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Green Intellectual Capital as a Fundamental Pillar for Achieving Sustainable Environmental Performance

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Abstract: This study aims to enrich the topic of green intellectual capital as a key factor in stimulating the shift towards a more sustainable and environmentally friendly green economy, which contributes to improving environmental performance indicators and following up on sustainable development strategies.The descriptive analytical approach was used in this study to analyze the relationship between green intellectual capital and its impact on sustainable environmental performance.

Keywords:
Green intellectual capital, Green human capital, Green structural capital, Green relational capital, Sustainable environmental performance.

Introduction :

In recent years, there has been an increasing interest in the environment and climate change and their implications for economic and social fields, as well as their connection to labor markets by involving governments, workers, and employers as active elements for change towards environmentally friendly methods and approaches to ensure sustainability and the spread of green thinking across many industries that have changed traditional regulatory practices and their use of resources. One aspect of the green trend in the business world is that the success of an organization was previously viewed based on the economic value achieved, but today environmental considerations and social factors have become among the most important means of evaluating business organizations. Over the past few years, organizations have faced pressure from stakeholders to adopt environmentally friendly business practices, making it essential to identify green practices that promote sustainability.

On the other hand, Green Intellectual Capital is a topic that requires further research. It is necessary for organizations to adopt a strategy to deal with the negative impacts on the environment by creating a green, pollutant-free environment that drives them towards enhancing Green Intellectual Capital. Despite the emergence of many related studies on green environmental management, awareness of environmental issues has become prevalent among workers in various industries, and their concern about environmental issues such as global warming, pollution, waste increase, and sustainable resource usage has grown. This is expected to lead to more activities related to environmental protection. Thus, Green Intellectual Capital has become worthy of attention from researchers because it achieves sustainable competitive advantages for many organizations.

Moreover, Green Intellectual Capital is an important aspect of environmental management that has not yet been adequately explored, especially in the Arab environment.

1.1. Problem Statement:

The increasing focus of organizations on environmental sustainability compels us to understand how it impacts the environment. With the growing environmental challenges and various pollution issues such as waste, noise pollution, thermal emissions, water pollution, and car exhausts, among other environmental pollutants, there is a need to think about how to preserve it. Thus, there is an urgent necessity to employ green intellectual capital in environmental sustainability. This research was conducted to discuss this, and based on the above, the problem of the study can be summarized in answering the following question:

How does green intellectual capital affect the sustainability of environmental performance?

1.2. Subsidiary Questions:

- What is green intellectual capital and what are its dimensions?
- What are the most important principles of environmental sustainability?
- Is there an improvement in the ranking of Arab countries according to the Sustainable Environmental Performance Index for the year 2024?
- Does the application of green intellectual capital contribute positively to improving sustainable environmental performance?

1.3. Hypotheses:

First hypothesis: Green intellectual capital is a set of intangible assets related to knowledge, innovation, and human capabilities that contribute to the promotion of sustainable environmental practices within organizations.

The Second Hypothesis: Principles of environmental sustainability are a set of principles aimed at preserving the environment and natural resources for future generations.

Hypothesis Three: There is an improvement in the ranking of Arab countries according to the Sustainable Environmental Performance Index for the year 2024.

Hypothesis Four: The application of green intellectual capital positively contributes to improving sustainable environmental performance in institutions.

1.4. The Importance of the Study:

The study derives its importance from the following points:

- The topic of green intellectual capital is relatively modern in management thought, which necessitates a deeper study and clarification of its dimensions;
- Highlighting the importance of green intellectual capital in complementing sustainable development prospects;
- The importance of the research variables represented by green intellectual capital and environmental sustainability as important variables that contribute to preserving the environment both within and outside organizations and enhancing environmental sustainability.

1.5. Study Objectives: The study objectives were as follows:

- Recognizing green intellectual capital and its components.

- Identifying and diagnosing the dimensions of green intellectual capital and the dimensions of environmental sustainability;
- Reaching some conclusions and providing a set of recommendations that the researchers hope will contribute to activating green intellectual capital and using it to achieve sustainability in environmental performance.

1.6. Study Methodology:

In order to answer the problem of the study, the descriptive and analytical approaches were used through theoretical reasoning from previous studies related to the topic of green intellectual capital and sustainable environmental performance, including theses, scientific articles, and reports of international organizations.

1.7. Literature Review:

The study of Mohammed Muneeb Mahmoud Al-Dabbagh (2021), entitled The role of green intellectual capital in the possibility of applying sustainable manufacturing: An exploratory study of the opinions of employees in Diyali General Company for Electrical Industries, Almuthanna Journal of Administrative and Economic Sciences, Volume (11) Issue (4).

The research aimed to determine whether there is a role for green intellectual capital in sustainable manufacturing from the perspective of managers at Diyali General Company for Electrical Industries. The research relied on descriptive and analytical methods in its treatments. A questionnaire form was used to collect research data, with (38) questionnaires distributed to individuals working in the company, focusing on managers at various administrative levels. The research concluded with several results, including that there is a significant correlation and impact of green intellectual capital on sustainable manufacturing. Several recommendations consistent with this were presented.

Ullah et al., (2022) study entitled: Nexus between IT capability and green intellectual capital on sustainable businesses: evidence from emerging economies. Environmental Science and Pollution Research, 28, This study aimed to examine the complex relationship between Green Intellectual Capital (GIC), Green Human Resource Management (GHRM), and Green Innovation (GI) to improve the Environmental Performance (EP) of the organization. The study reached several conclusions, the most important of which is that neither Green Intellectual Capital nor Green Human Resource Management has a direct impact on Environmental Performance. Additionally, Green Innovation plays an intermediary role in making Green Intellectual Capital and Green Human Resource Management beneficial in improving the Environmental Performance of the organization. Environmental strategies play an important role in Environmental Performance and act as a mediator in the relationship between Green Innovation and Environmental Performance.

