

Building sustainability index for Dubai electricity and water authority

Abstract

The “Building Sustainability Index for Dubai Electricity and Water Authority” study aims to develop a comprehensive sustainability index specifically tailored for the Dubai Electricity and Water Authority (DEWA). The index will serve as a tool to assess and measure the sustainability performance of DEWA’s buildings, promoting a more sustainable approach to energy and water consumption. The study begins by conducting a thorough review of existing sustainability frameworks and indices to identify relevant indicators and best practices. By considering the unique context of DEWA, the index will be customized to align with the organization’s goals, strategies, and operational practices. To develop the index, an interdisciplinary approach will be adopted, involving experts in the fields of sustainable building design, energy efficiency, water management, and environmental impact assessment. The index will encompass various dimensions of sustainability, including energy efficiency, water conservation, waste management, indoor environmental quality, and overall environmental impact. Key performance indicators will be established to quantify and evaluate the sustainability performance of DEWA’s buildings. These indicators will be based on measurable data related to energy and water consumption, waste generation, and environmental emissions. The index will provide a systematic framework for tracking progress, identifying areas for improvement, and setting sustainability targets for DEWA’s building portfolio. Furthermore, the study will address the importance of stakeholder engagement and create mechanisms for knowledge sharing and collaboration within DEWA. This will ensure that sustainability goals are integrated into the organization’s culture and practices, fostering a sense of ownership and responsibility among employees. The outcomes of this study will be valuable for DEWA in optimizing energy and water consumption, reducing environmental impact, and enhancing the overall sustainability of its buildings. The index will also contribute to the broader sustainability goals of Dubai, aligning with the city’s vision of becoming a global leader in sustainable development. Overall, the “Building Sustainability Index for Dubai Electricity and Water Authority” study presents a significant opportunity for DEWA to embrace sustainability as a core principle, driving positive change in the organization’s operations and contributing to a more sustainable future for Dubai.

Keywords: sustainability index, sustainability performance, collaboration, sustainable development, organization responsibility

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Introduction

Sustainability and environmental responsibility are crucial in today’s world for several reasons. Firstly, by embracing sustainable practices, one can ensure the long-term availability of resources for future generations. Earth has limited resources, and it’s essential to maintain a healthy and balanced ecosystem. Secondly, environmental responsibility is vital for mitigating climate change and reducing pollution. By adopting sustainable practices, such as using renewable energy sources, reducing waste, and conserving water, one can minimize carbon footprint and protect the environment. This is particularly important as climate change poses significant challenges for ecosystems, biodiversity, and human societies. Moreover, sustainability also offers economic benefits. Many sustainable practices can lead to cost savings in the long run. For instance, energy-efficient technologies can lower energy bills, and waste reduction strategies can minimize disposal costs.¹ Embracing sustainability can also drive innovation and create new job opportunities in sectors such as renewable energy and green technologies. Additionally, there is growing public awareness and demand for sustainable products and practices. Consumers are becoming more conscious of the environmental impact of their choices and are actively seeking eco-friendly alternatives. By incorporating sustainability into

businesses and industries, companies can meet customer demands, enhance their reputation, and stay competitive in the market.² Lastly, sustainability and environmental responsibility are interconnected with social equity. By ensuring a sustainable future, leads towards a more just and equitable society. This involves considering the needs of marginalized communities, promoting fair labour practices, and addressing environmental justice issues that disproportionately affect vulnerable populations. In a nutshell, sustainability and environmental responsibility are crucial in our current times to protect our planet, ensure a better future, drive economic benefits, meet consumer demands, and promote social equity. By making conscious choices and taking responsibility for actions, collectively a positive impact on the world can be made.³

Background

Sustainability in the energy sector has become critical due to several reasons. Firstly, the increasing global population and economic growth have led to a surge in energy demand. This demand, primarily met by fossil fuel-based sources, has resulted in significant environmental issues such as climate change, air pollution, and resource depletion. To mitigate these challenges and ensure a secure and resilient energy future, sustainability has emerged as a crucial aspect. One of the key benefits of sustainability in the energy

sector is the reduction of greenhouse gas emissions. By transitioning to renewable and clean energy sources, such as solar, wind, and hydroelectric power, carbon emissions can be significantly reduced, thereby mitigating climate change impacts.⁴ This shift also helps to diversify energy sources, reducing reliance on fossil fuels and enhancing energy security. Another benefit is improved air quality and public health. Fossil fuel combustion for energy production releases pollutants that have detrimental effects on human health, leading to respiratory problems and other illnesses. Sustainable energy sources produce minimal to no air pollutants, promoting healthier environments and reducing healthcare costs. Sustainability in the energy sector also offers economic advantages, such as job creation and energy cost savings. The renewable energy industry has witnessed rapid growth, creating employment opportunities in manufacturing, installation, and maintenance of renewable energy systems.⁵ Additionally, as renewable energy technologies advance and become more cost-effective, energy costs for consumers can decrease in the long run. However, achieving sustainability in the energy sector also comes with challenges. One of the primary challenges is the initial high cost of renewable energy infrastructure. While the long-term operational costs of renewable energy systems are usually lower, the upfront investment can be a barrier, especially for developing countries or regions with limited financial resources. Intermittency and storage of renewable energy is another challenge. Unlike fossil fuel-based power plants that can provide a constant and predictable energy supply, renewable energy generation is subject to weather conditions and natural variability. To ensure a reliable and stable energy supply, efficient energy storage technologies and smart grid systems are required.⁶ Additionally, the existing energy infrastructure heavily relies on fossil fuel-based systems, which presents a challenge in terms of transitioning to sustainable alternatives. Retrofitting or replacing existing infrastructure can be costly and time-consuming. Furthermore, the integration of renewable energy into the traditional energy grid requires substantial changes in infrastructure planning and management. This includes grid modernization, implementing advanced monitoring and control systems, and addressing grid stability issues associated with fluctuating renewable energy inputs. Sustainability in the energy sector has become critical due to environmental, economic, and health concerns. While the benefits of sustainability are numerous, challenges such as cost, intermittency, infrastructure transformation, and grid integration need to be addressed to ensure a successful transition towards a sustainable energy future.⁷

Research scope

The research scope for “Building Sustainability Index for Dubai Electricity and Water Authority” will focus on assessing and developing a sustainability index specifically tailored for the Dubai Electricity and Water Authority (DEWA). The research will involve evaluating the current sustainability practices and initiatives of DEWA, analysing relevant international sustainability frameworks, and designing a comprehensive index that aligns with DEWA’s goals and objectives.

