X_2$$

Third Model

Sustainable Quality (Dependent variable), Green Human Capital (Independent variable)

Table (9) shows the value of the simple correlation coefficient of (0.706[a]) as we indicated in Table (1), a determination coefficient of (0.498) was produced, which explains (49%) of the explanatory variable, and the remaining percentage is due to external factors. The table also showed that there is no autocorrelation problem according to the Durbin-Watson Test value of (2.115), which is greater than the standard value of the test (1.3

Table 12: Model Summary

Model Summary[b]					
Model	R	R Square	F Change	Sig. F Change	Durbin-Watson
1	0.706[a]	0.498	87.46	0.000	2.115
a. Predictors: (Constant), X					
b. Dependent Variable: Y					

Source: SPSS outputs, elaborated by the authors

The analysis proved that the model had a high morale (0.000) according to statistics (F = 87.446), and this indicates that there is an impact of the Green Human Capital on Sustainable Quality

Table 13: ANOVA Table

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4143.239	1	4143.239	87.446	0.000[b]
	Residual	4169.483	88	47.380		
	Total	8312.722	89			
a. Dependent Variable: Sustainable Quality						
b. Predictors: (Constant), Green Human Capital						

Source: SPSS outputs, elaborated by the authors

Table (14) shows that the value of (9.351) was at a high moral level (0.000), with no problem of multicollinearity according to the value of the coefficient of variation inflation (VIF = 2.01), which is lower than the standard value of the test of (3). The marginal slope of the model was uniform (β_1 = 1.955), as it indicates that an increase of one unit in the independent variable leads to an increase in the mass of the dependent variable by the value of the marginal slope, the estimated linear regression equation

Table 14: Model Coefficients

Coefficients[a]							
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	VIF
		B	Std. Error	Beta			
1	(Constant)	18.795	4.000		4.542	0.000	
	X	1.955	0.209	0.706	9.351	0.000	2.01
a. Dependent Variable: Y							

Source: SPSS outputs, elaborated by the authors

$$\hat{Y} = 18.795 + 1.955\ X_3$$

Discussion

Following the completion of the practical component, all primary and secondary hypotheses per-taining to correlation and influence were validated. Although the main hypotheses demonstrated robust relationships in testing both correlation and influence, certain limitations were observed in their formulation and presentation—despite yielding positive and statistically significant results. For instance, this was particularly evident in the sub-hypotheses designed to measure the correlation of influence, we found that the relationship between some dimensions of green intellectual capita and sustainable quality was weak. This is due to the weakness in the implementation of the environmental protection manage-ment system, and the fact that the department has not introduced innovations related to environ-mental protection throughout this period. This is what we actually observed on the ground. There is also a weakness in environmental-related research and development expenditures, and the small percentage of employees working in environmental management.

Furthermore, there is compe-tence, albeit at a low level, in developing green products or using environmentally friendly packag-ing. There is also a lack of understanding and awareness of environmental knowledge among a number of employees. Furthermore, the department has not designed products that are compatible with environmental aspirations, and there is a weakness in joint cooperation with some environ-mentally conscious medical manufacturing partners. If this were addressed, it would support the strategy toward complete transformation.

Chapter Four: Conclusions and Recommendations

Conclusion

Green intellectual capital represents a qualitative shift in the way institutions are managing their resources and knowledge to achieve sustainable quality. Despite the challenges it faces, the benefits resulting from it highlights its importance as a long -term strategic investment. It is important to employ institutions within the development of environmental competencies and enhance innovation to achieve excellence in a world tending to sustainability. Green intellectual capital is not an option, but rather a need to secure sustainable quality in light of the current environmental and economic confrontations. By enhancing innovation, improving efficiency, and developing sustainable relationships with partners and clients, institutions can guarantee a more sustainable and prosperous future. To achieve this, it is imperative for employment institutions to enlarge the head of richness, while intensifying the challenges and taking advantage of the many advantages they offer.

The study conclusively established that most hypotheses were validated through the conducted statistical analysis. The findings revealed that green human capital exhibits the strongest association with sustainable quality, both in terms of correlation and influence. Structural capital, meanwhile, demonstrated a moderate relationship with sustainable quality, while relational capital showed only a weak connection. Based on these results, organizations aiming to implement sustainable quality initiatives should prioritize: Developing green human capital as a primary focus, Enhancing structural and relational capital components as secondary objectives, and increasing investments in environmental R&D to develop eco-friendly products that minimize environmental pollution Wide use of plastic packaging materials requires finding sustainable and effective alternatives to environmental responsibility. Regarding packaging operations, the continuous development of environmentally friendly designs that are in line with environmental standards through regular updates. This section must also implement awareness campaigns to educate customers about the importance of sustainable materials and enhance their adoption. Organizations leveraging green intellectual capital demonstrate greater adaptability to environmental challenges while gaining competitive advantages. By strategically applying environmental knowledge, these entities enhance their ecological performance and market competitiveness through optimized resource utilization, waste reduction, and improved innovation capacity. The adoption of environmentally-conscious techniques fosters sustainable productivity growth, generating substantial economic and social benefits while strengthening customer relationships through better alignment with environmental expectations. Key recommendations emphasize the critical need for organizations to cultivate green intellectual capital through: Comprehensive environmental education and training programs, Implementation of sustainable quality practices to boost economic efficiency while minimizing ecological impact, Development of strong sustainability-focused relationships with employees and suppliers, Systematic integration of sustainability as a core factor in achieving quality standards.

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