

Green Use of Information Technology and its Impact on Enhancing Sustainable Organizational Performance: A Survey Study of the Opinions of a Sample of Employees at the North Refineries Company

Murad Mousa Abed Al Jubory

College of Administration and economics University of Mosul, Muradmusa_hwj@ntu.edu.iq

Dr. Thaeir Ahmed AL Samman

*Prof., college of Administration and economics University of Mosul,
thaeiralsamman@uomosul.edu.iq*

Abstract: This research seeks to achieve a primary objective, which is to attempt to identify the green use of information technology as an independent variable, represented by its dimensions (tangible benefit, individual user characteristics, IT characteristics, and company characteristics), and its impact on enhancing sustainable organizational performance as an independent variable, represented by its dimensions (economic performance, environmental performance, and social performance) at the Northern Refineries Company. To achieve this objective, a hypothetical model was constructed upon which a set of hypotheses were based. These hypotheses were subjected to several tests to verify their validity. The research followed the descriptive-analytical approach by designing a questionnaire designed for this purpose, which was distributed to a research sample of (500) individuals working in the company. The statistical programs (SPSS 27) and (Amos 24) were used to analyze the data. The research reached a set of conclusions, based on which a set of proposals were presented to the company.

Key words: Green use of information technology, sustainable organizational performance.



This is an open-access article under the [CC-BY 4.0](https://creativecommons.org/licenses/by/4.0/) license

Axis One: Theoretical Framework

First: Introduction: In light of the environmental challenges and increasing competitive pressures facing industrial companies in the twenty-first century, success is no longer measured solely by traditional economic criteria. This has expanded to include a company's ability to achieve a balance between profitability, environmental conservation, and social responsibility. Sustainability concepts have emerged as a strategic framework for achieving this balance, as sustainable organizational performance seeks to enhance long-term competitiveness by integrating economic, environmental, and social dimensions at the core of its operations. In this context, information technology (IT) has become an indispensable pillar for achieving these ambitious goals, particularly with the emergence of the concept of "green technology" or "green use of IT,"

which aims to efficiently use technological resources to reduce harmful environmental impacts while enhancing operational efficiency. From this perspective, the problem of the current study is summarized in the following question: How does the green use of IT contribute to enhancing sustainable organizational performance at the Northern Refineries Company?

Second: The problem of the study: Despite the growing awareness of the importance of green practices in the industrial sector, there remains a gap in the literature regarding how the green use of IT, through its multiple dimensions, can effectively contribute to enhancing sustainable organizational performance with its comprehensive components, especially in sensitive and resource-intensive operational environments such as refining and oil companies. The problem lies in the need for a deeper understanding of the relationship between these variables and how to exploit them to achieve a sustainable competitive advantage.

Third: Study Objective: The current study seeks to achieve the primary objective of identifying the impact of the green use of information technology as an independent variable—represented by its dimensions: (tangible benefit, individual user characteristics, information technology characteristics, and company characteristics)—on enhancing sustainable organizational performance. The study also seeks to identify the impact of the green use of information technology as an independent variable—represented by its dimensions: (economic performance, environmental performance, and social performance)—on enhancing sustainable organizational performance at the Northern Refineries Company.

Fourth: Hypothetical Study Plan: The study will adopt the hypothetical plan shown in Figure (1) to illustrate the impact of the green use of information technology, with its dimensions (tangible benefit, individual user characteristics, information technology characteristics, and company characteristics) on enhancing sustainable organizational performance, which includes (the environmental dimension, the social dimension, and the economic dimension) to achieve the study objective. Figure (1) represents the hypothetical study plan.