Research questions

1. What are the current sustainability practices and initiatives implemented by DEWA?
2. What are the key components and indicators of existing international sustainability frameworks that can be applied to DEWA?
3. How can the sustainability index be designed to effectively measure and track DEWA’s sustainability performance?

Research objectives

1. To assess the current sustainability practices and initiatives implemented by DEWA.
2. To identify and analyze relevant international sustainability frameworks and their applicability to DEWA.
3. To evaluate the feasibility and effectiveness of the sustainability index in measuring and tracking DEWA’s sustainability performance.

Literature survey

To examine the existing research in building sustainability, building sustainability index, and energy and water companies, a comprehensive literature review would need to be conducted. Sustainable Building Design and Construction, Green Building Certification Systems, Indoor Environmental Quality, support the cause. This research area focuses on developing sustainable practices and technologies for designing and constructing buildings, such as energy-efficient materials, renewable energy integration, and waste management systems. Numerous studies have explored different green building certification systems like LEED (Leadership in Energy and Environmental Design) and BREEAM (Building Research Establishment Environmental Assessment Method) to assess their effectiveness in promoting sustainability in the building sector. Research has been conducted to evaluate the impact of building design on indoor environmental quality, including air quality, lighting, acoustics, and thermal comfort.⁸

Building Sustainability Index leads to Development and Evaluation of Sustainability Indices. Researchers have developed and evaluated various sustainability indices to measure the environmental, social, and economic performance of buildings or organizations. These studies analyze the indicators and methodologies used in creating the indices and assess their applicability and effectiveness. Case Studies and Application of Sustainability Indices can give a way forward. Research has been conducted to apply sustainability indices in real-world scenarios, examining their usage and outcomes in different contexts, such as cities, companies, or specific building projects. Energy and Water Companies follow the Sustainable Energy Practices.⁹ Research in this area focuses on the adoption of renewable energy sources, energy efficiency measures, and the integration of smart grid technologies in energy companies. Studies have explored sustainable water management strategies, including water reuse, rainwater harvesting, and efficient water distribution systems, to minimize water consumption and promote conservation. Research has been conducted to analyze the social and environmental practices of energy and water companies, examining their commitment to sustainability, stakeholder engagement, and transparency in reporting. By conducting a thorough literature review, the researchers were able to delve deeper into each of these research areas and identify gaps or specific research questions that can inform the study on building sustainability index for energy and water companies.¹⁰ There are several organizations that have developed and implemented sustainability indices to assess and monitor the sustainability performance of companies. Some notable examples include:

Dow Jones Sustainability Indices (DJSI): The DJSI, created by S&P Dow Jones Indices and RobecoSAM, evaluates the sustainability performance of the world’s leading companies across various industries.¹¹

FTSE4Good Index Series: Developed by FTSE Russell, the FTSE4Good Index Series identifies companies that meet globally recognized ESG (Environmental, Social, and Governance) standards.¹²

MSCI ESG Ratings: MSCI provides ESG ratings and indices that assess the sustainability performance of companies globally. Their ratings are widely used by institutional investors and asset managers.¹³

Corporate Knights Global 100 Index: The Corporate Knights Global 100 Index ranks companies based on their sustainability performance across multiple dimensions, including resource management and social impact.¹⁴

CDP (formerly Carbon Disclosure Project): CDP assesses companies' environmental impact, including their carbon emissions and climate change strategies. Their ratings and indices are widely used by investors and companies to manage environmental risks and opportunities.¹⁵

Global Reporting Initiative (GRI): GRI provides guidelines and standards for sustainability reporting. While not specifically an index, GRI's reporting framework is widely adopted by organizations to disclose their sustainability performance.¹⁶

These are just a few examples, and there are several other organizations that have developed and follow sustainability indices. It's important to note that different indices may focus on different aspects of sustainability and may have different methodologies for evaluation.

The Integrated Multi-level Sustainability Model is most appropriate as it looks at the involvement of all stakeholders at various levels who can enable the process. It begins at the employee level follows to the Organizational level, the national level, and the International level. Any led off at any one of the above-mentioned levels, the sustainability is not possible and is totally dependent on each stakeholder and the technology availability.¹⁷

The individual or employee contribution to the successful implementation of DEWA (Dubai Electricity and Water Authority) Sustainability Index can be significant. Employees should be educated about the importance of sustainability and the specific goals and targets set by DEWA. Training programs can be conducted to enhance their understanding of sustainability practices and how their roles and responsibilities contribute to DEWA's sustainability objectives. Employees should follow the established sustainability policies, procedures, and guidelines set by DEWA. This includes practicing energy and water conservation, waste reduction, and responsible resource management in their day-to-day activities. Employees can contribute by identifying and implementing innovative ideas and solutions that promote sustainability.¹⁸ This can include suggesting energy-efficient technologies, waste reduction initiatives, or implementing green practices within their departments. Employees can collaborate with their colleagues to share best practices and success stories related to sustainability. This can foster a culture of learning and continuous improvement, where employees can learn from each other's experiences and implement successful sustainability practices across the organization. Employees may be responsible for collecting and reporting data related to sustainability indicators and performance metrics. Accurate and timely data collection is crucial for monitoring progress and identifying areas for improvement. Employees can engage with stakeholders, such as customers, suppliers, and community members, to promote sustainability practices and raise awareness about DEWA's sustainability efforts.¹⁹ This can include educating customers on energy and water conservation, collaborating with suppliers to ensure sustainable procurement practices, or participating in community outreach programs. Ultimately, the successful implementation of DEWA's Sustainability Index relies on the collective efforts and commitment of all employees to integrate

