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DOI:

<https://doi.org/10.21608/ijaefs.2024.313878.1030>

IJAEOFs

**International Journal of Administrative, Economic
and Financial Sciences**

Volume (3). Issue (11). Oct 2024

E-ISSN: 2812-6408

P-ISSN: 2812-6394

<https://ijaefs.journals.ekb.eg/>

Publisher

Association of Scientific Research Technology and the Arts

<https://srtaeg.org/>

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ABSTRACT

This study investigated the impact of sustainability practices on organizational performance at Alexandria National Refining and Petrochemical Company (ANRPC) in the Egyptian petroleum industry.

The study focused on quantitative data collected through pre-questionnaire implementation and follow-up with 100 employees in various sectors. The results of the culture of sustainability at the center included identifying employees, involvement in the principle of sustainability management, and best practice skills. Results showed significant improvements after implementation, with significant increases in employee engagement and sustainability performance measures. For example, employees' knowledge of growth culture improved from 2.05 to 3.98 (94.1% improvement). Employee engagement increased from 2.03 to 3.64 (79.3% improvement). Regression analysis showed that employee knowledge and participation significantly improved sustainability planning. The comparative findings revealed significant improvements in

sustainability objectives, employee satisfaction, and environmental impact, with overall sustainability outcomes achieving an improvement of 77.5%. The study concluded that incorporating sustainability into corporate strategies significantly enhances organizational performance. It recommends expanding sustainability programs in petroleum industries, investing in new technologies, increasing stakeholder participation, and gender differences have been promoted. This study highlights the transformational potential of sustainability practices in fostering a more resilient and responsible petroleum industry in Egypt.

KEYWORDS: Sustainable practices, organizational performance, petroleum sector, sustainability training program.

تحسين الأداء التنظيمي من خلال تطبيق الممارسات المستدامة (دراسة حالة في شركة الإسكندرية الوطنية للتكرير والبتروكيماويات (ANRPC))

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هدفت هذه الدراسة التعرف على تأثير ممارسات الاستدامة على تحسين الأداء التنظيمي لشركة الإسكندرية الوطنية للتكرير والبتروكيماويات (ANRPC) في قطاع البترول بمصر، وقد ركزت الدراسة على البيانات الكمية التي تم جمعها من خلال أداة استبيان تم تطبيقها على ١٠٠ موظف من مختلف قطاعات الشركة، ومن مستويات وظيفية مختلفة، وقد تضمنت الممارسات المستدامة الرئيسية التي تم دراستها الوعي الثقافي بالاستدامة بين الموظفين، والمشاركة في تنفيذ مبادئ الاستدامة، والوعي بأنظمة الجودة، والاستدامة لقياس المعرفة عن مستوى تطبيق الاستدامة

بالشركة وقد تم عمل تدريب شامل في مجال الاستدامة وتم قياس مدى التحسن المعرفي في مجال الاستدامة بنفس أداة الاستبيان بعد التدريب ومدى تأثيرها في النواحي الاقتصادية والاجتماعية والبيئية وقد تم عمل تحليل إحصائي للبيانات قبل وبعد التدريب باستخدام اختبار ANOVA بالإضافة إلى تحليل الانحدار ونماذج الانحدار المتعدد وتحليل التباين، وأسفرت النتائج عن تحسن كبير في جميع الجوانب المدروسة، كما أظهرت النتائج أن نسبة التحسن في المعرفة بثقافة الاستدامة بلغت ٩٤,١٪، حيث ارتفعت من ٢,٠٥ إلى ٣,٩٨، كما زادت مشاركة الموظفين في ممارسات الاستدامة من ٢,٠٣ إلى ٣,٦٤، بنسبة تحسن قدرها ٧٩,٣٪، كما كانت نسبة التحسن في الجانب الاقتصادي ٧٧,٥٪، والجانب الاجتماعي ٦٥,٢٪، والجانب البيئي ٨٢,٤٪.

وقد أشارت نتائج الدراسة إلى تحسن كبير بعد تعرض العاملين بالشركة للبرنامج التدريبي على الاستدامة، مع زيادات ملحوظة في مشاركة الموظفين ومعايير أداء الاستدامة، كما كشفت تحليلات الانحدار أن وعي الموظفين ومشاركتهم قد حسنت بشكل كبير فعالية برامج الاستدامة داخل الشركة، كما أظهرت التحليلات المقارنة تحسناً كبيراً في تحقيق أهداف الاستدامة، ورضا الموظفين، والأثر البيئي، وقد أوصت الدراسة بضرورة التوسع في تطبيق مبادرات الاستدامة بالقطاعات البترولية المتنوعة، والاستثمار في الابتكارات التكنولوجية، وتعزيز مشاركة العاملين في برنامج الاستدامة، وبهذا تسلط هذه الدراسة الضوء على ضرورة دمج الاستدامة في الاستراتيجيات والسياسات المؤسسية، مما لها دور لتعزيز التنمية المستدامة في شركات الطاقة والبترو في قطاع البترول المصري، مما يجعل صناعة البترول أكثر مرونة في تطبيق الاستدامة.

الكلمات الرئيسية: الممارسات المستدامة، الأداء التنظيمي، قطاع البترول، تطبيق الاستدامة.

1. INTRODUCTION:

In recent years, the global industrial landscape has shifted towards sustainability and environmental stewardship. Organizations now recognize the importance of balancing economic growth with social and environmental responsibilities for long-term success. The petroleum refining industry faces unique challenges due to its substantial environmental impact and the demand for cleaner

energy. This study explores the potential for improving organizational performance by applying sustainable practices in Egypt's petroleum sector. The petroleum refining industry plays a vital role in the global economy, supplying essential fuels and raw materials. However, its operations are linked to significant environmental and social issues, such as greenhouse gas emissions, pollution, and resource depletion. Thus, petroleum companies must adopt sustainable practices to minimize their environmental footprint while enhancing efficiency and competitiveness. The sector's large environmental footprint, including emissions, wastewater, and solid waste, demands higher accountability (Kaufmann, 2023). Addressing global issues like climate change and resource scarcity requires balancing business objectives with environmental and social responsibility (Fallah Shayan et al., 2022).

Long-term success and public expectations for environmental management necessitate integrating sustainable practices into corporate strategy (Góes et al., 2023). Efforts include increasing energy efficiency, reducing emissions, conserving water, managing waste, and engaging with communities (Alamosh, 2021). The global challenges of oil and energy sustainability are multifaceted. Water extraction, treatment, fuel combustion, and petrochemical production (Liu et al., 2023) are still linked to critical issues such as oil spills, toxic pollutants, and greenhouse gas emissions. Enterprises in this area must prioritize supporting green technology, improving energy efficiency, responsibly managing waste and carbon dioxide, promoting community development, and providing accurate reporting (d'Amore, 2020).