A study by Bassem Wadi Abdul Hussein Al-Fatlawi, Iman Karim, Zahir Habib Al-Haidari, (2023), entitled: Employing green intellectual capital in enhancing the proactive sustainability strategy (an analytical survey study in a sample of food industry companies), Warith Scientific Journal, Volume 5, Issue 15.

This study aims to demonstrate the impact of employing green intellectual capital in enhancing proactive sustainability strategy at the level of a sample of food industry companies. To achieve this, the variable of green intellectual capital was measured through three sub-dimensions:

structural, human, and relational. Likewise, the proactive sustainability strategy was measured through three sub-dimensions: economic sustainability strategy, social sustainability strategy, and environmental sustainability strategy. The study population consisted of five food industry companies in the Holy Province of Karbala, with a study sample of 130 individuals from the responsible personnel in these companies. A questionnaire was used as the primary tool for collecting the necessary data and information. For data analysis and statistical processing, the study relied on a set of statistical methods available in the programs SPSS V.23, AMOS V.23, and Microsoft Excel 2010. The study reached several conclusions, the most important of which was the existence of statistically significant correlation and impact relationships between green intellectual capital and the proactive sustainability strategy. Additionally, the research provided some important recommendations.

Hani Mohamed Galal Abd Elshakour Deif and Mohamed Hassan Mohamed Al-Ashry's study (2024), "The Mediating Role of Green Intellectual Capital in the Relationship Between Green Human Resource Management Practices and Environmental Citizenship Behaviors: An Applied Study on Industrial Companies in Dakahlia Governorate," Volume (25) - Issue Three.

This study aimed to clarify the relationship between green human resource management (HRM) practices and environmental citizenship behaviors, as well as to identify the mediating role of green intellectual capital in this relationship. A survey questionnaire was used to collect the primary data necessary for testing the study hypotheses from a sample of 366 employees working in industrial companies in Dakahlia Governorate. The data was analyzed using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach through the JASP statistical software. The researchers adopted the descriptive-analytical method. The results revealed a significant positive impact of green HRM practices on green intellectual capital, as well as a significant positive impact of green intellectual capital on environmental citizenship behaviors. Finally, the findings indicated that green intellectual capital plays a partial mediating role in the relationship between green HRM practices and environmental citizenship behaviors. Based on the study results, the researchers proposed a set of recommendations and future research directions.

A study by Akram Ghaleb Jabbar, Amer Abdel Latif Kazem, and Sawsan Jawad Hussein (2024), titled "The Role of Green Human Capital in Promoting Environmental Sustainability: An Exploratory Study in the Kufa Cement Plant." Journal Port Science Research, 7(2).

The research aimed to determine the impact of green human capital on environmental sustainability. A questionnaire was used as a data collection tool, with a total population of 1,789 individuals, out of which 308 participated in the survey. The study employed a descriptive analytical approach and utilized various statistical methods, including the arithmetic mean, standard deviation, Cronbach's alpha reliability coefficient, confirmatory factor analysis, Pearson correlation coefficient, and simple linear regression. The research reached several findings, the most notable of which is the existence of a correlation and impact of green human capital on environmental sustainability and its dimensions. Among the key recommendations is the necessity for Kufa Cement Plant to adopt awareness programs for its leadership teams, highlighting the importance of human resources in environmental conservation and demonstrating their impact on environmental improvement.

Amer Abdul Latif Kazem, Sawsan Jawad' study (2024), titled: "The Role of Green Human Capital in Enhancing Environmental Sustainability: An Exploratory Study at Kufa Cement Factory," Minaa of Scientific Research Journal, Volume 7, Issue 2.
The research aims to determine the impact of green human capital on environmental sustainability. The research problem was framed as a key question, and a questionnaire was used as a data collection tool. The study population consisted of 1,789 individuals, with 308 participants responding to the questionnaire. The descriptive-analytical approach was employed, along with various statistical methods, including confirmatory factor analysis, Pearson correlation coefficient, and simple linear regression. The research yielded several findings, the most notable being the existence of a correlation and impact of green human capital on environmental sustainability and its dimensions. Among the key recommendations was the necessity for Kufa Cement Plant to adopt awareness programs for its leadership to emphasize the importance of human resources in environmental conservation and to highlight their role in improving the environment.

1.8. Study Plan: the study is divided into three sections. In the first section, the concept of green capital was addressed, focusing on its definition, importance, and dimensions. The second section is dedicated to sustainable environmental performance, exploring its concept and key dimensions, as well as examining the environmental performance indicators for the year 2025. The final section is devoted to studying the relationship between the dimensions of green capital and sustainable environmental performance.

2. Green Intellectual Capital:

2.1. The Concept of Green Intellectual Capital:

In the current environmental era, institutions are leaning towards eco-friendly approaches to achieve their goals and ensure sustainability. The concept of "green" has expanded significantly, contributing to a transformation in production processes. Green intellectual capital is one of the prominent strategies adopted by companies seeking to transition towards green production and implement sustainability principles (Yadiati, 2019, p. 263). It helps institutions ensure innovation and gain a competitive advantage, in addition to creating value for the organization and meeting customer demands regarding environmental issues (Sugiono, 2019, p. 283).
It is recognized as the total stock of all types of intangible assets, knowledge, capabilities, relationships, and so on related to environmental protection, whether at the individual or organizational level. It represents the intangible assets of the organization, including knowledge, capabilities, expertise, and innovation in the field of environmental protection. (Asiaei, 2023, p. 82)
Green intellectual capital has been defined as one of the ways that contribute to achieving sustainable development and promoting the green economy. It encourages the use of resources in a way that preserves the environment without causing harm, by employing sustainable and smart methods. (Barhal, 2024, p. 154)
In light of the above, green intellectual capital can be operationally defined as the total stock of intangible assets, knowledge, capabilities, and so on, aimed at environmental protection at the organizational level. It includes three dimensions: human capital, structural capital, and relational capital.