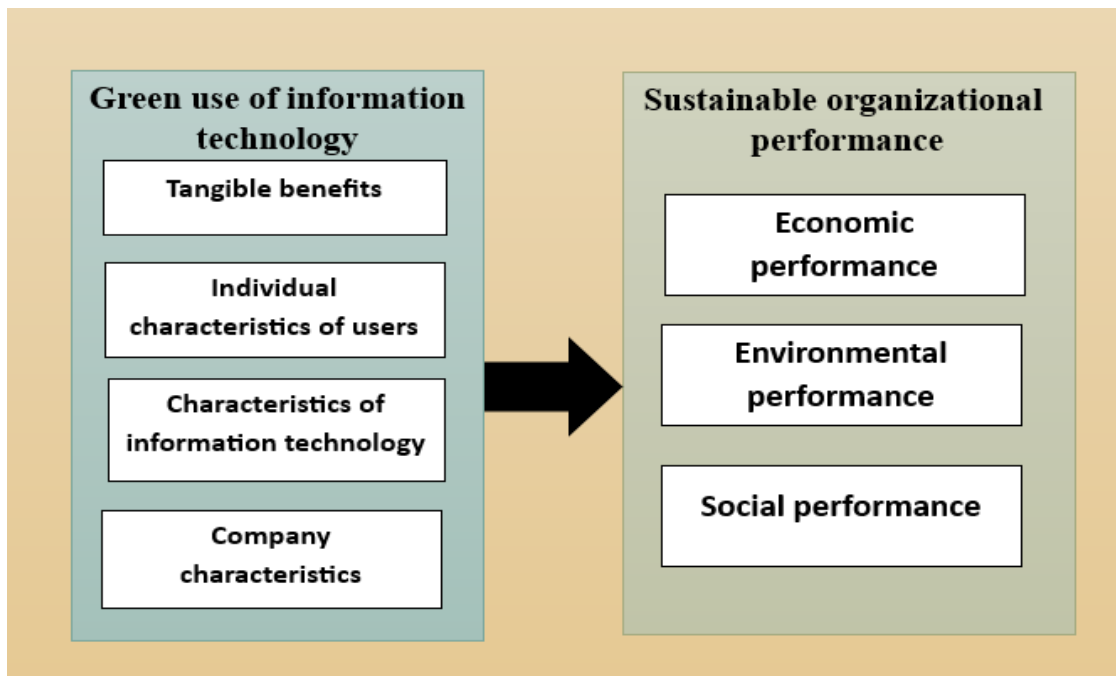


Figure (1) Hypothetical diagram

Source: Prepared by the researcher

Fifth: Study hypothesis: A hypothesis was formulated for the study variables in light of the hypothetical model of the study, as follows: There is no significant impact of the green use of information technology on sustainable organizational performance.

Sixth: Green use of information technology: Organizations can initiate and innovate in the field of environmental sustainability by setting policies with supervisory support from management, but they still depend on individuals equipped with the skills and ability to implement and execute as environmental innovators (Ramus & Steger, 2000, 12). It is not easy for the organization to transform to become greener, because this involves each individual doing his part. Therefore, this process has been linked to factors at the organizational and individual levels (Hostage et al., 2000, 66). Andersson & Bateman (2000, 31) found that individuals who possess the ability to identify, present, or embrace environmental issues play important roles in driving an organization toward environmental sustainability. Individuals working within organizations can play a significant role in communicating the strategic importance of green IT practices across the organization and allocating resources (Mithas et al., 2010, 34). In particular, their positive attitude is essential to the success of green IT practices because they influence the institutionalization of new behavior patterns in several ways, starting with influencing organizational policies and directives (Butler, 2011, 54). Unruh & Ettenson (2010, 76) show that two-thirds of executives at Toyota, General Electric, and Starbucks believe that adopting sustainable environmental initiatives is a revenue driver. A study (Liang et al., 2007, 37) indicates that the success of IT systems requires investments in complementary resources within the organization, which is only possible when individuals are committed to and integrate the IT implementation process into the organization's broader strategies and activities. While investigating the relationship between environmental attitudes and behavior, (Denis-Rémis, 2011, 115) found that in encouraging people to take environmental action, emotional appeal has a stronger effect than logical reasoning or realistic descriptions of the harmful effects of environmental pollution. In another study, (Chow & Chen, 2009) found that attitudes toward green computing are the dominant factor explaining IT users' belief or intention to practice green computing. Therefore, whether an organization takes green IT practices seriously will depend on its employees' feelings toward environmental concerns (Molla & Cooper, 2010). (Abdullah & Lim, 2023, 12) defined the green use of information technology as the strategic and responsible use of information technology resources to reduce negative environmental, social and economic impacts while enhancing long-term sustainability, while (Mat Nawi et. al., 2024, 2) defined it as the use of information technology resources in a cost-effective, environmentally friendly and energy-efficient manner through the greening of computers and related products.