sustainable practices into their work and contribute towards DEWA's sustainability goals. Several organizational factors contribute to the successful implementation of DEWA Sustainability Index. A strong commitment from top management and leaders is essential for the successful implementation of the Sustainability Index.²⁰ When leaders prioritize sustainability and integrate it into the organization's strategic goals, it sets the tone for the entire organization. DEWA should have well-defined sustainability objectives and targets that align with its overall mission and vision. These objectives should be specific, measurable, achievable, relevant, and time-bound (SMART), providing a clear direction for the organization's sustainability efforts. Sustainability should be integrated into the core business processes and decision-making frameworks of DEWA. It should not be seen as a separate function, but rather as an integral part of the organization's overall operations and strategies.²¹ Adequate resources, including financial, human, and technological resources, should be allocated for the implementation of the Sustainability Index. This includes budgeting for sustainability initiatives, hiring skilled personnel, and investing in technologies that support sustainable practices. DEWA should establish mechanisms to monitor and measure the performance of sustainability initiatives. This includes collecting data, analyzing trends, and reporting progress against the set targets. Regular reporting helps identify areas of improvement and highlights successes that can be replicated across the organization. Engaging stakeholders, such as employees, customers, suppliers, and the community, is crucial for the successful implementation of the Sustainability Index.²² DEWA should involve stakeholders in the decision-making processes, seek their input, and communicate transparently about its sustainability initiatives. DEWA should provide training and capacity-building programs to employees to enhance their understanding of sustainability and equip them with the necessary skills and knowledge to contribute effectively to the implementation of the Sustainability Index. DEWA should foster a culture of continuous improvement and adaptability. This includes regularly reviewing and updating sustainability goals and strategies based on changing circumstances, emerging trends, and new opportunities. By considering and implementing these organizational factors, DEWA can create an environment that supports the successful implementation of its Sustainability Index and drives its sustainability efforts forward.²³

At the national level, several factors contribute to the successful implementation of DEWA Sustainability Index. Supportive government policies and regulations play a crucial role in the successful implementation of the Sustainability Index. The government should establish clear sustainability goals and provide incentives and regulations that encourage organizations to adopt sustainable practices. Collaboration between the government, industry associations, and other relevant stakeholders is essential for the successful implementation of the Sustainability Index. By working together, sharing resources and knowledge, and leveraging collective expertise, organizations can accelerate their sustainability efforts. The availability of financial support and incentives from the government can significantly contribute to the successful implementation of the Sustainability Index.²⁴ Subsidies, grants, and tax incentives can motivate organizations to invest in sustainable practices and technologies. The government should invest in education and awareness programs to promote sustainability and raise awareness about the importance of the Sustainability Index. These programs can target various stakeholders, including businesses, employees, consumers, and the general public. Adequate infrastructure and technology are critical for the successful implementation of the Sustainability Index. The government should invest in sustainable infrastructure development, such as renewable energy projects,

waste management systems, and efficient transportation networks. Government support for research and development (R&D) activities focused on sustainability can drive innovation and contribute to the successful implementation of the Sustainability Index.²⁵ R&D funding can help develop new technologies, methodologies, and practices that support sustainability goals. The establishment of national reporting and monitoring frameworks is crucial for tracking progress and ensuring transparency in the implementation of the Sustainability Index. These frameworks can provide standardized guidelines and metrics for reporting sustainability performance. Collaboration between the public and private sectors is essential for the successful implementation of the Sustainability Index. Public-private partnerships can foster knowledge-sharing, resource pooling, and joint initiatives that accelerate sustainability efforts. By considering and addressing these national-level factors, the government can create an enabling environment for the successful implementation of DEWA Sustainability Index and drive sustainability across various sectors of the economy.²⁶

At the global level, several factors contribute to the successful implementation of the DEWA Sustainability Index. Collaboration and cooperation between countries play a significant role in the successful implementation of the Sustainability Index. International agreements, such as the Paris Agreement, can provide a framework for global sustainability goals and encourage countries to adopt sustainable practices. Sharing knowledge, experiences, and best practices among countries is essential for the successful implementation of the Sustainability Index. Global platforms and forums, such as United Nations conferences and international organizations, facilitate the exchange of information and support capacity building efforts.²⁷ Access to funding and investment at the global level is crucial for the successful implementation of the Sustainability Index. International financial institutions, green funds, and climate financing mechanisms can provide financial support to countries and organizations for implementing sustainable practices. Technology transfer from developed to developing countries is vital for the successful implementation of the Sustainability Index. Access to sustainable technologies and innovation can help bridge the technological gap and enable countries to adopt more sustainable practices. Global standards and certifications related to sustainability can contribute to the successful implementation of the Sustainability Index.²⁸ These standards provide a common framework for measuring and reporting sustainability performance, ensuring consistency and comparability across different organizations and countries. Global advocacy efforts and awareness campaigns play a crucial role in driving the successful implementation of the Sustainability Index. International organizations, NGOs, and influential individuals can raise awareness about the importance of sustainability and promote the adoption of the Sustainability Index globally. Alignment of national policies and strategies with global sustainability goals is essential for the successful implementation of the Sustainability Index.²⁹ Countries should ensure that their policies and regulations are in line with international commitments and agreements related to sustainability. Global monitoring and reporting systems can help track progress and ensure accountability in the implementation of the Sustainability Index. International organizations and initiatives can establish frameworks for monitoring and reporting sustainability performance at the global level.³⁰

By considering and addressing these global-level factors, countries can contribute to the successful implementation of the DEWA Sustainability Index and work towards achieving global sustainability goals. The availability of technology plays a crucial

role in the successful implementation of the DEWA Sustainability Index. Robust data management systems are essential for collecting, storing, and analyzing the data required for assessing sustainability performance. Availability of advanced data management tools and technologies enables organizations to effectively track and report on their sustainability metrics.³¹ Energy management systems help organizations monitor and manage their energy consumption, identify energy-saving opportunities, and track progress towards energy efficiency targets. The availability of smart meters, energy monitoring devices, and energy management software supports organizations in optimizing their energy usage and improving their sustainability performance. Promoting the use of renewable energy sources is a key aspect of the DEWA Sustainability Index. The availability of various renewable energy technologies, such as solar panels, wind turbines, and geothermal systems, allows organizations to generate clean energy on-site and reduce their dependence on fossil fuels.³² IoT technology can play a significant role in monitoring and controlling various sustainability-related parameters. Sensors, connected devices, and IoT platforms enable organizations to collect real-time data on energy consumption, water usage, waste management, and other sustainability indicators. This data helps in identifying areas for improvement and optimizing resource utilization. Building management systems (BMS) allow organizations to monitor and control various aspects of their buildings, including lighting, HVAC systems, and occupancy levels. The availability of advanced BMS technologies helps organizations optimize energy efficiency, reduce waste, and create healthier and more sustainable indoor environments. Effective communication and visualization of sustainability data are important for organizations to understand their performance and make informed decisions.³³ The availability of data visualization and reporting tools simplifies the process of presenting complex sustainability data in a visually appealing and easily understandable format. AI and machine learning technologies can enhance the efficiency and effectiveness of sustainability practices. These technologies can analyze large amounts of data, identify patterns, and provide insights that help organizations optimize their operations, reduce waste, and improve overall sustainability performance. The availability of mobile applications enables organizations to track and manage sustainability-related activities on the go. Mobile apps can provide real-time access to sustainability data, allow for remote monitoring, and control of resources, and facilitate collaboration among stakeholders. It is important to note that the availability and adoption of technology can vary depending on the region and the resources available to organizations. However, leveraging technology in the implementation of the DEWA Sustainability Index can significantly enhance sustainability practices and outcomes.³⁴