2.2. The Importance of Green Intellectual Capital:

Chen (2008) highlights the importance of green intellectual capital and its role in enhancing a company's competitive position. His study results indicated that the three types of green intellectual capital—green human capital, green structural capital, and green relational capital—had positive effects on strengthening companies' competitive positions. Cheng et al. (2011) argue that a company's competitive advantage is achieved when it possesses capabilities similar to those of its competitors but at a lower cost (cost advantage) or when it can generate profits exceeding those of its competitors (differentiation advantage). A differentiation advantage can be built through product quality, technology, innovation, reliability, brand image, company reputation, flexibility, and customer service, provided that all these resources are unique to the company and difficult for competitors to imitate. (Al-Dabbagh, 2021, pp. 206-207)

The importance of green intellectual capital also lies in the fact that it is one of the intangible assets of institutions, helping them achieve excellence and distinction. This is especially relevant today, as competition is based on the skills and competencies an institution possesses. Moreover, it significantly contributes to the institution's success, distinction, and performance improvement, ultimately enhancing organizational competitiveness by fostering the level of green innovation. (Sugiono, 2019, p. 264)

Green intellectual capital plays an important role in achieving sustainable corporate performance by promoting pro-environmental behaviors among employees, enhancing corporate reputation, and yielding a range of positive outcomes for companies. These include achieving a sustainable competitive advantage, improving efficiency, strengthening their green image, and capitalizing on new market opportunities. Additionally, it enhances customer satisfaction and improves their purchase intentions. Green intellectual capital not only reduces environmental impact but also provides a competitive advantage by lowering costs. (Imam, 2022, p. 220)

(Yuosre Badir, 2021, pp. 43-45) sees that the importance of green intellectual capital lies in the following:

a- **Achieving a Sustainable Competitive Advantage for the Organization**: Organizations can attain a sustainable competitive advantage if they possess rare and valuable assets and capabilities, including green intellectual resources that are difficult to imitate. Investing in these rare and unique resources will serve as a key source of sustainable competitive advantage.

b- **Improving Competitive Position in the Market:** Organizations invest in green intellectual capital to succeed in their competitive position through the expertise and skills of their employees, enabling them to enhance their efficiency and effectiveness.

c- **Supporting and Developing the Organization's Social Capital:** The importance of green intellectual capital can be clarified through the interconnected and complementary relationship between human capital and social capital. Despite the significance of green human capital and its potential to drive the success and development of organizations, its benefits are limited without social capital. Learning, training, and adaptation of individuals require a social environment that enables employees to showcase their abilities, which represent a valuable asset to the organization.

2.3. Dimensions of Green Intellectual Capital:

2.3.1. Green Human Capital (GHC):

Human capital is defined as the aggregation of individuals' knowledge, skills, innovation, and capabilities to achieve objectives. Human capital has two determining factors: individuals' abilities and commitments. It is an integral part of individuals rather than organizations and can be developed through training and education. Green human capital is defined as a summary of individuals' knowledge, skills, abilities, experience, attitudes, judgment, creativity, and commitments, among other factors, in relation to environmental protection or green innovation (Malik, 2022, p. 431).

It consists of all the attributes associated with individuals in organizations, including their practices, experiences, skills, and creative and innovative abilities. It encompasses all intangible information and knowledge within the human mind in organizations and serves as the fundamental basis for sustaining organizational creativity and strategy. Distinguished human capital is linked to high organizational productivity and the achievement of substantial returns and profits. Therefore, human resource managers must strive to recruit and develop the best possible team to gain a competitive advantage for their organization. Human capital represents an investment in enhancing individuals' efficiency so they can work more effectively and efficiently. It includes knowledge, skills, experiences, the ability to innovate and create, problem-solving skills, leadership, managerial skills, entrepreneurship, accumulated expertise, teamwork capabilities, and harmony, among other attributes. Human capital refers to the expertise, skills, and shared knowledge within an organization that add value. Green intellectual capital is considered one of the important components of intellectual capital. (Omar, 2017, p. 2560).

Additionally, it is the essential element of intellectual capital, playing the role of the driving force behind green structural capital and green relational capital. These characteristics are not owned by organizations and cannot be imitated. The attributes of individuals, which include both tacit and explicit knowledge, are an invaluable asset in achieving successful human resource management. Due to this uniqueness, these qualities represent a form of competitive advantage for the organization. (Malik, 2022, p. 432)

In light of the above, green human intellectual capital refers to the optimal employment of individuals who possess intellectual knowledge to produce environmentally friendly products. The knowledge and skills that individuals possess are closely linked to the productivity of the organization. Green organizations strive diligently to keep up with developments in the global environment.

2.3.2. Green Structural Capital:

Human capital alone is not sufficient to achieve sustainable performance; structural capital is also necessary to accomplish this. It represents the organizational assets that reflect a commitment to environmental protection or green innovation within the institution. It relates to organizational commitments, organizational capabilities, corporate culture, reward systems, databases, knowledge management systems, and the institution’s reputation. (Fawehinmi, 2019, p. 366)

Green structural capital is defined as a stock of organizational capabilities, organizational commitments, knowledge management, reward systems, information technology systems, databases, managerial contexts, operational processes, managerial philosophies, organizational culture, corporate images, patents, property rights, trademarks, etc., in relation to environmental protection or green innovation within the organization (Malik, 2022, p. 432). Green structural capital is also defined as "institutional knowledge about the form of organizational processes, structures, technologies, policies, and culture. These resources are valuable intangible assets owned

by the organization and can be used to support green human resource management within the organization" (Wang Z. W., 2014, p. 243).