Seventh: Objectives of Green IT Use: Adhikari (2023, 51) identified a set of points that express his perspective on defining the objectives of green IT use for organizations and institutions, as follows:

1. Promoting the adoption of environmentally sustainable practices and technologies in the design, deployment, and management of ICT infrastructure and services in companies and organizations.
2. Reducing the carbon footprint and energy consumption of higher education institutions by implementing energy-efficient ICT equipment and technologies.
3. Raising awareness and educating workers and employees about the importance of green ICT practices and their role in enhancing sustainable organizational performance.
4. Assisting in the development and implementation of policies and guidelines that support the integration of green ICT principles into strategic planning and decision-making in organizations and institutions.

5. Promoting the process of establishing partnerships with industry, government, and other stakeholders to promote the development and deployment of innovative green ICT solutions.

Eighth: Reasons for the Failure of Green IT Use: Green ICT can bring many benefits to an organization, but there are a number of challenges during the implementation phase, as with all organizational changes. These challenges are as follows (Jarbur, 2014, 31):

1. Lack of support and guidance from management: (Chou, 2013, 235) argues that "in order to formulate a green IT strategy, strong support from senior management is crucial." (Suryawanshi & Narkhede, 2013, 34) argue that the lack of adequate funding and support from senior management is the main challenge to implementing green ICT. (James & Hopkinson, 2009, 16) both point to the importance of funding, but (Chou, 2013, 235) and (Suryawanshi & Narkhede, 2013, 35) add that guidance and information are important factors in using green ICT. Since green ICT is a new topic for many employees, they need someone who can lead them in the right direction and helping them understand the options they can make to become greener.
2. Lack of knowledge about green IT: Suryawanshi & Narkhede (2013, p. 251) identified several challenges facing organizations using green ICT in their study of industrial and service organizations. One clear problem is a lack of knowledge about the problem. They found that there is often a lack of knowledge regarding green ICT, and employees do not fully understand their role. Many of the impacts are hidden. They cited energy costs as an example; employees often do not know how much energy their equipment consumes. Paruchuri (2011, p. 31) agrees that things like energy consumption are often not communicated to employees, and the result is that people do not know how much energy their equipment consumes, nor how to improve efficiency.
3. Lack of a comprehensive vision: The main challenge facing green ICT is the fact that a comprehensive vision is often absent in organizations. They explain (Paruchuri, 2011, 32) This is taken as an example of purchasing new equipment. The person responsible for purchasing is rarely the person who will use the equipment, and therefore will be mostly concerned with price, not operating costs or energy efficiency. (Kamilaris et al., 2014, 538) and (James & Hopkinson, 2009, 20) point out that the energy bill for ICT equipment rarely ends up in the IT department, meaning that "IT managers do not know how much energy they are consuming and therefore cannot know the extent of the emissions for which they are responsible."
4. Costs: In their study of the challenges facing green IT, (Gavrilovksa et al., 2013, 23) found that the cost of green ICT solutions is one of the biggest challenges. James & Hopkinson (2009, 21) point out that investments in green equipment and technologies often pay off very quickly due to improved efficiency, but organizations either don't realize this or can't find room in their budgets to fund even short-term investments. The cost issue is linked to the lack of a comprehensive vision, as departments will try to save money in their own area, unaware that this leads to higher costs in another area. Gavrilovksa et al. (2013, 23) again gives the example of ICT energy costs, which are typically not covered by the ICT budget.
5. Lack of Motivation: (Suryawanshi & Narkhede, 2013, 43) and (Chou & Chou, 2012, 31) stated that factors related to lack of motivation are a very important issue for users as they view it as a matter of priorities. With employees carrying high workloads, some tasks should be given lower priority. Green ICT may seem "complicated and time-consuming" and therefore it is not attempted. Establishing measures to communicate Green IT performance results to employees is important to motivate people (Jarbur, 2014, 31).