A study conducted by Soeherman in 2023 has revealed several advantages linked to the implementation of sustainable practices, including increased efficiency, reduced operating costs, beneficial partnerships, enhanced company reputation, increased profitability, long-term viability, increased market share, talent acquisition, and competitive advantage (Danso et al., 2020). Despite these benefits, there are significant challenges in implementing sustainable practices within the PRS. These include a lack

of awareness and commitment to sustainability among corporate leaders, resistance to operational change, and a focus on short-term profitability that can undermine long-term sustainable practices (Pasaribu et al., 2020).

Addressing the need for standardized guidelines and best practices, the ISO 20121 standards for sustainable events have emerged as widely accepted benchmarks in various industries. ISO 20121 addresses important issues such as sustainability practices, stakeholder engagement, and continuous improvement (Fasoulis et al., 2023). Compliance with ISO 20121 guidelines enables energy companies to demonstrate their commitment to sustainable development and corporate responsibility (Balía & Saragih, 2023).

Despite the solid theoretical basis for sustainability in the PRS, there is a notable lack of research on practical implementation strategies and performance evaluation, particularly regarding aligning the ISO 20121 standard with organizational contexts. This study aims to address this gap by examining the broader context of the PRS. The primary aim is to evaluate the potential for enhancing organizational performance in the PRS by applying sustainable practices. Using the survey method, this study examines the impact of sustainability initiatives on environmental performance, stakeholder relations, and economic growth.

This study addresses the lack of knowledge about sustainability integration strategies in the PRS, especially those compliant with ISO 20121.

This will be done through the study of the following:

- To what extent do sustainability practices developed in the Egyptian PRS comply with established industry standards, particularly ISO 20121?
- How do the critical components of sustainable practices employed in the petroleum sector in Egypt impact its economic, social, and environmental performance?

- How do stakeholders, including employees, perceive the effectiveness and impact of sustainability practices within the PRS in Egypt?

2. LITERATURE REVIEW:

Sustainable practices in the Petroleum Refining Sector (PRS) focus on minimizing environmental impact, promoting social responsibility, and ensuring long-term economic viability. These practices are driven by concerns about climate change, resource depletion, and responsible business conduct (Cancela et al., 2023). Energy efficiency is critical, with refineries benefiting from process optimization and energy-efficient equipment, such as combined heat and power (CHP) systems, which reduce greenhouse gas emissions and operating costs (Alamosh, 2021; Nuroobi et al., 2020). Water resource management is also vital, with conservation, recycling, and advanced treatment technologies minimizing freshwater consumption and environmental impact (Liu et al., 2023; Pasaribu et al., 2020). Waste management strategies aim to minimize waste generation, promote recycling, and ensure safe disposal, often through advanced catalytic processes that convert waste into valuable products (Góes et al., 2023; Fasoulis et al., 2023).

Air emissions reduction remains a key focus, utilizing flue gas desulfurization, selective catalytic reduction, and leak detection and repair (LDAR) programs to minimize pollutants (Balía & Saragih, 2023; d'Amore, 2020). Additionally, integrating renewable energy sources like solar and wind power can significantly reduce reliance on fossil fuels and decrease refineries' carbon footprint (Gusariandari, 2023; Kaufmann, 2023). Sustainable practices extend to social dimensions, including community engagement and stakeholder relations. Companies increasingly focus on building positive relationships with local communities through development programs, employment opportunities, and transparent communication (Fallah Shayan et al., 2022; Cancela et al., 2023). Aligning with international standards such as ISO 20121 ensures a consistent

approach to managing environmental and social impacts, demonstrating a company's commitment to sustainability (Fasoulis et al., 2023; Balia & Saragih, 2023).

However, significant challenges remain, including high capital costs, the need for specialized expertise and training, resistance to change, and inconsistent regulations across jurisdictions (Pasaribu et al., 2020; Nuroobi et al., 2020). Collaborative efforts among industry stakeholders play a vital role in developing standards, sharing knowledge, and creating supportive policy frameworks (Góes et al., 2023).

Organizational performance in the PRS includes financial performance, operational efficiency, environmental sustainability, and social responsibility. Non-financial performance measures are increasingly recognized alongside traditional financial metrics (Gadekar et al., 2022). Financial performance faces challenges from oil price volatility, high capital intensity, and the costs of environmental regulations (Nuroobi et al., 2020).

Improving operational efficiency through technologies like process automation and data analytics significantly impacts financial performance and sustainability (Pasaribu et al., 2020; Góes et al., 2023). Sustainable practices also enhance environmental sustainability by improving key indicators such as carbon emissions, water consumption, and waste generation (Alamosh, 2021; Liu et al., 2023).

Social responsibility, essential for fostering community engagement and ensuring employee well-being, is reflected in community involvement, employee satisfaction, and safety performance. Initiatives like community programs and employee training enhance stakeholder relationships and organizational reputation (Fallah Shayan et al., 2022; Cancela et al., 2023). Frameworks like the Global Reporting Initiative (GRI) and the Sustainability Accounting Standards Board (SASB) ensure accountability and transparency in measuring organizational performance (Fasoulis et al., 2023; Balia & Saragih, 2023).

Despite recognizing non-financial performance measures, challenges remain in integrating sustainability into performance management. These include the lack of standardized metrics and difficulty quantifying business value. Collaborative efforts to develop best practices and create supportive policies are necessary (Pasaribu et al., 2020; Góes et al., 2023).

As seen with CHP systems, sustainable practices offer potential cost savings and efficiency gains, which reduce operating costs and improve profitability by saving energy and reducing emissions (Pasaribu et al., 2020; Góes et al., 2023). Companies committed to sustainability build positive relationships with customers, investors, and communities, enhancing reputation and stakeholder relations through community programs and transparent communication (Alamosh, 2021; Liu et al., 2023).

More empirical research and case studies are needed to understand the relationship between sustainable practices and organizational performance in the PRS. This research should examine the specific mechanisms and contextual factors influencing this relationship through Quantitative methods (Nuroobi et al., 2020).

The relationship between sustainable practices and organizational performance in the PRS is multifaceted, characterized by potential benefits, trade-offs, and various influencing factors. By embracing and integrating these practices into performance management, companies can enhance sustainability and create long-term value for stakeholders, ultimately contributing to a more responsible and resilient industry.

3. THEORETICAL BACKGROUND:

The relationship between sustainable practices and organizational performance in the Petroleum Refining Sector (PRS) can be understood through several theoretical frameworks. These theories provide a foundation for understanding the mechanisms

through which sustainability initiatives can influence various dimensions of organizational performance, including financial, environmental, and social aspects.

One of the critical theories that underpin this relationship is the Stakeholder Theory, which posits that organizations have a responsibility to consider the interests of various stakeholders, including shareholders, employees, customers, suppliers, and the broader community (Nuro Obi et al., 2020). According to this theory, companies that engage in sustainable practices are more likely to build positive relationships with their stakeholders, improving reputation, increasing customer loyalty, and enhancing employee engagement (Nuroobi et al., 2020). These factors, in turn, can contribute to better financial performance and long-term organizational success (Pasaribu et al., 2020).