Structural capital includes patents, trademarks, hardware, software, databases, organizational culture, and organizational capabilities within an organization. It is an integral part of organizations, as it is owned by the organization rather than individuals and represents the fundamental infrastructure that supports human capital. This requires storing competencies with the help of technologies, documenting processes, guidelines, and networks, among others, ensuring that expertise remains within the organization even when employees leave or retire. It also encompasses organizational learning, knowledge sharing, and storage within the organization—such as its culture, processes, databases, operating procedures, and intellectual assets. Structural capital not only creates value but also adds to the financial value of the organization and has a positive impact on performance and profitability in organizations (Malik, 2022, p. 432).
In light of the above, green structural intellectual capital refers to how an organization's infrastructure, including equipment, machinery, and technology, is used in an environmentally friendly and sustainable manner. It represents the organization's capability.

2.3.3. Green Relational Capital:

Relational green capital has been defined as the interactive relationships of an organization with customers, suppliers, allies, and partners in a way that achieves environmental management and green innovation for organizations, enabling them to succeed and gain competitive advantages. As an intangible asset, relational green capital focuses on developing, nurturing, and maintaining good relationships with organizations, individuals, and groups that may influence the organization's position in the market. (Malik, 2022, p. 433)
Relational capital represents the relationships that enable an organization to collaborate or communicate with other organizations, research centers, and customers. It is measured by the strength of cooperation between local actors [4]. It consists of the organization's relationships with external stakeholders and how they perceive its products and services. This is extremely important for any organization, as it creates awareness and value in the minds of stakeholders through the organization's human and structural capital. The organization's investment in strengthening its relationships with customers and suppliers leads to an improved reputation, which has a significant impact on business success. (Erinos, 2017, p. 76)
It is the broader concept of customer capital, where customer capital is a subset of relational capital. It also represents good relationships with individuals, customers, and stakeholders who contribute to achieving high performance and increasing the organization's competitiveness (Omar, 2017, p. 2563).
In light of the above, green relational capital is defined as the process of building interactive relationships between employees and stakeholders to achieve the green objectives of the organization and the environment.

3. Sustainable Environmental Performance

3.1. The Concept of Sustainable Environmental Performance and its dimensions:

3.1.1. The Concept of Environmental Performance:

Academic research assumes that sustainable environmental performance is the measurable outcome of an environmental management system concerning the control exerted by an organization over its environmental impacts based on its environmental policy. From this perspective, environmental performance is considered a multidimensional construct that not only includes the results and impacts of organizations on stakeholders and the environment but also encompasses the principles of environmental responsibility and the environmental response processes of organizations that determine future outcomes and impacts. (Albertini, 2016, p. 2)
Lober views sustainable environmental performance as the commitment of organizations to preserving and protecting their natural environment in its various dimensions, such as maintaining the quality of water, air, and soil, among others. Therefore, sustainable environmental performance is a concept that refers to how the impact of human economic and social activities on the environment is assessed or measured. (Barhal, 2024, p. 156)

3.2. Principles of Environmental Sustainability:

The principles of environmental sustainability announced at the Rio Conference are as follows: (Jawad, 2024, pp. 152-153)

a. **The Principle of Integration:** This principle emphasizes that achieving sustainable development must include environmental protection as an essential part of development, rather than being separate from it.

b. **The Principle of Eradicating Poverty**: It entails the necessity for all countries and peoples to cooperate in eliminating poverty as a fundamental requirement for achieving sustainable development.

c. **The Principle of Common and Differentiated Responsibilities**: Emphasizes the cooperation of states in a spirit of global partnership to preserve, protect, and restore the health and integrity of the ecosystem.

d. **The Principle of Changing Production and Consumption Patterns**: It emphasizes achieving sustainable development, improving the quality of life for people, and reducing unsustainable production and consumption patterns.

e. **The Principle of Cooperation in Capacity Building and Enhancement**: It involves cooperation to strengthen self-capacity building through the exchange, development, adaptation, and dissemination of scientific and technological knowledge, including modern technology.

f. **The Principle of Participation in Decision-Making:** It involves addressing environmental issues in the best possible way through the participation of concerned citizens at the appropriate level.