The factors of organizational culture, capacity building, resilience, and Dubai government supervision play a crucial role in influencing the successful implementation of the DEWA Sustainability Index. A strong organizational culture that values sustainability is essential for successful implementation. When sustainability is deeply embedded in the organization's values, norms, and behaviors, it becomes a part of the daily operations and decision-making processes. This culture motivates employees to actively participate in sustainability initiatives and ensures long-term commitment towards achieving sustainability goals. Building the necessary knowledge, skills, and capabilities within the organization is vital for successful implementation. Capacity building initiatives provide employees with the tools and resources to understand and implement sustainable practices. It includes training programs, workshops, and educational campaigns that enhance the sustainability-related competencies of the workforce.³⁵ Capacity building ensures that employees are equipped to contribute effectively

to the DEWA Sustainability Index and its goals. Resilience refers to an organization's ability to adapt, respond, and recover from challenges or disruptions. In the context of the DEWA Sustainability Index, resilience plays a role in successfully implementing sustainability practices despite obstacles or changes in the business environment. Resilient organizations can navigate uncertainties, overcome barriers, and maintain their commitment to sustainability even in challenging circumstances. The supervision and support provided by the Dubai government are crucial for the successful implementation of the DEWA Sustainability Index.³⁶ The government's commitment to sustainability, along with supportive policies and regulations, creates an enabling environment for organizations to adopt sustainable practices. Government supervision ensures compliance, provides guidance, and encourages organizations to actively participate in sustainability initiatives. By fostering a positive organizational culture, investing in capacity building, promoting resilience, and providing government supervision, organizations can enhance their ability to implement the DEWA Sustainability Index successfully. These factors create a supportive ecosystem that empowers organizations to integrate sustainability into their operations, achieve their sustainability goals, and contribute to Dubai's overall sustainability objectives.³⁷

The successful implementation of the DEWA Sustainability Index within the Integrated Multi-Level Sustainability Model hinges on the seamless coordination and engagement of stakeholders across all levels individual, organizational, national, and international. At the individual level, employees play a crucial role by integrating sustainability into their daily activities, adhering to DEWA's policies, and fostering a culture of continuous improvement through collaboration and innovation. Organizational commitment is pivotal, where top management's strategic vision aligns with sustainability goals, supported by adequate resources and robust monitoring mechanisms. At the national level, supportive government policies, financial incentives, and infrastructure development are essential, creating an environment that encourages sustainable practices. Internationally, global cooperation, knowledge sharing, and access to funding and technology accelerate sustainability efforts, aligning national actions with global sustainability goals. The availability of advanced technologies, such as data management systems, renewable energy solutions, and IoT devices, further enhances the ability to track, analyze, and optimize sustainability performance. Moreover, fostering a strong organizational culture that values sustainability, investing in capacity building, and promoting resilience ensures that organizations can adapt and thrive in changing environments. By addressing these interconnected factors, the Integrated Multi-Level Sustainability Model provides a comprehensive framework for the successful implementation of the DEWA Sustainability Index, driving collective progress towards sustainability objectives at all levels.

Implementing the DEWA Sustainability Index using the Integrated Multi-Level Sustainability Model presents several challenges. One major challenge is ensuring effective communication and coordination among stakeholders at various levels individual, organizational, national, and international. Misalignment or gaps in communication can lead to fragmented efforts and reduce the overall impact of sustainability initiatives. Securing commitment and active participation from all stakeholders is also difficult, as it requires aligning diverse interests and priorities with sustainability

goals. Additionally, the varying availability and adoption of advanced technologies across different regions and organizations can create disparities in implementation capabilities. Organizations may struggle with resource constraints, lacking the financial, human, and technological resources necessary for comprehensive sustainability practices. Furthermore, the dynamic nature of external factors, such as economic instability, regulatory changes, and global events like pandemics, demands continuous adaptation and flexibility in strategies. Establishing standardized metrics and methodologies for measuring and reporting sustainability performance across different levels is complex, posing challenges for consistency and comparability. Cultural resistance within organizations can also impede the adoption of sustainability practices, requiring significant efforts to foster a culture of sustainability and continuous improvement. Lastly, ensuring long-term commitment and resilience to sustain these efforts over time, especially amid changing leadership and priorities, remains a critical challenge. Addressing these challenges necessitates robust communication frameworks, stakeholder engagement strategies, resource allocation, adaptive planning, and continuous monitoring and evaluation to ensure the successful implementation of the DEWA sustainability index within the integrated multi-level sustainability model (Figure 1).

Methodology

The Research study will involve interviews with subject experts from similar Sector companies including DEWA to get expert opinion. The semi-structured interviews will be conducted online or face to face, record it and transcript to summarize the findings. The sample size of 25 experts from the Energy sector will be interviewed over a period of two months for the data collection. This will be the basis of the analysis of the research and further discussions.³⁸ The study had a limitation of not being able to provide in-depth explanations for the choices of the participants. To overcome this, the questionnaire included open-ended questions to elicit more detailed feedback.³⁹ The study combined qualitative and quantitative data to gain a deeper understanding and conduct statistical analysis.⁴⁰ The data from the interviews were analyzed using thematic analysis. The researcher checked the accuracy of the transcriptions and responses. The data were coded and reviewed to identify main themes and sub-themes based on similarities. Table 1 presented the findings effectively by summarizing the main themes and sub-themes found in the study. This research study used suitable and efficient methodologies to meet the research objectives and obtain valid and reliable results.⁴¹

To develop a sustainability index for DEWA and create a sustainable future, it is crucial to acknowledge the role of technology in generating innovative energy solutions. The Power and Energy sector must stay updated with technological trends and experiment with new technologies to unlock their potential benefits. However, ethical implications should also be considered, ensuring technology aligns with core values and respects environmental and social responsibilities. While technology offers opportunities to improve energy distribution and reduce losses, careful implementation and risk assessment are necessary. By integrating technology, innovation, and ethical considerations, DEWA can build a sustainable and efficient energy sector.⁷³