The Institutional Theory also provides insights into adopting sustainable practices in the PRS. This theory posits that organizations are influenced by the institutional pressures and norms within their operating environment, including regulatory requirements, industry standards, and societal expectations (Fasoulis et al., 2023). In the context of sustainability, the Institutional Theory suggests that companies in the PRS are more likely to adopt sustainable practices when they face pressure from stakeholders, such as governments, investors, and customers, to conform to sustainability standards and expectations (Liu et al., 2023). Compliance with sustainability standards, such as ISO 20121, can help companies gain legitimacy and social acceptance, improving organizational performance (Fasoulis et al., 2023).

3.1 Study Aims:

1. To assess the effectiveness of sustainable practices in improving the organizational performance of the Egyptian Petroleum sector.

2. To examine the impact of stakeholder engagement and collaboration on the successful implementation of sustainable practices within the Egyptian Petroleum sector.
3. To explore the role of change management and organizational culture in successfully adopting sustainable practices within the Petroleum sector.
4. To develop a framework for measuring and evaluating the impact of sustainable practices on Petroleum sector organizational performance.
5. To provide practical recommendations and insights for other organizations in the petroleum refining industry to enhance their performance by adopting sustainable practices.

4. METHODOLOGY:

This study used a quantitative approach to assess the impact of sustainable practices on organizational performance at ANRPC. Initially, a pilot study was conducted to understand employees' sustainability practices and training needs. Insights from this pilot study guided the development of a detailed questionnaire to collect quantitative data on sustainability performance indicators. The methodology included designing and implementing targeted training programs based on these needs, followed by a post-training survey to evaluate changes in employee awareness, engagement, and the effectiveness of the sustainability initiatives. This approach gave us a well-rounded view of how sustainability practices impact organizational performance, highlighting areas where improvements can be made and offering practical recommendations to move forward.

4.1 Research Design

The study adopted an embedded survey approach, focusing primarily on quantitative data supplemented by Quantitative insights. The quantitative component involved collecting numerical data through surveys, encompassing metrics on profitability, energy use, waste costs, turnover, and sustainability expenditures. This approach facilitated a detailed examination of the relationship between sustainability practices and organizational performance (Chen & Chen, 2019).

4.2 Case Study

ANRPC is selected as a case study because of its significant role in Egypt's petroleum sector and its strong commitment to sustainability practices. This case study employed a descriptive exploratory approach to investigate the implementation of sustainable practices at ANRPC, which acts as a key player in Egypt's petroleum sector. The study thoroughly explored complex issues in a real-world setting using this approach. This gave us important insights into the detailed processes of how organizations change and integrate sustainability effects on organizational performance. (Rashid, 2019).

4.3 Sampling

The research population comprised all ANRPC employees, totaling over 2,000 individuals across various departments and levels of seniority. A stratified random sampling method was employed to select a representative sample of 100 employees, ensuring diversity and representation across different departments, employment levels, demographics, and other relevant factors (Lakens, 2022).

4.4 Data Collection

Data collection involved administering structured questionnaires to ANRPC personnel from various organizational levels and departments. The survey tool included closed-

ended questions utilizing Likert and ordinal scales to gather quantitative information on employee views and attitudes toward sustainability practices and their impact (Sammur et al., 2021). The research utilized a meticulously designed questionnaire developed by the researchers to measure sustainable practices across various sectors within ANRPC and to assess the extent of their implementation. The questionnaire was designed to measure the effectiveness of implementing sustainable practices on organizational performance.

4.5 Pre- and Post-Questionnaire Implementation

Initially, a pre-questionnaire was distributed to the 100 selected participants to assess their understanding and attitudes toward sustainability practices. The intervention training program was conducted through seven training courses and workshops for three months, as shown in Figure (1).



Figure (1): Content of workshops

The effectiveness of the training was measured by comparing the responses from the pre-questionnaire to those from a post-questionnaire after the completion of the training program to measure changes in their perceptions and the effectiveness of the sustainability training program on their performance.

The findings aimed to offer valuable insights for the broader petroleum industry in Egypt and contribute to the growing knowledge on sustainability in industrial systems.

4.6 Sustainability Action Plan for Improving Organizational Performance

ANRPC implemented an extensive action plan to integrate sustainability into its core activities as part of the sustainability initiative. This plan involved forming a dedicated sustainability team, conducting team selection interviews, and organizing internal training workshops. Employee training on sustainability included a variety of engaging topics spread across seven different courses and workshops: -Sustainability towards a Sustainable Future,- Egypt Vision 2030 and the National Agenda for Sustainable Development, -United Nations' Sustainable Development Goals (17 Goals to Transform Our World), -ANRPC's Specific Sustainability Goals, -ISO 20121 Required Documentation, -Contributing to the UN Sustainable Development Goals with ISO 20121:2012 - and Introduction to Carbon Footprint.

This plan was used as a reference program, and its effectiveness in improving organizational performance was evaluated using a questionnaire sheet.

4.7 Quantitative Data Analysis

Quantitative data were analyzed using SPSS software. Descriptive statistics summarized the data, providing insights into general trends and patterns. Inferential statistics, including correlation analysis, analysis of variance (ANOVA), and multiple regression models, were employed to identify significant predictors of organizational

effectiveness and explore the relationships between sustainability practices and performance metrics (Chen & Chen, 2019).

The outcome findings provided practical recommendations and insights for other organizations in the petroleum refining industry to enhance their performance by adopting sustainable practices.

Finally, Figure (2) Summarizes the research framework of this study.