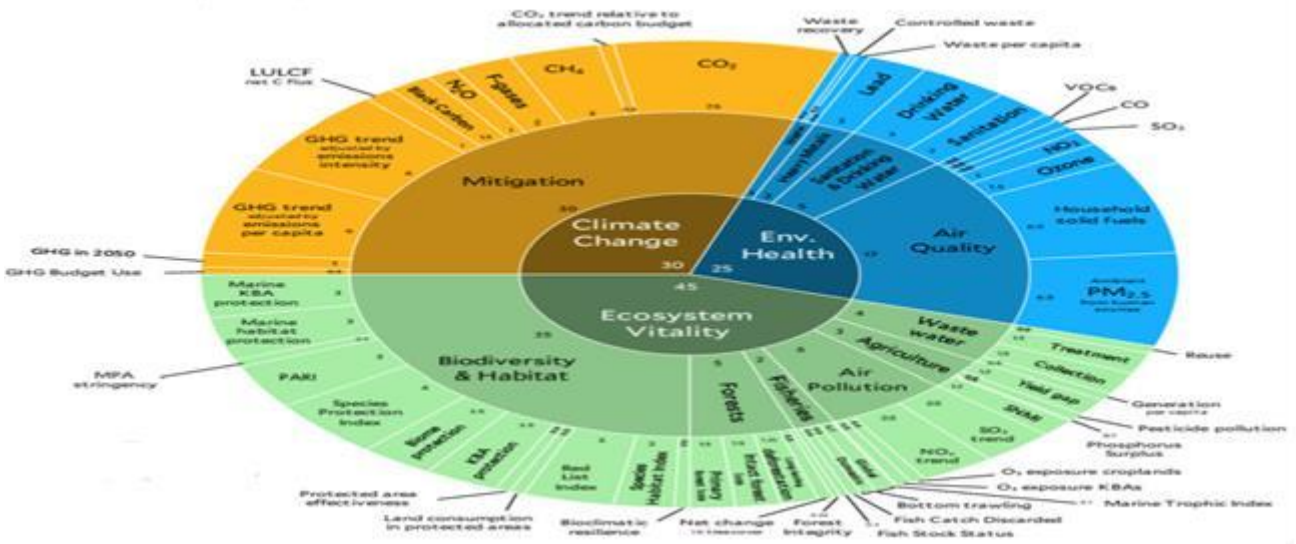
3.3. Sustainable Environmental Performance Indicators (EPI) and Their Evaluation:

3.3.1. Sustainable Environmental Performance Indicators (EPI) for the Year 2024 Globally and in the Arab World:

On June 4, 2024, the Environmental Performance Index (EPI) 2024 was released by the Yale Center for Environmental Law & Policy, in collaboration with the Columbia Center for International Earth Science Information Network. The index is published biennially and was first launched by the World Economic Forum in 2002. The EPI assesses the progress of countries toward achieving international environmental policy goals, including the United Nations Sustainable Development Goals, the Paris Agreement on Climate Change (2015), and the Kunming-Montreal Global Biodiversity Framework. The 2024 Environmental Performance Index (EPI) leverages the latest

datasets, science, and technology to provide the most comprehensive assessment of sustainability worldwide. It includes 58 indicators to rank 180 countries based on their progress in mitigating climate change, ensuring ecosystem vitality, and promoting environmental health. This broad set of metrics is a powerful tool for tracking progress toward the United Nations Sustainable Development Goals and the climate mitigation commitments in the 2015 Paris Agreement. (Mahmoud, 2024)

Figure (01): Variables of Environmental Performance Indicators 2024 According to Axes, Fields, Indicators, and Their Weights



Source: http:epi.yale.edu/downloads/2024epireport.pdf

From the figure, it is clear that the outer shape of the circle includes 58 performance indicators within 11 categories in the middle circle. These categories are grouped into the central core, which consists of three elements: ecosystem vitality, climate change, and environmental health. For the first time, the 2024 Environmental Performance Index has introduced new metrics to assess how successfully countries protect essential natural resources, in addition to indicators measuring the effectiveness of protected area regulations in each country. (Mahmoud, 2024)

From the figure, countries can determine the results they have achieved regarding the evaluated index. If the total points exceed the specified reference value, the countries are in a good position. However, if the points are lower, the countries must work hard to address weaknesses. The environmental indicators used measure the environmental effectiveness of countries and ensure that investment efforts yield the best benefits. These indicators assess how close countries are to meeting sustainability standards by providing data to identify key obstacles and challenges. They also offer information on successful environmental protection practices implemented in developed countries that could be beneficial if applied elsewhere. The Environmental Performance Index report serves as a motivation for countries to improve their environmental performance and enhance their ability to compete globally. (Mahmoud, 2024)

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الترتيب EPI 2024	الدولة alamarabi.com	الترتيب 2020-14				EPI 2022	EPI 2024	EPI 2024 محاور alamarabi.com		
		2014	2016	2018	2020			الحد من تغير المناخ	صحة البيئة	حيوية النظام البيئي
1	استونيا	20	8	48	30	14	75.3	82.8	63.9	76.6
2	لوكسمبورغ	2	20	7	2	6	75.0	62.4	74.6	83.6
3	المانيا	6	30	13	10	13	74.6	64.9	75.4	80.5
4	فنلندا	18	1	10	7	4	73.7	71.8	85.6	68.4
5	المملكة المتحدة	12	12	6	4	2	72.7	67.8	77.4	73.3
6	السويد	9	3	5	8	5	70.5	62.9	85.5	67.3
7	النرويج	10	17	14	9	20	70.0	52.6	86.3	72.6
8	النمسا	8	18	8	6	8	69.0	54.1	70.0	78.2
9	سويسرا	1	16	1	3	9	68.0	59.4	75.6	69.4
10	الدنمارك	13	4	3	1	1	67.9	67.1	76.9	63.5

Source: (Arabi, 2024)

The Environmental Performance Index found that many countries that were leading in achieving sustainability goals have lagged or stalled, highlighting the challenges of reducing emissions in hard-to-decarbonize industries and resistant sectors such as agriculture. In many countries, recent declines in agricultural greenhouse gas emissions have been the result of external conditions rather than policy measures.

Estonia topped the ranking, advancing 13 points, due to its success in reducing greenhouse gas emissions by 40% over the past decade by replacing oil shale power plants with clean energy sources. Estonia plans to achieve a carbon-neutral energy sector and public transport network by 2040.

Luxembourg ranked second, advancing by 5 points, and excelled in the Ecosystem Vitality pillar, as more than 55% of its land is under protection.
Germany ranked third, advancing by 10 points, due to its rapid deployment of renewable energy and comprehensive waste management practices.
Finland ranked fourth, excelling in the Environmental Health category with a score of 85.6, particularly in heavy metal management (99.3), water and sanitation (95.2), and air quality (82.2).