Ninth: Dimensions of the Green Use of Information Technology: In the current study, the researcher relied on the model identified by (Mahmood et al., 2001, 110), as it aligns with our

Iraqi environment and the oil sector in particular. This model identified a set of dimensions for the green use of information technology, and considered it an important driver for the success of information technology within companies to achieve the purpose for which information technology was created. To clarify these dimensions in more detail, the researcher studied each dimension separately, as follows:

1. **Tangible Benefits:** (Ge et al., 2023, 109) indicates that in a technological environment, the intention to continue using technology is influenced by the perceived benefit component. The desire to continue using technology is driven by its benefits as long as the benefits are clear. Research to date indicates that GIT attitudes are significantly influenced by perceived benefits. People are likely to have positive attitudes toward information technology in general if they believe that using the system or technology will improve their productivity or quality of life. A person's attitude toward technology can be positively influenced by their belief that technology helps them achieve their goals and deliver results. Better work on the use of green technology (Masukujjaman et al., 2021, 170).
2. **Individual characteristics of IT users:** The question of what motivates certain types of end-users to use computers has been studied, with interesting results that appear to depend on the psychological factors of different groups of individuals. For example, Kopka et al. (2023, 25) found that factors such as perceived enjoyment and fun, along with social pressures, were key in determining the level of use. Training, skill level, and organizational support were also found to be important factors in this study.
3. **Characteristics of IT:** All industrial revolutions to date have been associated with the introduction of pioneering technologies that accelerate progress and economic development, leading to major societal changes. The same applies to the Fourth Industrial Revolution, based on digital transformation, which offers new technological solutions that are causing massive changes in almost all areas of social and economic life. The introduction of modern solutions based on digital and information technologies (so-called Industry 4.0 technologies) has enabled organizations to improve their operational efficiency and competitiveness (Javaid et al., 2022).
4. **Company Characteristics:** Organizations that excel in green IT combine sustainable infrastructure, circular economy practices, energy-efficient programs, remote work policies, strong governance, employee engagement, and AI-driven optimization. These strategies align with global sustainability goals (such as the United Nations Sustainable Development Goals) and companies' commitments to environmental, social, and corporate governance. Organizations that effectively support the green use of IT typically have several key characteristics, ranging from sustainable infrastructure to environmentally friendly policies (Patel et al., 2024, 4).

Tenth: Sustainable organizational performance: Researchers and writers attribute the birth of the concept of sustainable performance to the Brundtand Commission report held in 1987 and multiple interpretations by other writers, which led to a lack of agreement on a unified concept of sustainable performance (Asif et.al, 2011: 356) and the attempt of economic units to employ their resources, which was reflected in raising the standard of living of the population, in addition to the trend to reduce the consumption of both energy and natural resources, and on the other hand, maintaining their interest in financial performance by providing appropriate financial information that serves users (Al-Eid & Al-Obaidi, 2024, 805). (Al-Eid & Al-Obaidi, 2024, 807) explained sustainable organizational performance as a term synonymous with success and excellence, and that achieving strategic superiority is nothing but a way for the survival of the economic unit and the continuity of its growth through a group of dimensions represented by economic performance, social performance, and environmental performance, while (Al-Sharkani, 2024, 61) explained it as the organization's ability to obtain The goal is to leverage resources and utilize new approaches

and methods, with the aim of achieving creativity and innovation in its activities and operations, integrating sustainability dimensions into organizational culture, and achieving superiority over competing organizations in areas of environmental, social, and economic concern. This positively impacts the organization's business development and facilitates the organization's achievement of its objectives. (Rashid et al., 2025, p. 8) argues that the dimensions of sustainable organizational performance are:

1. **Economic performance:** Writers and researchers often consider the economic dimension of organizational sustainability to be the most general and comprehensive dimension, as economic sustainability encompasses the general aspects of the organization (such as technology, innovation, collaboration, knowledge management, etc.), which must be respected alongside environmental and social aspects in order to remain in the market for the long term (Al-Zayadi and Al-Dhabawi, 2022, p. 67).
2. **Environmental Performance:** This dimension represents the alignment between the organization's activities and the protection of ecosystems. It assumes an analysis of the organization's impacts and outcomes, represented by resource consumption, by-product production (production waste), and associated emissions and pollutants. This is achieved if the organization consumes natural resources at a rate lower than natural regeneration, generating exhaust and limited emissions (Al-Zayadi and Al-Dhabawi, 2022, 67).
3. **Social Performance:** Social responsibility is a driver for organizations in the social dimension (social progress), which refers to organizations' commitment to contributing to sustainable economic development and working with employees, their families, the local community, and society as a whole to improve their quality of life (Ebner & Baumgartner, 2006, 3).