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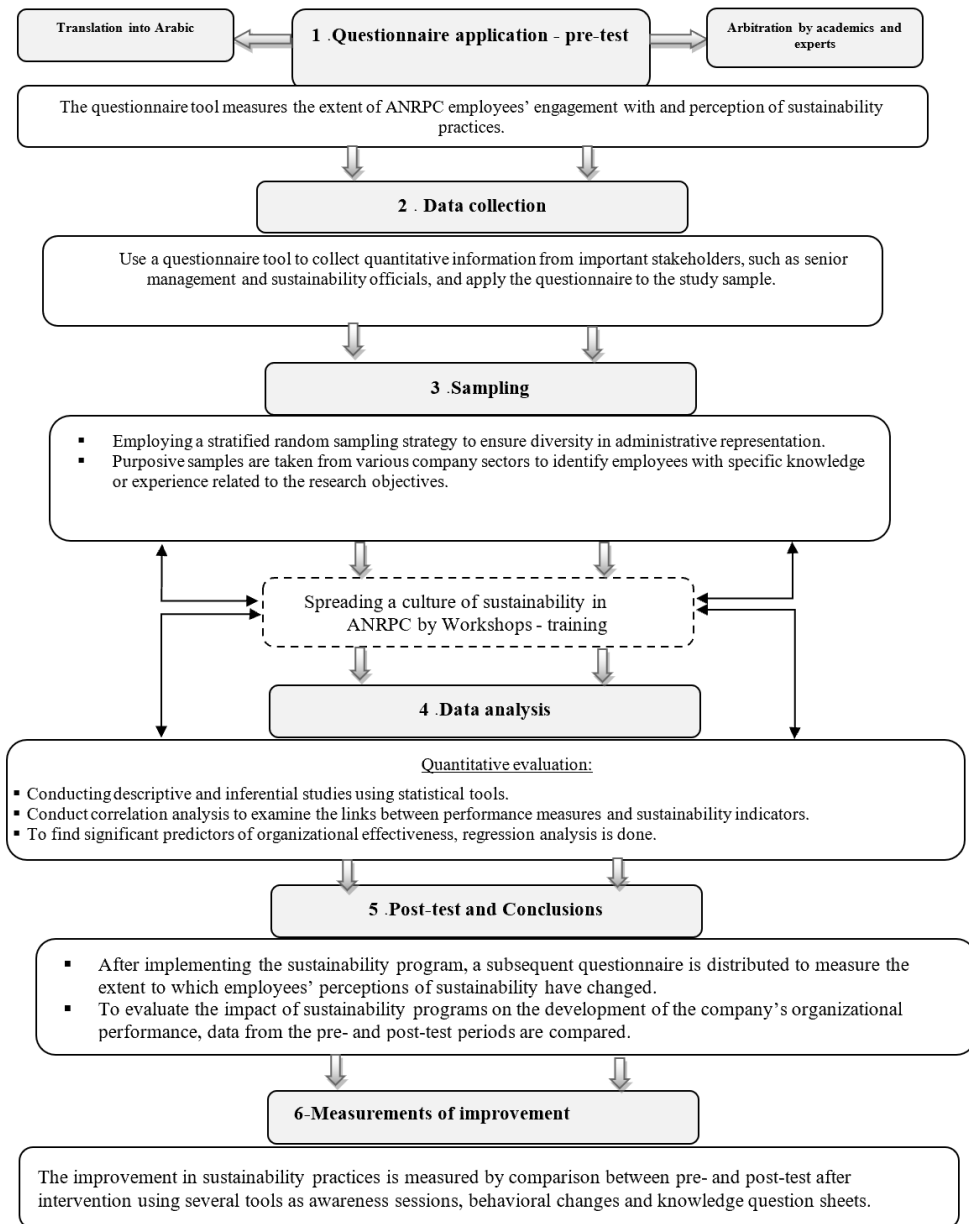


Figure (2): Summarize the research framework

5. RESULTS:

This section presents the statistical findings from the study, which examines the impact of implementing sustainable practices on organizational performance at ANRPC. The analysis includes regression models assessing pre- and post-program data and a comparative analysis of key performance indicators before and after the implementation of the sustainability program. The results show clear improvements in several areas, such as how aware employees are, their level of participation, and the overall sustainability performance. This gives us a well-rounded picture of how effective the sustainable practices we have implemented have been.

5-1 Data collection and analysis

5-1-1 sampling description

Table (1) shows the distribution of the sample studied regarding their essential characteristics. The sample comprised 100 employees from different administrative levels, 72% male and 28% female. This significant difference in gender distribution is due to the nature of work in the petroleum sector. The departments represented included General Department for Development and Technology (11%), General Department for Operations (6%), General Management for Production Planning (5%), General Management for Facilities (3%), General Management for Corporate Responsibility (3%), Energy Conservation Sector (6%), Occupational Health and Safety Sector (10%), General Management for Chemical Plants (3%), Environmental Protection Sector (6%), and other management positions. (15)

About 63% of the selected sample were joiners and senior staff responsible for implementing sustainability action plans in their departments.

Regarding years of experience in ANRPC, 46% of the sample had less than ten years of experience, 40% had between 10 to 20 years, and 14% had more than 20 years of experience. The job levels within the sample included assistant to the Company

President (2%), Department Manager (12%), General Manager (11%), Assistant General Manager (12%), Department Head (28%), and other positions. (١٣٥)

The variety of backgrounds, experiences, and roles among our team members gives us a well-rounded view of the different perspectives within the organization. This stratified approach enhances the reliability and validity of the study's findings, offering a well-rounded understanding of the impact of sustainability practices on organizational performance at ANRPC.

Table (1) Distribution of the sample studied of managers regarding their essential characteristics.

Managers Characteristics	Number	Percent
Gender		
Male	72	72.0%
Female	28	28.0%
Departments		
General Department for Development and Technology	11	11.0%
General Department for Operations	6	6.0%
General Department for Production Planning	5	5.0%
General Department for Facilities	3	3.0%
General Department for Social Responsibility	3	3.0%
Energy Conservation Sector	6	6.0%
Occupational Health and Safety Sector	10	10.0%
General Department for Chemical Laboratories	3	3.0%
Environmental Protection Sector	6	6.0%
Other Departments	47	47.0%
Years of experience in ANRPC		
Less than 10 years	46	46.0%

Managers Characteristics	Number	Percent
From 10 to 20 years	40	40.0%
More than 20 years	14	14.0%
Job levels		
Assistant to the Company President	2	2.0%
Department Manager	12	12.0%
General Department	11	11.0%
Assistant General Department	12	12.0%
Head of the department	28	28.0%
Other seniors and junior staff	35	35.0%

5-1-2 Impact of training program on percent improvement in economic, social, and environmental dimensions

Table (2) and Figure (3) compare the pre-and post-program economic, social, and environmental dimensions of sustainable practice and sustainable results at ANRPC. The figure indicates that all critical improvements in the dimensions have been demonstrated after adopting the sustainability training program. Economic practices realized a high surge in mean scores, which increased from 2.10 in the pre-program period to 3.83 in the post-program period, indicating an 82.4% improvement. Social practices also registered significant improvements, increasing from a mean of 1.97 before the program to 3.61 after the program had ended, which indicates an 83.2% improvement. Environmental practices showed a moderate increase from 3.31 to 4.51, a 36.3% improvement. All in all, total sustainable practices improved by 70.8%. The result indicates that the economic results improved from 1.91 to 3.21, which is a 68.1% improvement. Social results substantially increased from 2.46 to 4.01, marking a 63.0% improvement. Environmental results also showed a significant improvement from 2.16 to 3.56, with an improvement of 64.8%. Total sustainable results improved by 77.5%.

Overall, total sustainable results improved by 77.5%. These visual data support the statistical findings in Table (3) because they represent holistic impacts on the effectiveness of the sustainability program for ANRPC in the economic, social, and environmental senses. Large-scale improvements in practices and results reflect the positive consequences that the program had on sustainability performance.

These results indicate that the ANRPC sustainability program has yielded marked improvement in economic, social, and environmental practices and results, proving its broad effectiveness. The holistic impacts on the effectiveness of the sustainability program for ANRPC in the economic, social, and environmental senses. Large-scale improvements in practices and results reflect the positive consequences impact on the organization's sustainability performance.

Table (2): Comparison between pre and post-program Economic, social, and environmental dimensions of both sustainable practice and sustainable results.