The United Kingdom ranked fifth, achieving high scores in Environmental Health (77.4), especially in heavy metal management (95.7), water and sanitation (98.2), and air pollution control (92) within the ecosystem vitality category.

Sweden excelled in the Environmental Health category with a score of 85.5, particularly in heavy metal management (100), water and sanitation (97), and air quality (81.2).
Norway (advancing 13 points) and Switzerland excelled in the Environmental Health category, scoring 86.3 and 75.6, respectively, while Austria led in the Climate Change Mitigation category with a score of 78.2. Denmark dropped from first place in the Environmental Performance Index in 2020 and 2022 to tenth place, as the pace of decarbonization slowed due to the transition from coal to natural gas for electricity generation and the expansion of renewable energy. This indicates that energy generation alone is not sufficient.

As for the results of the Environmental Performance Index (EPI) for Arab countries in 2024, which included 17 Arab nations, the United Arab Emirates ranked first in the Arab world and 53rd globally, followed by Oman in second place regionally and 54th globally, Jordan in third place regionally and 74th globally, and Qatar in fourth place regionally and 79th globally.

Regarding the Arab countries that received the lowest rankings, Morocco ranked 11th in the Arab world and 125th globally, Bahrain ranked 14th in the Arab world and 151st globally, and Iraq ranked last, 17th in the Arab world and 172nd globally. Iraq's low ranking, according to the Environmental Performance Index results, is attributed to poor ecosystem management and inadequate efforts to mitigate climate change.

3.3.2. Evaluation of the Environmental Performance Index (EPI) for the year 2024.

First: The Positives of the Environmental Performance Index are: (Mahmoud, 2024)

- The index provides a scorecard that highlights leaders and laggards in environmental performance and offers practical guidance for countries aspiring to move toward a sustainable future. Its indicators provide a way to identify issues, set goals, track trends, understand outcomes, and determine best policy practices.
- The Environmental Performance Index uses statistics to assess the level of sustainability worldwide. These metrics show how close countries are to achieving their nationally stated environmental policy goals.
- The Environmental Performance Index is considered more accurate than other reports because it uses outcome-oriented indicators. Good data and fact-based research can also help policymakers narrow their goals, improve relationships with key stakeholders, and maximize the return on investment in the environment.
- The Environmental Performance Index is a powerful policy tool that can help achieve the United Nations' Sustainable Development Goals and move society toward more sustainable development. The Environmental Performance Index produces a scorecard that recognizes environmental leaders and laggards and provides practical recommendations for countries striving for a more sustainable world.

Secondly: The Criticisms Directed at the Environmental Performance Index are as follows: (Arabi, 2024)

The criticisms included the adjustment of the weights of certain variables, which led to a reduction in the weight of some indicators in which certain countries had performed well. Additionally, indicators such as agricultural biodiversity, soil productivity conservation, and food loss and waste were not included, despite the fact that these indicators could be crucial for developing countries with large agricultural populations.

The methodology of the Environmental Performance Index has also been criticized for its arbitrary selection of metrics, which may lead to bias, and its poor performance as an indicator of environmental sustainability. Additional criticisms focus on the index's lack of specific policy recommendations and weighting biases against countries that lack data, resulting in the neglect of environmental progress in developing countries.

4. Green Intellectual Capital as a Fundamental Pillar for Sustainable Environmental Performance:

4.1. The Role of Green Practices in Supporting Environmental Sustainability:

Sustainability, in general, is an absolute necessity for any organization that seeks to achieve its goals and gain a competitive advantage that sets it apart from its rivals. Therefore, it is essential to adopt appropriate green practices and green business functions, as these serve as a fundamental pillar in building environmentally sustainable institutions. Some people believe that environmental responsibility is limited to technical and technological aspects. However, the truth is that the human element plays a crucial role in the success of any environmental initiative. For this reason, Green Human Resource Management (GHRM) is considered one of the most important strategies aimed at enhancing environmental efforts and striving to achieve environmental sustainability. To make an organization green, it is necessary to adopt a green work approach, which includes a set of policies and practices that promote environmental conservation and reduce the negative environmental impacts of various activities. This approach involves dealing with natural or renewable materials, adopting green buildings, reducing plastic use, improving energy efficiency, adopting eco-labeling, reducing raw material consumption, embracing green packaging, distributing and promoting products in environmentally friendly ways, and providing green customer services. Additionally, it includes waste management, directing research and development towards environmental innovations, and adopting green accounting and finance practices as part of the organization's comprehensive sustainability strategy. Green intellectual capital is considered a fundamental factor in making an organization sustainable. (Mohammad Muzahidul Islam, 2019, p. 8)

4.2. The Relationship Between Green Intellectual Capital and Environmental Sustainability:

The success of organizations of various types largely depends on the extent to which green intellectual capital is applied and green ideas are translated in an environmentally friendly manner to preserve available resources for future generations from waste. This, in turn, benefits the organization, society, and the environment. Green intellectual capital is an essential part of achieving proactive sustainability in organizational operations, as well as helping organizations meet market trends in sustainable development and environmental issues. Environmental sustainability refers to the ability to maintain a balance between present and future needs while also protecting environmental resources. In order to enhance the environmental sustainability of organizations and maintain their competitiveness, these organizations need to consider their green intellectual capital, as it is one of the most important strategic resources for their success (Yacob, 2019, p. 9). From the resource-based view, which assumes that the successful implementation of an organization's strategy to achieve competitive advantage and preserve the environment depends on the use of intangible, valuable, rare, and unique resources, green intellectual capital is considered a valuable and unique resource for organizations. In fact, it is one of the most important organizational resources that support economic growth, survival, performance, and social development. This is because it is likely to be rare, irreplaceable, and difficult to imitate. Organizations need individuals with knowledge and excellent expertise and skills in solving complex problems they face at work, in addition to possessing high competence in making sound and effective decisions under work pressures. (Jawad, 2024, p. 153)