Carreno (2023, 10) agreed with Zabin and Al-Kanani (2022, 74) on identifying the benefits of sustainable organizational performance, which are explained as follows:

1. It allows the organization to understand the potential consequences of controls and other mitigation strategies. To deal with obstacles or interruptions.
2. Ensure that employees and management understand their roles and responsibilities during normal operations and during crises and disruptions.
3. Remove obstacles or interruptions that may prevent the achievement of the organization's goals.
4. Help the organization understand how it can continue to achieve its goals in the event of obstacles.
5. Build consensus and commitment to the requirements for implementing and disseminating business sustainability and continuity, which are integrated as part of the routine way the organization conducts its business.

Axis Two: The Practical Aspect

This axis includes a presentation and analysis of the findings of the field study at the company under study (North Refineries Company), based on the opinions of the study sample. This is intended to verify the study plan and test the hypotheses established in its methodology, as follows:

First: Description and diagnosis of the study variables: This section focuses on describing and diagnosing the study variables from the perspective of a sample of individuals working at the Northern Refineries Company. The researcher used ready-made programs (SPSS V27, AMOS 24) to infer percentages, frequencies, arithmetic means, standard deviations, coefficient of variation, and response rates.

➤ **Description and diagnosis of the respondents' answers to the variable of green use of information technology:**

It can be said that all answers for all dimensions of the green use of information technology variable were higher than the hypothetical arithmetic mean of (3), and that Table (1) illustrates the relative importance of the dimensions of green use of information technology from the perspective of a sample of employees at the Northern Refineries Company. Through the values of the arithmetic mean, standard deviation, and relative importance, it became clear to us that the most important dimension of the green use of information technology variable, relatively speaking, is the dimension of individual user characteristics, as indicated by the value of the arithmetic mean of (4.08) and the standard deviation of (0.84), with a relative importance of (0.82). It was followed in terms of relative importance by the dimension of organizational characteristics, as indicated by the value of the arithmetic mean of (3.93) and the standard deviation of (0.94), with a relative importance of (0.79). In third place came the dimension of tangible benefit, as indicated by the value of the arithmetic mean of (3.90) and the standard deviation of (0.92), with a relative importance of (0.78). (0.78), while the dimension of information technology characteristics was shown to be the least important dimension, as indicated by the arithmetic mean value, which reached (3.89) and the standard deviation (0.98), with a relative importance of (0.78).

Table (1) Relative importance of the dimensions of green use of information technology

NO.	Dimensions	Mean	Standard Deviation	Relative Importance	Ranking
1	Tangible benefit	3.90	0.92	0.78	Third
2	Individual user characteristics	4.08	0.84	0.82	First
3	Organizational characteristics	3.93	0.94	0.79	Second
4	IT characteristics	3.89	0.98	0.78	Fourth

Source: Prepared by the researcher based on the outputs of the SPSS V.26 program, n=500

➤ **Description and diagnosis of the respondents' answers to the sustainable organizational performance variable:**

All answers for all dimensions of the sustainable organizational performance variable were higher than the hypothetical arithmetic mean of (3). Table (2) illustrates the relative importance of the dimensions of sustainable organizational performance from the perspective of a sample of employees at the Northern Refineries Company. Using the values of the arithmetic mean, standard deviation, and relative importance, it became clear to us that the most important dimension of the sustainable organizational performance variable is the social dimension, as indicated by the arithmetic mean value of (4.12) and the standard deviation of (0.88), with a relative importance of (0.82). It was followed in terms of relative importance by the environmental performance dimension, as indicated by the arithmetic mean value of (4.02) and the standard deviation of (0.92), with a relative importance of (0.80). In third and last place came the economic performance dimension, as indicated by the arithmetic mean value of (3.93) and the standard deviation of (0.95), with a relative importance of (0.79).