	Pre-program	Post-program	Percent of improvement	P value
I. Sustainable Practices				
Economic	2.10±0.73	3.83±0.51	82.4	0.001*
Social	1.97±0.63	3.61±0.63	83.2	0.003*
Environmental	3.31±0.48	4.51±0.56	36.3	0.017*
Total Sustainable Practices	2.36±0.58	4.03±0.47	70.8	0.003*
II. Sustainable Results				
Economic	1.91±0.82	3.21±0.51	68.1	0.008*
Social	2.46±0.45	4.01±0.51	63.0	0.007*
Environmental	2.16±0.64	3.56±0.54	64.8	0.0086*
Total Sustainable Results	2.18±0.52	3.87±0.41	77.5	0.0042*

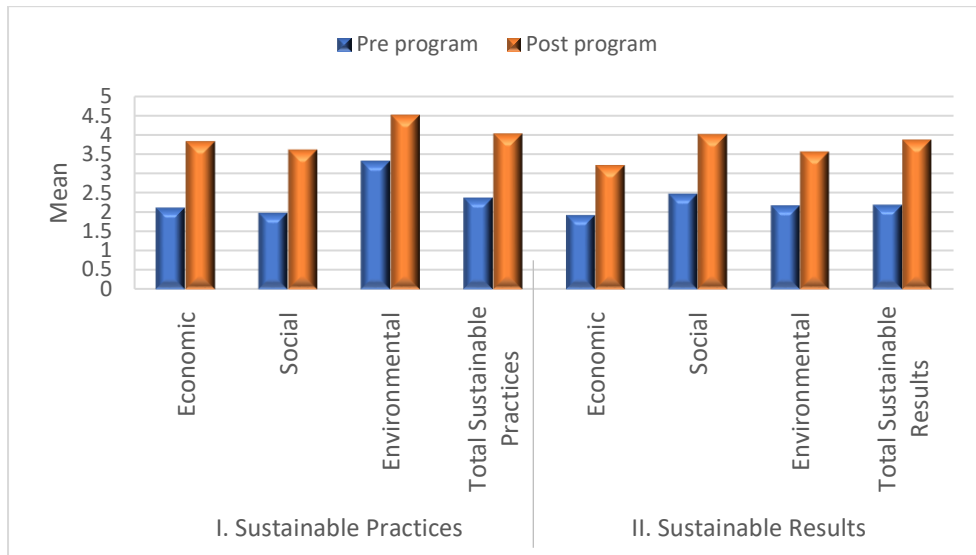


Fig. (3): Comparison between pre- and post-program Economic, social, and environmental dimensions of both sustainable practice and sustainable results.

5-1-3 Impacts of a sustainable training program on sustainable practice and sustainable results in different items.

Table (3) and figure (4) compare sustainable practice and results in different items between pre- and post-program. They depict significant improvements in all surveyed aspects of sustainability at ANRPC.

The awareness of the culture related to sustainability in employees increased from 2.05 ± 0.69 to 3.98 ± 0.43 (94.1% improvement, P value: 0.002). Employee participation in the implementation of the principles for sustainability improved from 2.03 ± 0.59 to 3.64 ± 0.61 (79.3% improvement, P value: 0.006). There was a 36.5% improvement in Employees' awareness of the quality systems implemented in the organization. Sustainable practice improved by 69.9 % (P value: 0.009).

For Sustainable Results, there was an increase of 67.7% in the performance due to the impact of the programs (P value: 0.007). There was an improvement of 62.1% in

attaining sustainability goals and standards compliance (P value: 0.0058). There was an improvement of 68.1% in employee satisfaction and impact on society and the environment (P value: 0.0081). Challenges and opportunities for sustainability improved by 78.5% (P value: 0.0094). Generally, sustainable results improved by 77.5% (P value: 0.004).

Consequently, the outcomes indicated improved employees' awareness, involvement, satisfaction, and realization of sustainability goals within ANRPC.

Table (3): Comparison between pre- and post-program items for sustainable practice and results.

	Pre-program	Post-program	Percent of improvement	P value
I. Sustainable Practices				
Employees' awareness of sustainability culture	2.05±0.69	3.98±0.43	94.1	0.002*
Employee participation in implementing sustainability principles	2.03±0.59	3.64±0.61	79.3	0.006*
Employees' awareness of the quality systems implemented in the organization	3.29±0.46	4.49±0.57	36.5	0.0086*
Total Sustainable Practices	2.36±0.58	4.01±0.46	69.9	0.009*
II. Sustainable Results				
The impact of sustainability programs on performance	1.92±0.84	3.22±0.47	67.7	0.007*
Achieving sustainability goals and compliance with standards	2.48±0.69	4.02±0.53	62.1	0.0058*

	Pre-program	Post-program	Percent of improvement	P value
Employee satisfaction and the impact of sustainability on society and the environment	2.13±0.65	3.58±0.57	68.1	0.0081*
Challenges and opportunities for sustainability at ANRPC Company	2.23±0.57	3.98±0.43	78.5	0.0094*
Total Sustainable Results	2.22±0.54	3.94±0.422	77.5	0.0041*

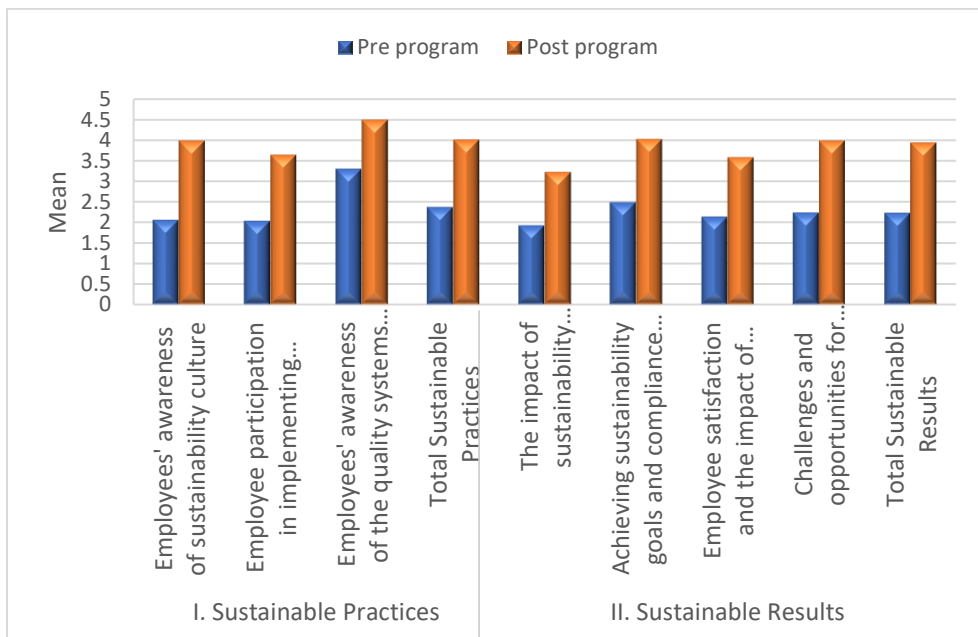


Fig. (4): Comparison between pre and post-program different items of both sustainable practice and sustainable results.