Organizations that work on developing their green intellectual capital will be able to improve environmental sustainability in their operations (Mahdi, 2019, p. 74). In the same context, focusing on the role of qualified green intellectual capital within the organization can enhance awareness of environmental regulations and compliance with them, leading to improved environmental performance. Additionally, green intellectual capital, particularly green human capital, can facilitate the organization's ability to identify, embrace, and value its intangible resources in order to shape and implement agile green strategies that enhance environmental performance (Malik, 2022, p. 439), There is a positive relationship between green human capital and business sustainability. The greater the awareness among employees, the more sustainable their businesses will be. Additionally, employing green ideas contributes to offering environmentally friendly products and conserving resources. Therefore, most organizations strive to implement green thinking across all their departments and to develop their human resources accordingly. (Imam, 2022, p. 283)

4.3. The Impact of Green Intellectual Capital Dimensions on Enhancing Sustainable Environmental Performance:

The impact of green intellectual capital dimensions in enhancing sustainable environmental performance is as follows:

4.3.1. Green Human Capital and Sustainable Environmental Performance:

Green human capital is one of the prominent prospects for organizations to achieve a competitive advantage. Researchers have confirmed that human capital is one of the fundamental strategic resources behind organizational success, as employees play a crucial role in business sustainability amid accelerating environmental changes. Additionally, employees' advanced knowledge and skills enhance productivity. Accordingly, the continuous development of skills improves work efficiency, reduces decision-making errors, and enhances work quality, leading to higher performance. It is worth noting that organizations today also consider environmental aspects, leading to the exploration of the role of green human capital in business sustainability. Consequently, green human capital facilitates an organization's ability to identify its intangible resources and shape its response to environmental changes. (Ismail, 2021, p. 4)

Human resources are very important for developing organizational sustainability because they help improve organizational performance in its three dimensions (economic, environmental, and social). Additionally, there is a positive impact between the level of education, knowledge creation, and employee behavior. However, several studies have shown that green human capital has no impact on the sustainability performance of manufacturing organizations in Malaysia. In contrast, research conducted on non-financial organizations in India has proven that there is a significant relationship between green human capital and sustainable organizational growth. (S. Y. Malik, 2020, p. 3228) Green human capital also creates ethical principles and an organizational culture related to sustainability values within the organization. (Tjahjadi(B), 2023, p. 798)

4.3.2. Green Structural Capital and Sustainable Environmental Performance:

It is important to note that green human capital alone is not sufficient to achieve environmentally friendly outcomes, especially in the absence of the required organizational structure, information systems, and necessary strategies. This is because institutions cannot achieve good performance if they have flawed systems. Institutions with green structures motivate employees to continuously

acquire knowledge, thereby enhancing the organization's capabilities and placing it in a strong competitive position. Therefore, green structural capital facilitates the implementation of environmentally friendly behaviors within the organization, leading to improved environmental performance. (Berhal, 2024, p. 160)

Having structural capital along with a strong collaborative environment enables an organization to motivate employees and other stakeholders to transfer and absorb more knowledge. On the other hand, organizations with weak systems and procedures tend to fail in maximizing performance and achieving their goals, as the policies and structures established by the organization are crucial for ensuring its sustainability. Therefore, organizations need a well-structured organizational framework to implement corporate social responsibility (CSR) strategies. Many studies highlight the positive impact of green structural capital on organizational performance. For example, green structural capital has a positive effect on the development and innovation of environmental products. Additionally, green corporate social responsibility strategies can encourage the creation of sustainable green structural capital, including organizational capabilities, processes, organizational culture, corporate image, and the enhancement of organizational values and performance. (M. Y. Yusliza, 2020)

4.3.3. Green Relational Capital and Sustainable Environmental Performance:

Green relational capital refers to an organization's intangible assets based on its relationships with suppliers, customers, the green innovation network, and partners in environmental management, with the aim of gaining competitive advantages. Every organization seeks to obtain information from stakeholders through communication with them to achieve positive organizational outcomes. Notably, cooperation in the green economy helps spread environmental awareness among partners, which can translate into better environmentally friendly behaviors. Moreover, the green connection between partners, including suppliers, has gained significant recognition in recent years for its contribution to enhancing environmental responsibility as well as its impact on environmental performance (Berhal, 2024, p. 160).

Good relational capital management enables the exchange of information between the organization and its stakeholders, thereby allowing the organization to obtain relevant information. The greater the interaction with stakeholders, the better the organizational relationships, as cooperation is essential to fostering sustainable knowledge exchange and environmental awareness. Therefore, knowledge sharing and collaboration are necessary for adopting sustainable practices. Green relational capital has a significant and positive relationship with organizational sustainability. A study on industrial organizations in Korea demonstrated that green relational capital positively affects organizational sustainability. Additionally, green relational capital can influence corporate social responsibility activities, as organizations are concerned with social and environmental issues that align with stakeholder expectations. Therefore, green relational capital must be properly managed for an organization to gain a competitive advantage. Well-managed environmental and social aspects can contribute to developing the organization's culture and image while reinforcing its commitment to sustainability.(Tjahjadi(B), 2023, pp. 798-799)

5. Conclusion:

In conclusion, it is evident that green intellectual capital serves as a vital approach to enhancing sustainable environmental performance within organizations. By focusing on knowledge, creativity, and innovation in the field of sustainability, organizations can achieve significant improvements in their environmental performance, contributing to the reduction of negative environmental impacts and the promotion of social responsibility. Green intellectual capital is also considered a fundamental pillar in addressing current and future environmental challenges. Investing in this field not only enhances environmental performance efficiency but also helps build a strong corporate reputation, which positively impacts all stakeholders. Therefore, it is essential for organizations to continue developing and strengthening this type of intellectual capital to achieve their sustainable environmental goals.