Table (2) Relative importance of the dimensions of sustainable organizational performance

NO.	Dimensions	Mean	Standard Deviation	Relative Importance	Ranking
1	Economic Performance	3.93	0.95	0.79	Third
2	Environmental Performance	4.02	0.92	0.80	Second
3	Social Performance	4.12	0.88	0.82	First

Source: Prepared by the researcher based on SPSS V.26 outputs, n=500.

Second: Analyzing the Impact of Green Use of Information Technology on Sustainable Organizational Performance: The content of this analysis reflects a test of the impact relationships between the independent variable (green use of information technology) and the dependent variable (sustainable organizational performance). Table (3) shows the following:

1. There is a direct impact of green use of information technology on sustainable organizational performance, as indicated by the value of the regression coefficient (β), which reached (1.00). This impact is significant, as indicated by the probability value (P-value), which reached (0.000), which is less than (0.05). The same result is indicated by the critical value (C.R), which reached (14.302), which is greater than the tabular value, which reached (1.96), at a significance level of (0.05).
2. The value of the coefficient of determination (R-square) shows that (81%) of the changes in (sustainable organizational performance) are due to (green use of information technology) and that the remaining percentage of (19%) is attributed to other variables that were not included in the regression model.

Table (3) Results of the impact of the Green Use of IT on sustainable organizational performance

independent variable	Direction of Effect	Dependent Variable	Regression Coefficient Estimate(β)	Standard Error of Regression Coefficient SE.(β)	Coefficient of determination R-square	Critical value	P-value
						C.R.	
Green Use of IT	→	sustainable organizational performance	1.00	0.070	0.81	14.302	0.000

Source: Prepared by the researcher based on the results of the statistical analysis using AMOS V24 software, n=500.

Axis Three: Conclusions and Proposals

First: Conclusions: In light of what the researchers addressed in the theoretical and applied framework, a set of conclusions emerged that formed a basic foundation upon which to base proposals, as follows:

1. The relative importance of the dimensions of green IT use expressed by individuals working at the Northern Refineries Company was demonstrated by the values of the arithmetic mean, standard deviation, and relative importance. The most important dimension of the green IT use variable, relatively speaking, is the individual user characteristics dimension, followed in terms of relative importance by the organizational characteristics dimension. In third place came the tangible benefit dimension, while the IT characteristics dimension proved to be the least important dimension. All of this proves that the Northern Refineries Company uses its information technology in a green manner, and the green use dimensions adopted in the study play their roles in promoting this use, albeit to varying degrees.
2. The relative importance of the dimensions of sustainable organizational performance expressed by individuals working at the Northern Refineries Company was demonstrated, through the values of the arithmetic mean, standard deviation, and relative importance. The most important dimensions of the sustainable organizational performance variable, relatively speaking, are the social performance dimensions, followed in terms of relative importance by the environmental performance dimensions, and in third and last place came the economic performance dimensions. All of this proves to us that the company, the study sample, significantly enhances its sustainable performance through the dimensions of sustainable performance adopted in this study, and that the company is most concerned with the social

dimension, and that it cares about society more than anything else, and does not achieve profits at the expense of society and its employees.

3. The results, which express the opinions of individuals working in the Northern Refineries Company, indicate the existence of a direct effect of the green use of information technology on sustainable organizational performance, as indicated by the value of the regression coefficient. This effect is significant in terms of the probability value. The same result indicates the critical value (C.R), in addition to what is indicated by the value of the coefficient of determination (R-square), that (81%) of the changes occurring in (sustainable organizational performance) are due to (the green use of information technology), and the remaining percentage, amounting to (19%), is attributed to other variables that were not included in the regression model.

Second: Proposals: To complement the methodological requirements, in light of the theoretical and applied framework, and based on the results and conclusions reached in the current study, the researchers found it useful to present a set of proposals, as follows:

1. The management of the company, the sample company, should focus on promoting a culture of mutual dialogue between management and employees by holding periodic meetings with employees to discuss work-related matters, allowing them to express their opinions and suggestions necessary for the smooth running of work, and providing them with the opportunity to resolve problems they may encounter in the workplace.
2. Establish clear policies that support the adoption of green practices, such as standards for purchasing energy-efficient devices, adopting a "paperless office" policy to reduce reliance on paper, and establishing a sustainability committee affiliated with the company's management to monitor and periodically evaluate the implementation of green initiatives.
3. Organize workshops and training courses on the green use of information technology and sustainable organizational performance, and launch awareness campaigns within the company (such as Sustainability Week) to encourage green practices.