It is noticed that in most of the surveyed aspects of sustainability, there was quite a development after implementing this program. Employees' awareness of the culture of sustainability and participation in implementing its principles is on the rise, meaning training and raising awareness work effectively. Awareness of the quality systems the organization implemented also improved, which denoted the more successful integration of quality systems into daily operations. In general, sustainable practices depicted a whole deal of enhancement. On the results side, noticeable improvement in the impact of sustainability programs on performance indicated a positive effect on organizational performance. A significant increase in meeting the sustainability goals and standards showed an increase in better alignment with the set sustainability goals and adherence to standards. Employee satisfaction and impact on society and the environment increased; hence, there was a more significant satisfaction factor and positive societal and environmental impact. Issues and opportunities for sustainability in ANRPC were also efficiently recognized and responded to, consequently improving the overall sustainable outcomes. Thus, this graphical information supports statistical evidence and proves that the efforts in sustainability were indeed a success.

5-2 The regression model for various items of sustainable results affected by the pre-program of sustainable practices

Table (4) summarizes the regression model for various items of sustainable results affected by the pre-program of sustainable practices. Model 1a states the effect of various sustainable practice items and their influence on sustainability programs' performance. It was found that employee participation in implementing sustainability principles and employees' awareness of quality systems implemented in the organization significantly affect the performance of sustainability programs ($r^2 = 0.441$). The second model, 2a, expresses the effect of sustainable practice on achieving

sustainability goals and compliance with standards. It has been found that employee participation has a significant effect on implementing sustainability principles ($r^2=0.433$). The third model, 3a, represents the effect of sustainable practice on employee satisfaction and the impact of sustainability on society and the environment. Hence, only employee awareness of quality systems implemented in the organization was found to have a significant effect ($r^2 = 0.331$). Finally, the fourth model, 4a, represents the effect of sustainable practice on challenges and opportunities for sustainability at ANRPC Company. Two items significantly affect employees' awareness of sustainability culture and participation in implementing sustainability principles ($r^2 = 0.131$).

Table (4): Summary of the regression model of different items of sustainable results affected by sustainable practice pre-program

Pre-program	Model 1a	Model 2a	Model 3a	Model 4a
sustainable practice	The impact of sustainability programs on performance	Achieving sustainability goals and compliance with standards	Employee satisfaction and the impact of sustainability on society and the environment	Challenges and opportunities for sustainability at ANRPC Company
Constant	1.354 0.002	1.388 0.001	1.442 0.002	0.485 0.0001*
Employees' awareness of sustainability culture	0.197 0.063	0.037 0.730	0.082 0.478	0.977 0.017*
Employee participation in implementing	0.569 0.0001*	0.660 0.0001*	0.024 0.263	0.571 0.0001*

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Pre-program	Model 1a	Model 2a	Model 3a	Model 4a
sustainability principles				
Employees' awareness of the quality systems implemented in the organization	0.334 0.0001*	0.051 0.570	0.341 0.001*	0.072 0.477
R ² (P-value)	0.441 0.0001*	0.433 0.0001*	0.331 0.0001*	0.131 0.129

5-3 The regression model for various items of sustainable results affected by the post-program of sustainable practices

Table (5) summarizes the regression model for different items of sustainable results affected by post-program sustainable practice. Model 1b exhibits the effect of different sustainable practice items and their impact on sustainability programs' performance. It was found that employees' awareness of the sustainability culture, participation in implementing the principles of sustainability, and knowledge of quality systems implemented in the organization significantly affected sustainability programs' performance ($r^2 = 0.809$).

Model 2b describes the effect of sustainable practice in achieving sustainability goals and compliance with standards. It was found that there is a significant effect on employees' awareness of sustainability culture and participation in implementing sustainability principles ($r^2 = 0.489$).

Model 3b explains the effect of sustainable practice on employee satisfaction and the impact of sustainability on society and the environment. It was found that employees' awareness of sustainability culture and participation in implementing sustainability principles had a significant effect ($r^2 = 0.707$). Finally, model 4a presents the influence

of sustainable practice on handling challenges and opportunities for sustainability at ANRPC Company. All the items under sustainable practice had a significant influence, namely, employees' awareness of sustainability culture and participation in implementing sustainability principles ($r^2 = 0.807$).

Table (5): Summary of the regression model of different items of sustainable results which affected by sustainable practice post-program

Post program	Model 1b	Model 2b	Model 3b	Model 4b
Variables	The impact of sustainability programs on performance	Achieving sustainability goals and compliance with standards	Employee satisfaction and the impact of sustainability on society and the environment	Challenges and opportunities for sustainability at ANRPC Company
Constant	0.014 0.0096	0.964 0.017	0.026 0.009	0.318 0.0115
Employees' awareness of sustainability culture	0.701 0.0001*	0.552 0.0001*	0.479 0.0001*	0.512 0.0001*
Employee participation in implementing sustainability principles	0.622 0.0001*	0.259 0.013*	0.475 0.0001*	0.316 0.0001*
Employees' awareness of the quality systems implemented in the organization	0.233 0.006*	0.043 0.701	0.048 0.538	0.260 0.0001*

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Post program	Model 1b	Model 2b	Model 3b	Model 4b
R ²	0.809	0.489	0.707	0.807
(P-value)	0.0001*	0.0001*	0.0001*	0.0001*

5.4 Impact Factor Analysis of sustainability practices and results at ANRPC

The impact factor analysis of sustainability practices and outcomes at ANRPC revealed several key insights into the impact of implemented sustainability policies. The study identified three key factors that affect sustainability outcomes: sustainability-aware workforce culture, participation in implementing sustainability principles, and best planning skills. Before the program, these influences on business decisions were different. Post-program evaluations showed significant increases in the impact of these factors, with notable improvements in communication and the effectiveness of sustainability initiatives. Employee awareness of sustainability culture was a key factor significantly influencing performance, compliance with standards, and employee satisfaction. It also had a strong positive effect on addressing challenges. The quality of policy implementation skills continued to play an essential role in organizational performance and opportunities for improvement. The factor analysis underscores the broad and multifaceted benefits of sustainability policies at ANRPC, highlighting an integrated and high-impact approach to sustainability management. Moreover, employees' awareness of sustainability culture and their level of participation during the implementation of sustainability principles significantly influenced most of the results on sustainability, such as the impact of sustainability programs on performance and the attainment of sustainability goals. Awareness of quality systems also had a notable positive influence on performance, compliance with standards, and employee satisfaction.

So, the quality systems' awareness remained highly impacting, especially for performance and the opportunity for sustainability at ANRPC.

Fig. (5) summarizes the correlation between sustainable practices and pre- and post-training program results. The blue solid lines represent the significant effects of practices on results pre-program. In contrast, the dotted red lines represent the significant effects of different practice items on results post-program. The impacts were much more significant and interlinked.

It has been revealed that a better impact and greater reach of sustainability practices post-program means the program is highly efficient at embedding sustainability in the organizational structure. The diagram validates the numbers and proves the overall improvements brought about by the sustainability efforts that ANRPC takes pride in.