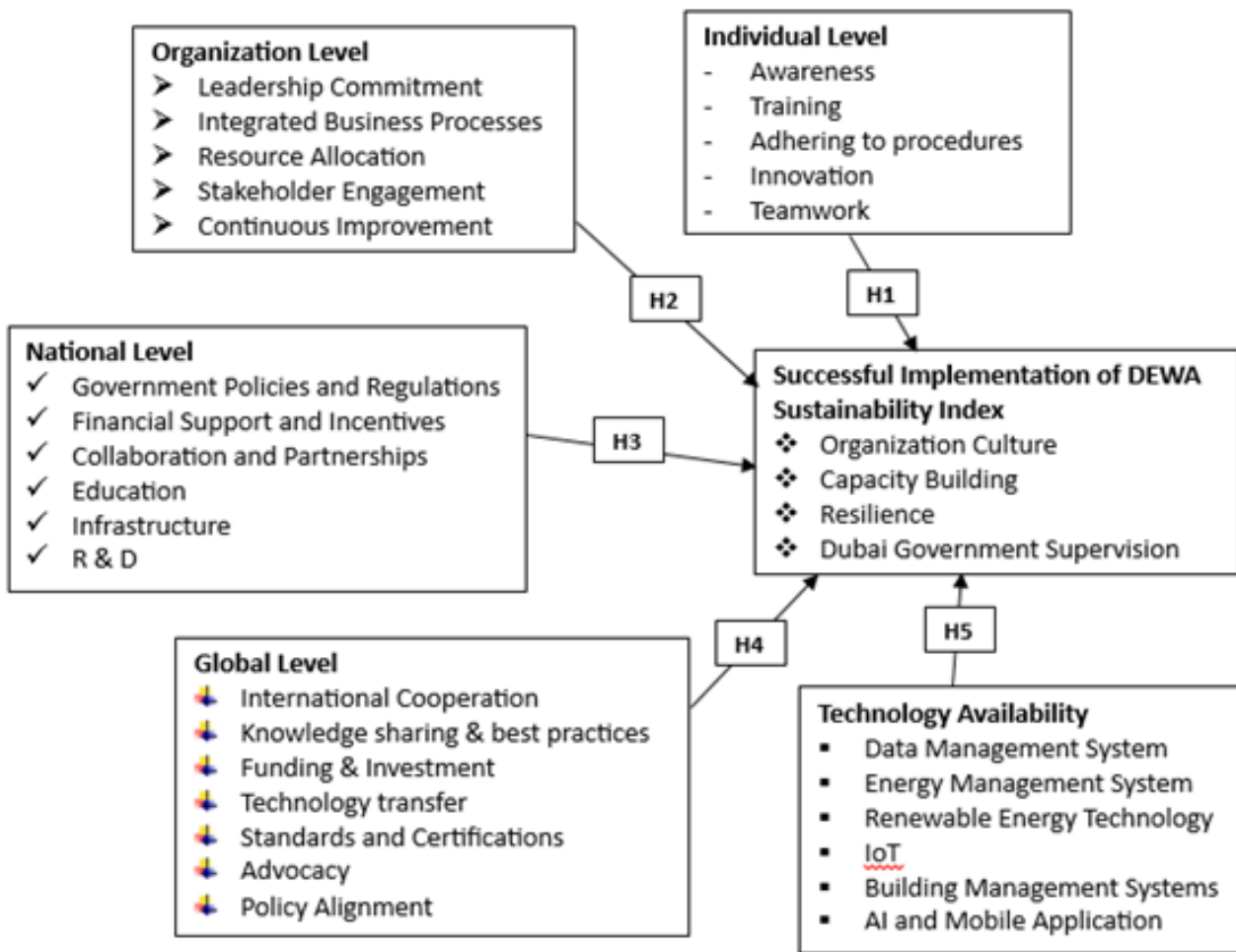


Figure 1 Integrated multi-level sustainability model.

H1: There is a significant relationship between the Individual level factors and the Successful Implementation of DEWA Sustainability Index

H2: There is a significant relationship between the Organization level factors and the Successful Implementation of DEWA Sustainability Index

H3: The National level factors significantly influence the Successful Implementation of DEWA Sustainability Index

H4: The Global level factors significantly influence the Successful Implementation of DEWA Sustainability Index

H5: There is a significant relationship between the Technology Availability factors and the Successful Implementation of DEWA Sustainability Index

Table 1 Interview Summary

| (Years of Experience), Interviewee no, Location, Designation. | Interviewee views on Resilient Supply Chain (Other Interviewees comments in agreement) |
|---|--|
| 1. (14), Sharjah Energy Sector, Vice President Operations | <ul style="list-style-type: none"> - DEWA and its stakeholders are aware of the potential risks and opportunities in their operations, as well as the best practices and strategies to achieve sustainability. - Awareness can be enhanced by conducting regular assessments, monitoring key indicators, and sharing information and insights across the supply chain - This is the process of developing the skills and competencies of DEWA’s employees and contractors to cope with uncertainty and change. - Training can include formal courses, simulations, workshops, mentoring, and on-the-job learning (Interviewee 4, 8, 10, 13)⁴² - Training can help build a culture of sustainability, where employees are empowered to make decisions, collaborate, and innovate in response to challenges. |
| 2. (13), CEO, Energy Sector, Abu Dhabi | <ul style="list-style-type: none"> - Following procedures helps to reduce errors, waste, and variability, while improving compliance and traceability. - However, procedures should also be flexible and adaptable to changing circumstances, allowing for exceptions and deviations when necessary. - Energy supply chain innovation entails the ability of actors to generate and implement new ideas, solutions, products, or processes that bring value to customers and stakeholders. (Interviewee 5, 8, 10, 12).^{43,44} |

Table I Continued...