References

1. Abdullah, N., & Lim, A. (2023). The Incorporating Sustainable and Green IT Practices in Modern IT Service Operations for an Environmentally Conscious Future. *Journal of Sustainable Technologies and Infrastructure Planning*, 7(3), 17-47.
2. Adhikari, A. (2023). GREEN INFORMATION AND COMMUNICATION TECHNOLOGY AT HIGHER EDUCATION ORGANIZATION: SOLUTION FOR SUSTENANCE OF ICT IN FUTURE. *INTERNATIONAL JOURNAL OF HUMANITIES, ENGINEERING, SCIENCE AND MANAGEMENT*, 4(1), 48-56.
3. Al Rashidi, Huda Saad And AL Sarayreh, Aktham A. (2019). Organizational Flexibility And Its Impact On The Service Quality: A Survey Study On Communication And Information Technology Regulatory Authority In Kuwait, **International Journal Of Human Resource Studies**, Vol.(9), No.(3).
4. Al-Eid, Azmi Abdul Jalil Jawad & Al-Obaidi, ilham Mohammed Wathik, (2024), The impact of the phenomenon of green washing on accounting reporting on sustainable performance, *Warith Scientific Journal*, ISSN: 2618-0278 Vol. 6No.Specil Issue August 2024.
5. Andreopoulou, Z. S. (2012). Green Informatics: ICT for green and Sustainability. *Journal of Agricultural Informatics*, 3(2).
6. Asif, M., & Searcy, C., & Zutshi, Am & Ahmed, N., (2011) "An integrated management systems approach to corporate sustainability " *European business review*, Vol .23, No.4.

7. Baumgartner, Rupert J. And Ebner, Daniela. (2010). Corporate Sustainability Strategies: Sustainability Profiles And Maturity Levels, **Sustainable Development**, Vol.(18), No.(2).
8. Bennis, W. F., and J. O'Toole. 2005. How business schools lost their way. *Harvard Business Review* 83 (5): 96–104.
9. Butler, J. (2011). *Bodies that matter: On the discursive limits of sex*. routledge.
10. Carreno, A. M. (2024). *Leading Through Change: Preserving Business Continuity While Driving Transformation*.
11. Chou, D. C. (2013). Risk identification in Green IT practice. *Computer Standards & Interfaces*, 35(2), 231-237.
12. Chow, W. S., & Chen, Y. (2009). Intended belief and actual behavior in green computing in Hong Kong. *Journal of computer information systems*, 50(2), 136-141.
13. Denis-Rémis, C., Codou, O., & Lebraty, J. F. (2011). Relation of Green IT and affective attitude within the Technology Acceptance Model: The cases of France and China. *Management & Avenir*, n 39 (9).
14. Gavrilovska, L., Atanasovski, V., Macaluso, I., & DaSilva, L. A. (2013). Learning and reasoning in cognitive radio networks. *IEEE Communications Surveys & Tutorials*, 15(4), 1761-1777.
15. James, P. and Hopkinson, L., 2009. Sustainable ICT in Further and Higher Education. [pdf] Available at: <<http://www.jisc.ac.uk/media/documents/programmes/greeningict/sustainableictreport.pdf>> [Accessed 3 July 2014]
16. JARBUR, REBECKA. (2014). *Developing Guidelines for Green Information and Communication Technology* (Doctoral dissertation, Thesis).
17. Kamilaris, A., Kalluri, B., Kondepudi, S., & Wai, T. K. (2014). A literature survey on measuring energy usage for miscellaneous electric loads in offices and commercial buildings. *Renewable and Sustainable Energy Reviews*, 34, 536-550.
18. Mat Nawi, M. N., Fauzi, M. A., Ting, I. W. K., Wider, W., & Amaka, G. B. (2024). Green information technology and green information systems: science mapping of present and future trends. *Kybernetes*.
19. Mithas, S., Khuntia, J., & Roy, P. K. (2010). Green information technology, energy efficiency, and profits: Evidence from an emerging economy.
20. Molla, A., & Cooper, V. (2010). Green IT readiness: A framework and preliminary proof of concept. *Australasian journal of information systems*, 16(2).
21. Omar Shamo Haider Al-Sharkani, & Asst. Prof. Dr. Iman Bashir Mohammed Abu Rdan. (2024). Contributions of participatory leadership in achieving sustainable organizational performance: A survey study of the opinions of lecturers in a number of colleges at the University of Duhok. *Al Kut Journal of Economics and Administrative Sciences*, 16(50).
22. Paruchuri, V. (2011, February). Greener ICT: Feasibility of successful technologies from energy sector. In 13th International Conference on Advanced Communication Technology (ICACT2011) (pp. 1398-1403). IEEE.
23. Ramus, C. A., & Steger, U. (2000). The roles of supervisory support behaviors and environmental policy in employee “ecoinitiatives” at leading-edge European companies. *Academy of Management journal*, 43(4), 605-626.