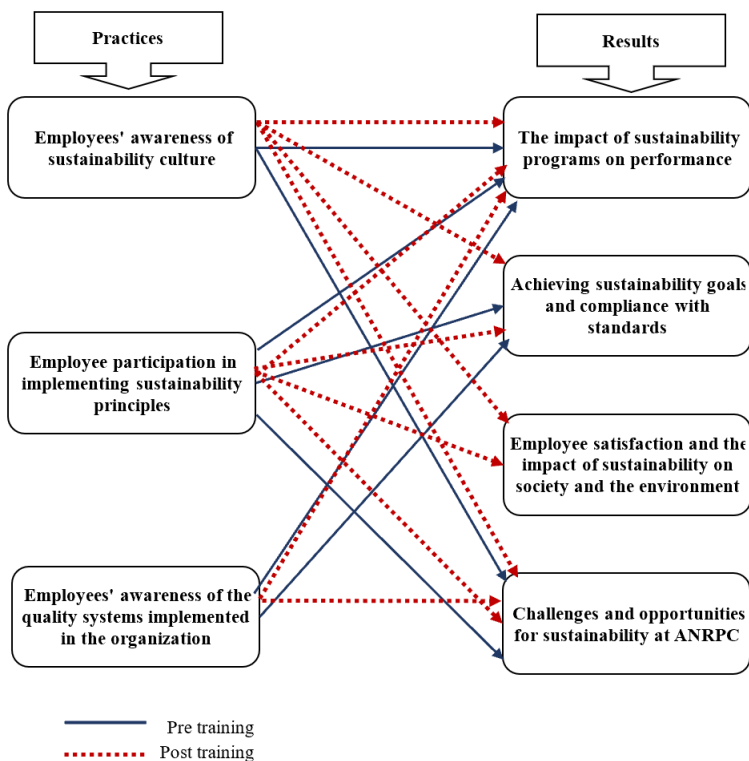


Figure 5. Summary of multiple regression results for pre and post-training.

5.5 Impact of Improvement Organizational Performance at ANRPC

The introduction of sustainability practices at the Alexandria National Refining and Petrochemical Company (ANRPC) has led to significant positive changes across various aspects of the organization. A thorough analysis comparing the situation before and after implementing these practices reveals how deeply these initiatives have influenced employees and overall company performance.

One of the most striking improvements was the awareness of sustainability among employees. The mean score for this metric jumped from 2.05 to 3.98, reflecting a remarkable 94.1% increase. This suggests that the sustainability training was informative and profoundly impactful, embedding sustainability into the everyday actions and mindset of the workforce. Additionally, participation in sustainability initiatives saw a substantial increase, with mean scores moving from 2.03 to 3.64, representing a 79.3% improvement. This indicates that employees were more aware and engaged in implementing sustainability principles.

Awareness of quality systems, a key component of successful sustainability, also improved significantly. The mean score increased from 3.29 to 4.49, marking a 36.5% enhancement. This demonstrates that the training reinforced existing knowledge while broadening the understanding of how quality systems contribute to achieving sustainability goals. The organization's sustainable practices improved significantly, with the overall score increasing by 69.9%, from 2.36 to 4.01. This substantial progress highlights the program's broad and positive influence on sustainability efforts throughout the company. Figure (6) highlights these improvements, visually illustrating the significant strides ANRPC has made in enhancing its sustainability performance.

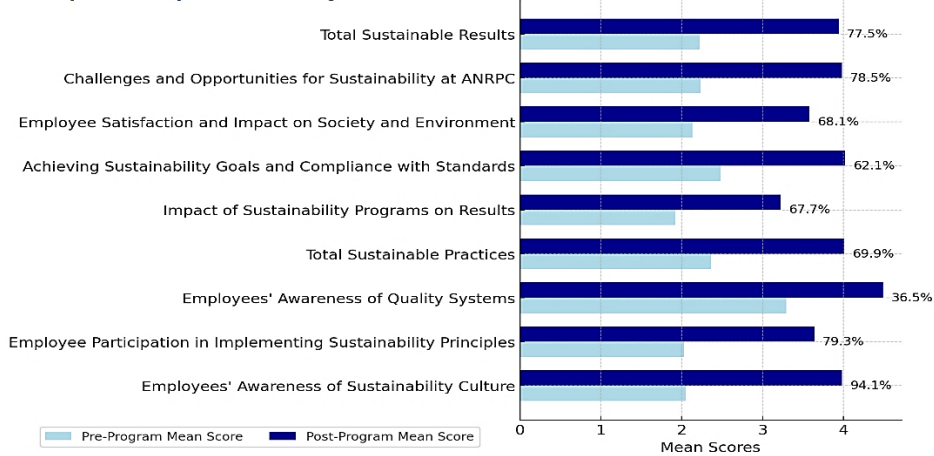
Impact of Improvement Organizational Performance in ANRPC

Figure 6. Impact of Improvement organizational performance in ANRPC

The sustainability initiatives at ANRPC reflect a positive impact on employees' awareness that effectively impacts sustainability programs on organizational performance, which outcomes improved by 67.7%, with mean scores increasing from 1.92 to 3.22. Furthermore, the organization's ability to meet sustainability goals and comply with industry standards revealed a 62.1% improvement, demonstrating these initiatives' effectiveness.

The benefits of these practices extended beyond ANRPC's internal workings. Employee satisfaction and the broader impact on society and the environment also improved notably, with scores rising from 2.13 to 3.58, reflecting a 68.1% increase. This indicates that the sustainability practices made a difference within the organization and had a positive ripple effect on its external relationships and societal contributions. The organization's ability to address sustainability-related challenges and seize new opportunities grew significantly, with scores increasing by 78.5%, from 2.23 to 3.98.

In summary, the total score for sustainable results at ANRPC improved by 77.5%, with mean scores rising from 2.22 to 3.94. This improvement highlights the significant

impact that thoughtfully implemented sustainability efforts can have on achieving suitability goals, enhancing organizational performance, and fostering a stronger, more sustainable future for ANRPC and its wider community.

6. DISCUSSION AND CONCLUSION:

This study aimed to evaluate the effectiveness of sustainable practices in improving the organizational performance of the Egyptian petroleum sector, with a specific focus on ANRPC.

This study builds on the theoretical frameworks of Stakeholder Theory (Nuroobi et al., 2020) and Institutional Theory (Fasoulis et al., 2023), offering practical insights into the mechanisms through which sustainability practices can influence organizational performance.

The questionnaire used in this study was meticulously designed to cover various aspects of sustainability practices and their impact on organizational performance. It consisted of several sections: questions focused on measuring employees' understanding and awareness of sustainability culture within the organization, assessed the extent of employee involvement in implementing sustainability principles, aimed at evaluating employees' knowledge of the quality systems implemented in the organization and their role in sustainability; measured the perceived effectiveness of the sustainability programs on organizational performance, including economic, social, and environmental dimensions; and explored the challenges faced by the organization in implementing sustainability practices and the opportunities for improvement—questionnaire to collect valuable feedback from employees at all levels and in different areas of ANRPC.

The findings revealed substantial improvements across various dimensions post-implementation of the sustainability program. The regression analysis highlights significant employee awareness, participation, and sustainability performance

enhancements. For example, employees' awareness of sustainability culture and participation in implementing sustainability principles show marked increases, which aligns with the study's objectives of enhancing internal engagement and fostering a culture of sustainability.