| (Years of Experience), Interviewee no, Location, Designation. | Interviewee views on Resilient Supply Chain (Other Interviewees comments in agreement) |
|--|---|
| 3. (15) Senior Specialist Operations Support, Dubai | <ul style="list-style-type: none"> - Adherence to established rules and guidelines within the supply chain ensures consistency and quality in operations. - Adhering to procedures can help reduce errors, waste, and variability, as well as improve compliance and traceability. - However, procedures should also be flexible and adaptable to changing circumstances, and allow for exceptions and deviations when necessary - This is the ability of DEWA and its stakeholders to generate and implement new ideas, solutions, products, or processes that create value for customers and society. - This is the process of monitoring, reviewing, learning from, and improving DEWA's sustainability performance on a regular basis. (Interviewee 2, 6, 9, 11).^{45,46} - Innovation can help DEWA gain a competitive edge, differentiate itself from rivals, and meet evolving customer needs. - Innovation can also help DEWA overcome constraints, exploit opportunities, and cope with disruptions |
| 4. (17) Chief Information Security Officer, Energy Sector, Sharjah | <ul style="list-style-type: none"> - This is the degree of collaboration and coordination among DEWA's employees, contractors, suppliers, customers, regulators, and other partners. - Teamwork can help improve communication, information sharing, problem solving, decision making, and conflict resolution. - Teamwork can also foster trust, commitment, and loyalty among supply chain partners, which can enhance their willingness to cooperate and support each other in times of crisis. - Continuous improvement can help measure the progress and achievements of DEWA's sustainability agenda, as well as identify the gaps and challenges that need to be addressed (Interviewee 1, 6, 12, 15, 24).⁴⁷ - The Process is based on the Global Reporting Initiative (GRI) Standards and the United Nations Sustainable Development Goals (SDGs). - This is the degree to which DEWA's top management and board of directors demonstrate their support and involvement in the sustainability agenda. |
| 5. (14), Creative Director, RAK Energy sector | <ul style="list-style-type: none"> - Leadership commitment can also help create a culture of sustainability, where sustainability is embedded in the core business strategy and operations of DEWA - This is the extent to which DEWA's business processes are aligned and coordinated to achieve sustainability objectives. - This is the process of allocating financial, human, technological, and physical resources to support the implementation of the sustainability agenda. - Continuous improvement can also help foster a culture of learning and innovation, where DEWA seeks to adopt best practices and new technologies to enhance its sustainability performance (Interviewee 10, 13, 18, 21).^{48,49} - Leadership commitment can help set the vision, mission, values, and goals of DEWA, as well as allocate resources, empower employees, and communicate with stakeholders. |
| 6. (10), Director- Project Management Office, Abu Dhabi Energy Sector | <ul style="list-style-type: none"> - Integrated business processes can help improve efficiency, effectiveness, quality, and innovation in DEWA's products and services, as well as reduce costs, risks, and environmental impacts. - Integrated business processes can also help enhance transparency, accountability, and reporting of DEWA's sustainability performance - Resource allocation can help ensure that DEWA has adequate and appropriate resources to carry out its sustainability activities and initiatives, as well as monitor and evaluate their outcomes and impacts. (Interviewee 3, 4, 13, 22, 24).⁵⁰ - Resource allocation can also help optimize the use of resources and minimize waste and inefficiency |
| 7. (16), Head of Contracts, Energy Sector, Fujairah | <ul style="list-style-type: none"> - This is the process of identifying, communicating, consulting, and collaborating with internal and external stakeholders who have an interest or influence on DEWA's sustainability performance. - Stakeholder engagement can help understand the needs, expectations, and concerns of stakeholders, as well as solicit their feedback and input. - Stakeholder engagement can also help build trust, loyalty, and partnership with stakeholders, as well as address any conflicts or issues that may arise (Interviewee 9, 16, 19, 22, 25) - These are the rules and guidelines set by the government to promote and support sustainability in the energy and water sectors. |
| 8. (11), Human Capital Chief Advisor - Vice President, Dubai Energy Sector | <ul style="list-style-type: none"> - The financial resources and benefits provided by the government or other entities to encourage and facilitate sustainability in the energy and water sectors. - Some examples of technology transfer that influence DEWA's sustainability performance are adopting smart technologies such as smart grids, smart meters, smart applications, smart buildings, etc. - Energy Management System can also help DEWA achieve its energy-related goals and targets in sustainability (Interviewee 5, 14, 17, 19, 20, 23). |

Table I Continued...

| (Years of Experience), Interviewee no, Location, Designation. | Interviewee views on Resilient Supply Chain (Other Interviewees comments in agreement) |
|---|---|
| 9. (12), Senior Vice President, Power Distribution, Dubai | <ul style="list-style-type: none"> - Some examples of government policies and regulations that influence DEWA's sustainability performance are the Dubai Clean Energy Strategy 2050, the Dubai Carbon Abatement Strategy 2021, the Dubai Integrated Energy Strategy 2030, the Dubai Green Building Regulations, and the Dubai Plan 2021 - Financial support and incentives can help reduce the costs and risks associated with sustainability projects and initiatives, as well as increase their attractiveness and feasibility. (Interviewee 15, 18, 21, 23, 24). |
| 10. (15), Assistant Vice President, Abu Dhabi Energy sector | <ul style="list-style-type: none"> - Government policies and regulations can help create a favorable environment for DEWA and its stakeholders to implement the sustainability agenda, as well as ensure compliance and accountability. - Some examples of financial support and incentives that influence DEWA's sustainability performance are the Green Fund, the Shams Dubai initiative, the Demand Side Management program, the Etihad ESCO program, and the Mohammed bin Rashid Al Maktoum Solar Park - This is the process of raising awareness and influencing public opinion or policy on sustainability issues in the energy and water sectors. - Advocacy can help DEWA educate and inform its stakeholders about the importance and benefits of sustainability, as well as persuade them to act or support its sustainability agenda. (Interviewee 11, 14, 17, 24, 25). |
| 11. (9), Vice President CTO, Supply chain sector, Dubai | <ul style="list-style-type: none"> - Standards and certifications can help DEWA demonstrate its commitment and adherence to sustainability principles and practices, as well as enhance its reputation and credibility. - This is the extent to which DEWA engages and collaborates with international organizations and entities to support and promote sustainability in the energy and water sectors. - International cooperation can help DEWA access global expertise, resources, and networks, as well as enhance its reputation and credibility. - This is the extent to which DEWA's policies and strategies are aligned with international or regional policies and strategies on sustainability in the energy and water sectors. (Interviewee 1, 5, 7, 10, 16, 19). |
| 12. (14), HSE senior Manager, Energy Sector, Abu Dhabi. | <ul style="list-style-type: none"> - These are the rules and guidelines set by international or regional organizations or entities to ensure quality, consistency, reliability, safety, security, transparency, accountability, compliance, etc. in the energy and water sectors. - Some examples of international cooperation that influence DEWA's sustainability performance are joining the United Nations Global Compact (UNGC), participating in the World Future Energy Summit (WFES), hosting the World Green Economy Summit (WGES), signing Memoranda of Understanding (MoUs) with various international partners - Policy alignment can help DEWA ensure coherence and consistency in its sustainability performance, as well as comply with international or regional obligations and commitments (Interviewee 3, 6, 8, 14, 22).^{48,51} - This is the process of exchanging and disseminating information, insights, and experiences related to sustainability among DEWA and its stakeholders, as well as learning from other leading organizations and entities in the field. |
| 13. (14), Environmental Consultant, Power Sector, Abu Dhabi | <ul style="list-style-type: none"> - Knowledge sharing and best practices can help DEWA improve its sustainability performance, as well as inspire and motivate others to adopt sustainability practices. - Data Management System collects, stores, processes, analyzes, and reports data related to DEWA's sustainability performance. - Some examples of knowledge sharing and best practices that influence DEWA's sustainability performance are publishing annual Sustainability Reports based on the GRI Standards, organizing the Innovation Week, (Interviewee 1, 2, 6, 8, 10, 16).⁴⁹ |
| 14. (20) CSR Vice President, Power Sector, Fujairah | <ul style="list-style-type: none"> - Some more examples of DEWA initiatives are participating in the Dubai Award for Sustainable Transport (DAST), benchmarking with other utilities through the International Benchmarking Network for Water and Sanitation Utilities (IBNET) - This is the process of securing and allocating financial resources to support and facilitate sustainability projects and initiatives in the energy and water sectors. - Funding and investment can help DEWA reduce the costs and risks associated with sustainability projects and initiatives, as well as increase their attractiveness and feasibility. (Interviewee 3, 4, 7, 12, 16, 21).^{47,50,52} |
| 15. (24), Senior Operations Vice President, Logistics sector, Sharjah | <ul style="list-style-type: none"> - This is the process of acquiring and adopting new or advanced technologies that enhance sustainability in the energy and water sectors. - Technology transfer can help DEWA improve its efficiency, effectiveness, quality, safety, security, innovation, and competitiveness in its products and services, as well as reduce its environmental impacts. - Energy Management System can help DEWA improve its efficiency, reliability, quality, safety, security, innovation, and competitiveness in its energy products and services, as well as reduce its environmental impacts. - Building Management Systems can help DEWA optimize the energy consumption, water consumption, indoor air quality, lighting levels, temperature levels, etc. of buildings (Interviewee 5, 7, 9, 14, 15).⁵³⁻⁵⁵ |