24. Sahar Abbas Hussein Al-Ziyadi, & Hussein Ismail Al-Dhabawi. (2022). The Impact of Authentic Leadership on Sustainable Performance: An Analytical Study of the Opinions of a Sample of Employees in the General Company for Grain Trade. *Iraqi Journal of Administrative Sciences*, 18(72), 56-90.
25. Simpson, I. R., McKinnon, K. A., Kennedy, D., Lawrence, D. M., Lehner, F., & Seager, R. (2024). Observed humidity trends in dry regions contradict climate models. *Proceedings of the National Academy of Sciences*, 121(1), e2302480120.
26. Suryawanshi, K., & Narkhede, S. (2013, December). Green ICT implementation at educational institution: A step towards sustainable future. In 2013 IEEE International Conference in MOOC, Innovation and Technology in Education (MITE). IEEE.
27. Unruh, G., & Ettenson, R. (2010). Growing green. *Harvard Business Review*, 88(6).
28. Verma, V., Fleisig, E., Tomlin, N., & Klein, D. (2023). Ghostbuster: Detecting text ghostwritten by large language models. arXiv preprint arXiv:2305.15047.
29. Zabin, Haider Atta and Al-Kanani, Diaan Mohsen Faris Radhi, 2022, Evaluating the Sustainable Performance of the Economic Unit, *Al-Riyada Journal of Finance and Business*, Volume (3), Issue (1).
30. Zhang, J., & Liang, X. J. (2012). Promoting green ICT in China: A framework based on innovation system approaches. *Telecommunications Policy*, 36(10-11), 997-1013.
31. Mahmood, M. A., Hall, L., & Swanberg, D. L. (2001). Factors affecting information technology usage: A meta-analysis of the empirical literature. *Journal of organizational computing and electronic commerce*, 11(2), 107-130.
32. Masukujjaman, M., Alam, S. S., Siwar, C., & Halim, S. A. (2021). Purchase intention of renewable energy technology in rural areas in Bangladesh: Empirical evidence. *Renewable Energy*, 170, 639-651.
33. Kopka, T., Löffler, C., Coraddu, A., & Polinder, H. (2023, November). Hierarchical Control Strategy for Fuel Cell-Battery Shipboard Power System Utilizing a Modular Control Architecture. In 2023 IEEE Transportation Electrification Conference and Expo, Asia-Pacific (ITEC Asia-Pacific) (pp. 1-8). IEEE.
34. Javaid, M., Haleem, A., Singh, R. P., Suman, R., & Gonzalez, E. S. (2022). Understanding the adoption of Industry 4.0 technologies in improving environmental sustainability. *Sustainable Operations and Computers*, 3, 203-217. Ghauri, P., Strange, R., & Cooke, F. L. (2021). Research on international business: The new realities. *International Business Review*, 30(2), 101794.
35. Patel, P., Gregersen, T., & Anderson, T. (2024). An agile pathway towards carbon-aware clouds. *ACM SIGENERGY Energy Informatics Review*, 4(3), 10-17.