These results corroborate the findings of previous studies. For instance, Alamoush et al. (2021) emphasized the critical role of employee engagement in successful sustainability programs, a view supported by the significant improvements observed at ANRPC. Pasaribu et al. (2020) also noted that employee participation in sustainability initiatives positively impacts organizational performance, further validating this study's results.

Cancela et al. (2023) highlighted the importance of energy efficiency and sustainable practices in reducing greenhouse gas emissions and operating costs, consistent with the improvements in ANRPC's performance metrics. Gusariandari et al. (2023) noted that integrating renewable energy sources and advanced treatment technologies can significantly reduce environmental footprints.

Additionally, the study by Fasoulis et al. (2023) emphasized the role of compliance with sustainability standards like ISO 20121 in achieving organizational legitimacy and social acceptance. As demonstrated in this study, the improvements in achieving sustainability goals and compliance with standards at ANRPC align with these findings. The significant enhancements in environmental performance metrics align with the studies by Liu et al. (2023).

However, there are areas where this study's findings diverge from previous research. For instance, d'Amore et al. (2020) suggested that adopting sustainable practices might face significant resistance due to high capital costs and the need for specialized expertise. Contrarily, the results from ANRPC indicate that the company achieved substantial improvements despite these challenges. This suggests that the benefits of sustainability programs can outweigh the initial costs and resistance when adequately

managed. Furthermore, while Pasaribu et al. (2020) highlighted the difficulty in quantifying the business value of sustainability initiatives, this study successfully demonstrated significant improvements in key financial performance indicators. This provides empirical evidence supporting the economic benefits of sustainable practices, illustrating that integrating sustainability can lead to enhanced financial performance and broader organizational benefits. So, the organization must financially support the sustainability program.

The results of this study revealed that implementing sustainable practices at ANRPC has significantly enhanced the company's overall performance while also playing a vital role in shaping its organizational culture and nurturing the skills of its employees. The substantial improvements in awareness, participation, and compliance with sustainability standards reflect a profound shift in how sustainability is perceived and integrated within the company. This transformation has empowered employees to engage in sustainable practices, leading to a more resilient and responsible organization. The advancements in key performance metrics underscore the long-term benefits of adopting sustainability initiatives, positioning ANRPC as a leading example in the Egyptian petroleum sector. These findings highlight the potential for other organizations to achieve similar success by embracing sustainability as a core component of their business strategy, ultimately driving positive change within the industry and contributing to broader societal and environmental goals.

Moreover, this study contributes to the existing body of knowledge by validating and extending previous research findings, offering empirical evidence that supports sustainable practices' economic, environmental, and social benefits. These insights can guide future sustainability programs, ensuring that they are well-structured, effectively implemented, and aligned with industry standards, thereby achieving sustainability in the petroleum sector in Egypt.

This study has successfully achieved its objectives, demonstrating the significant positive impact of sustainable practices on organizational performance at ANRPC. The findings highlight the importance of employee awareness and participation, stakeholder engagement, and the integration of sustainability into corporate strategies. The substantial improvements in performance metrics post-implementation underscore the effectiveness of the sustainability initiatives, providing a model for other organizations in the petroleum refining industry.

7. RECOMMENDATIONS:

Based on the results of this study, the following recommendations are proposed to enhance the implementation of sustainable practices and improve organizational performance in the Egyptian petroleum sector, particularly at ANRPC:

- Create a well-rounded sustainability training program for all employees to boost their understanding, awareness, and involvement in sustainable practices. The program should cover topics such as sustainability culture, principles, quality systems, and the impact of sustainability on organizational performance.
- Establish a dedicated sustainability team within the organization to oversee the implementation, monitoring, and continuous improvement of sustainable practices. This team should set sustainability goals, develop action plans, and engage stakeholders across various departments.
- Integrate sustainability metrics into the organization's performance management system to track progress, identify areas for improvement, and ensure alignment with overall business objectives. Key performance indicators should include environmental, social, and economic aspects of sustainability.
- Foster a culture of innovation and encourage employees to propose and implement sustainability initiatives. Recognize and reward employees who demonstrate exceptional commitment to sustainability and contribute to the organization's

sustainability goals.

- Collaborate with external stakeholders, suppliers, customers, and local communities to promote sustainable practices throughout the value chain. Engage in partnerships and initiatives that support sustainable development and enhance the organization's reputation as a responsible corporate citizen.
- Invest in advanced technologies and infrastructure that support sustainable operations, such as energy-efficient equipment, renewable energy sources, and waste management systems. Conduct regular audits and assessments to identify opportunities for improvement and ensure compliance with industry standards and regulations.
- Communicate the organization's sustainability efforts and achievements to internal and external stakeholders through regular reports, newsletters, and social media channels. Transparency and accountability will enhance stakeholder trust and support for the organization's sustainability initiatives.
- Provide ongoing support and resources to employees to implement sustainable practices successfully. This may include access to training, tools, and expertise and allocating sufficient time and budget for sustainability projects.
- Regularly review and update the organization's sustainability strategy (SWOT analysis) and corrective action plans based on performance data, stakeholder feedback, and emerging industry trends. Continuous improvement and adaptation will ensure that the organization remains at the forefront of sustainable practices in the petroleum sector.
- Share best practices and lessons learned with other organizations in the petroleum industry to promote sector-wide adoption of sustainable practices. Collaborate with industry associations, research institutions, and government agencies to drive systemic change and contribute to the sector's overall sustainability.

- Expanding sustainability programs in petroleum industries, investing in new technologies, and increasing stakeholder participation have been promoted. This study highlights the transformational potential of sustainability practices in fostering a more resilient and responsible petroleum industry in Egypt.

8. LIMITATIONS & FUTURE RESEARCH:

Despite this study's significant findings and contributions, several limitations should be acknowledged. The sample size was limited to 100 employees from a single company, ANRPC. A larger, more diverse sample across multiple companies would enhance the generalizability of the results.

Additionally, this study focused on the refining and petrochemical sectors. The petroleum industry encompasses various sectors, including drilling, exploration, shipping, and pipelines, each with unique challenges and opportunities.

Furthermore, this study employed a cross-sectional design, capturing data at a single point in time. Longitudinal studies tracking the impact of sustainable practices over an extended period would provide deeper insights into their long-term benefits and challenges.

Future research should explore these various sectors to gain a more complete understanding of sustainable practices throughout the entire industry. The study also considered the context of a single country, Egypt. Egypt's regulatory environment, cultural factors, and economic conditions may differ from other countries. Comparative studies involving multiple countries would offer insights into how these factors influence the implementation and effectiveness of sustainability initiatives globally.

Future research should also explore technological innovations in advancing sustainability, the role of corporate governance and leadership in adopting sustainable practices, and the effectiveness of stakeholder engagement strategies in driving sustainability performance. These avenues will contribute to a more nuanced

understanding of sustainability in the petroleum sector, building on this study's findings and offering practical insights for both academia and industry.

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