Table I Continued...

| (Years of Experience), Interviewee no, Location, Designation. | Interviewee views on Resilient Supply Chain (Other Interviewees comments in agreement) |
|--|--|
| 16. (14), Senior Manager HSE, Dubai Power Sector. | <ul style="list-style-type: none"> - Energy Management System manages and optimizes the production, transmission, distribution, and consumption of energy in a sustainable manner. This is the technology that generates or utilizes energy from renewable sources such as solar, wind, hydro, biomass, etc. Renewable Energy Technology can help DEWA diversify its energy mix, reduce its dependence on fossil fuels, lower its greenhouse gas emissions, and enhance its energy security. - Some examples of Renewable Energy Technology that influence DEWA's sustainability performance are: Solar Photovoltaic (PV) Panels; Concentrated Solar Power (CSP) Plants; Wind Turbines; Hydroelectric Power Plants; Biomass Power Plants - Data Management System can help DEWA measure and monitor its progress and achievements in sustainability, as well as identify the gaps and challenges that need to be addressed (Interviewee 15, 17, 22, 24, 25).^{45,56,57} - Data Management System can also help enhance transparency, accountability, and reporting of DEWA's sustainability performance. |
| 17. (21), HOD, Renewable Energy Department, Sharjah | <ul style="list-style-type: none"> - IoT can also help DEWA improve its efficiency, effectiveness, quality, safety, security, innovation, and competitiveness in its products and services. - BMS are the systems that monitor and control the mechanical, electrical, and plumbing systems of buildings in a sustainable manner. - AI enables machines or systems to perform tasks that normally require human intelligence such as learning, reasoning, decision making etc. (Interviewee 5, 6, 9, 14, 16, 23).^{42,43,58} - Renewable Energy Technology can also help DEWA contribute to the global efforts to combat climate change and achieve the SDGs. |
| 18. (20) Finance Manager, Fujairah, Logistics | <ul style="list-style-type: none"> - IoT is the technology that connects physical devices, vehicles, appliances, sensors, etc. to the internet or to each other through wireless networks. - Building Management Systems (BMS) can also help DEWA reduce the environmental impacts of buildings such as carbon footprint, water footprint, waste generation etc. - AI can help DEWA analyze large amounts of data faster and more accurately than humans can do it manually (Interviewee 3, 6, 13, 19, 24).⁵⁹⁻⁶¹ - AI can also help DEWA generate insights and recommendations that can improve its sustainability performance. - Mobile Application runs on mobile devices such as smartphones or tablets. |
| 19. (13) HR – Talent Acquisition, HOD, Private Logistics sector, RAK | <ul style="list-style-type: none"> - Organization Culture is the set of values, beliefs, norms, and behaviors that shape the identity and character of DEWA and its stakeholders. - Dubai Government Supervision ensures how DEWA is supervised and supported by the Dubai Government in implementing the sustainability agenda. (Interviewee 11, 14, 18, 21, 23).^{40,46,62} - IoT can help DEWA collect and exchange data in real-time, automate processes, control devices remotely, enhance customer experience, and create new business models. |
| 20. (13), Vice President, Logistics, Oil and Natural Gas sector, Abu Dhabi | <ul style="list-style-type: none"> - AI can also help DEWA automate processes that are repetitive or tedious for humans to do it manually - Mobile Application can also help DEWA provide information services feedback surveys etc. to its customers and stakeholders more easily and efficiently through various features such as notifications alerts reminders etc. - Resilience is the ability of DEWA to resist, adapt, and recover from disruptions or crises that may affect its sustainability performance (Interviewee 7, 8, 15, 16, 24).^{61,63,64} - Mobile Application can help DEWA communicate with its customers and stakeholders more effectively and conveniently through various channels such as voice calls text messages emails etc. - Resilience can help DEWA maintain its operational continuity and service quality in the face of uncertainty and change. |
| 21. (14), HOD Research and Development, Abu Dhabi | <ul style="list-style-type: none"> - Some examples of Organization Culture that influence DEWA's sustainability performance are DEWA's Values (Excellence, Happiness, Creativity, Social Responsibility); DEWA's Code of Ethics and Business Conduct; DEWA's Sustainability Policy; DEWA's Sustainability Culture Indicator (DSCI); DEWA's Sustainability Ambassador Program (DSAP) - Capacity Building can help DEWA enhance its human capital, which is one of its most valuable assets for sustainability. (Interviewee 2, 9, 12, 18, 22).⁶⁵ - Mobile Application can also help DEWA engage and empower its customers and stakeholders to participate in its sustainability initiatives and programs through various functions such as conservation tips rewards programs etc. |
| 22. (17), ITC Vice President, Power Sector, Dubai | <ul style="list-style-type: none"> - Some examples of Resilience that influence DEWA's sustainability performance are the Risk Management Framework; Business Continuity Management System (BCMS); Emergency Response Plan (ERP); Crisis Management Plan (CMP); Disaster Recovery Plan (DRP) - Resilience can also help DEWA mitigate the risks and impacts of disruptions or crises on its economic, environmental, social, and governance dimensions. - Capacity Building can also help DEWA empower its employees and stakeholders to make decisions, collaborate, and innovate in response to sustainability challenges and opportunities. (Interviewee 2, 6, 7, 10, 15, 22).^{58,66,67} |