5.1. Hypothesis Testing:

The First Hypothesis: Green intellectual capital is a set of intangible assets related to knowledge, innovation, and human capabilities that contribute to enhancing sustainable environmental practices within organizations. This type of capital focuses on applying environmental sustainability concepts across various business aspects by developing green technologies, improving resource efficiency, and raising employees' awareness of environmental responsibility.

The Second Hypothesis: The principles of environmental sustainability are a set of principles aimed at preserving the environment and natural resources for future generations. These principles include environmental justice, conservation of natural resources, pollution reduction, recycling and reuse, sustainable development, biodiversity, and green innovation.

Hypothesis Three: There is a noticeable improvement in the ranking of Arab countries according to the 2024 Sustainable Environmental Performance Index. The 2024 Environmental Performance Index covered 17 Arab countries. The United Arab Emirates ranked first among Arab countries and 53rd globally, followed by Oman in second place among Arab countries and 54th globally, Jordan in third place among Arab countries and 74th globally, and Qatar in fourth place among Arab countries and 79th globally. As for the Arab countries with the lowest rankings, Morocco ranked 11th among Arab countries and 125th globally, Bahrain ranked 14th among Arab countries and 151st globally, and finally, Iraq ranked 17th among Arab countries and 172nd globally. According to the Environmental Performance Index results, Iraq's low ranking is due to poor ecosystem management and inadequate measures to mitigate climate change.

The Fourth Hypothesis: The application of green intellectual capital positively contributes to improving sustainable environmental performance in organizations. Through the study, it is found that organizations that build green intellectual capital with its dimensions human, structural, and relational by investing in knowledge, innovation, and sustainable technology achieve better environmental performance than organizations that do not adhere to these principles

5.2. Study Results: The most important findings reached are as follows:

- Green intellectual capital represents a qualitative shift in the way the economy and sustainable development are understood. This concept reflects the recognition that investing in knowledge, skills, and education, as well as preserving the environment and natural resources, is essential;
- Investing in green intellectual capital enables institutions to develop effective strategies that align with the global community's aspirations for sustainability. It also opens the

door to innovations related to sustainable technologies and environmental practices, helping to achieve a balance between economic, social, and environmental goals;

- Institutional investment in the dimensions of green intellectual capital represents a fundamental step toward building a sustainable and more efficient work environment;
- Commitment to environmental resilience is not just a choice but an urgent necessity to face future challenges. Therefore, all stakeholders in society, including businesses, governments, and non-governmental organizations, must work together to adopt effective strategies based on green intellectual capital;
- By promoting knowledge and innovation, fostering leadership and collaboration values, and adopting sustainable technologies and effective management, organizations can not only improve their environmental performance but also enhance their competitiveness in the market;
- Green intellectual capital represents a fundamental basis for achieving sustainable development and a resource-based economy;
- Green intellectual capital enhances innovation and creativity in the efficient and sustainable use of resources, contributing to economic development and improved quality of life, while simultaneously preserving the environment and mitigating the negative impacts of economic growth on nature.

5.3. Recommendations: Based on the study results, a number of recommendations can be proposed:

1- Companies should encourage their employees to adopt and promote environmentally friendly practices. This can be achieved through various mechanisms, such as having senior management establish programs to reward employees for their excellence and commitment to implementing these practices.

2- Using modern technology in environmentally friendly production processes by recycling waste and managing production with renewable energy sources, such as relying on solar energy.

3- Developing a sense of greater responsibility among individuals in institutions towards the environment and nature, and working to implement practices that protect and preserve the environment.

4- Working on raising awareness among employees about the important and effective role of green intellectual capital in creating an environmentally friendly workplace and overcoming environmental challenges, which contributes to achieving sustainable environmental performance.

5- The green intellectual capital should not be neglected, as it represents a significant wealth that contributes to increasing market value by adopting flexible organizational structures that facilitate communication and coordination between different departments. This allows space for creative ideas and benefits from the knowledge possessed by employees to reach decisions that achieve outstanding performance.

6- Increasing attention to green structural capital practices regarding the dissemination of organizational culture, the provision of effective work systems and procedures, the establishment of an effective incentive and reward system, and the provision of an information system and databases, due to their role in enhancing innovation and its sustainability, ultimately leading to the achievement of a sustainable competitive advantage.

7- Institutions should increase their focus on green social capital by establishing strong relationships with customers that help achieve their satisfaction and enhance retention rates.
8- Raising awareness among individuals within the company at all administrative levels about the risks resulting from improper human practices and deepening awareness of environmental issues such as global warming and recycling.
9- The necessity of motivating employees in the company to improve mechanisms of cooperation and engagement with the local community and the stakeholders benefiting from the company's products and activities, in a way that contributes to enhancing the company's reputation and image in front of its audience.
10- Work on hiring highly capable employees, as well as developing their competencies regarding environmental protection to meet general environmental expectations, and establishing a rewards system for accomplishing environmental tasks within the laboratory.
11- The management of institutions must establish mechanisms to maintain the health and safety of workers or the community and train employees on them by involving them in awareness and educational courses in the field of environmental sustainability. Additionally, strict monitoring systems should be designed for periodic inspections to assess the extent of employees' compliance.

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