Table I Continued...

| (Years of Experience), Interviewee no, Location, Designation. | Interviewee views on Resilient Supply Chain (Other Interviewees comments in agreement) |
|---|--|
| 23. CEO, Power Sector, Abu Dhabi. | <ul style="list-style-type: none"> - Organizational culture can also help DEWA embed sustainability in its core business strategy and operations and promote innovation, learning, and continuous improvement. - DEWA's Values (Excellence, Happiness, Creativity, Social Responsibility); DEWA's Code of Ethics and Business Conduct; DEWA's Sustainability Policy; DEWA's Sustainability Culture Indicator (DSCI); DEWA's Sustainability Ambassador Program (DSAP). - DEWA Brand Image and Corporate, UAE Excellent performance is maintained - Some examples of Dubai Government Supervision that influence DEWA's sustainability performance are The Dubai Supreme Council of Energy; The Dubai Executive Council; The Dubai Green Economy Partnership; The Dubai Regulatory & Supervisory Bureau (Interviewee 5, 7, 10, 13, 19, 20).⁶⁸⁻⁷⁰ - Organization Culture can help DEWA create a shared vision, mission, and goals for sustainability, as well as foster a sense of commitment, ownership, and pride among its employees and partners. - DEWA human resources efforts ensure superb performance |
| 24. (15), Entrepreneur, Power sector, Machinery Supplier | <ul style="list-style-type: none"> - DEWA is known for its excellent training, R and D efforts as it has the resources to fund these initiatives and the Dubai Government support. - Some examples of Resilience that influence DEWA's sustainability performance are Risk Management Framework; Business Continuity Management System (BCMS); Emergency Response Plan (ERP); Crisis Management Plan (CMP); Disaster Recovery Plan (DRP) (Interviewee 3, 8, 16, 23, 25).^{69,71,72} - Dubai Government Supervision can help DEWA align its policies and strategies with the vision and directives of His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai. |
| 25. (26), Power and Energy Sector, Consultant, Dubai | <ul style="list-style-type: none"> - Dubai Government Supervision can also help DEWA access the guidance, resources, and networks of the Dubai Government entities that are responsible for overseeing and regulating the energy and water sectors (Interviewee 11, 14, 19, 20, 22)^{48,58,61} |

Source: Developed by the Author

Conclusion and recommendation

Implications of this research

Practical Implications: Research on building a sustainability index for Dubai Electricity and Water Authority (DEWA) has several practical implications. Research on building a sustainability index for DEWA allows accurate assessment of sustainability performance, evaluation of progress towards sustainability goals, identification of areas for improvement and priorities, benchmarking against industry peers and international standards, facilitating collaboration and learning from other organizations, supporting decision-making and resource allocation, and fostering transparency and accountability in reporting sustainability achievements and progress.⁷⁴

Social implications: Research on building a sustainability index for DEWA has significant social implications. Firstly, it promotes a holistic approach to sustainability, considering social and economic development, and ensuring DEWA's initiatives have a positive impact on society, fostering inclusivity and equity. Secondly, the research helps DEWA identify the social implications of its activities, allowing them to address negative consequences and enhance social well-being. Additionally, the sustainability index facilitates collaboration and knowledge sharing with other organizations, improving DEWA's social initiatives and contributing to regional social development. Lastly, the research supports transparent reporting, fostering trust and accountability among stakeholders and strengthening DEWA's reputation as a socially conscious organization.⁴²

Managerial implications: The research on building a sustainability index for DEWA has important implications for managers. It provides insights into DEWA's social, economic, and environmental aspects, enabling informed decision-making and prioritization of improvement areas. The research helps identify sustainability-related risks and opportunities, allowing managers to anticipate and mitigate potential challenges and find innovative ways to save costs. It also supports goal setting and progress tracking through the establishment

of a sustainability index, enabling better monitoring and evaluation of initiatives. Lastly, the research facilitates collaboration with other organizations, enabling benchmarking against industry best practices and fostering knowledge sharing for the adoption of innovative strategies and partnerships. Overall, this research equips managers with valuable information and tools to enhance sustainability performance and collaborate with others.⁷⁵

Limitations and future research

The research on building a sustainability index for DEWA has limitations regarding data reliability, the narrow focus on specific aspects of sustainability, inadequate consideration of the dynamic nature of sustainability, overlooking cultural and societal context, and neglecting trade-offs and synergies between sustainability goals. The research on building a sustainability index for DEWA faces several limitations. Data availability and quality pose significant challenges, as inconsistent or incomplete data can skew results and misinform decision-making processes. The scope and generalizability of the findings are also limited, as the research is specific to DEWA and the unique socio-economic and environmental conditions of Dubai, which may not be applicable to other regions or organizations. Technological barriers further complicate implementation, as not all organizations have equal access to advanced technologies necessary for monitoring and sustainability practices. Ensuring consistent and meaningful stakeholder engagement is another hurdle, given the diverse groups involved, including employees, customers, suppliers, and community members. The dynamic nature of external factors, such as economic fluctuations, regulatory changes, and global events like pandemics, requires continuous adaptation and reassessment. Resource constraints, particularly for smaller organizations, limit the ability to invest in and maintain comprehensive sustainability initiatives. Developing standardized metrics and methodologies for measuring sustainability performance is complex, challenging consistency and comparability across different sectors and regions. Achieving long-term commitment and cultural shifts within organizations is essential

yet difficult, especially amid changing leadership and priorities. Additionally, the regulatory and policy environment can significantly influence the success of sustainability initiatives, with inconsistent or insufficient government support impeding progress. Lastly, assessing the actual impact of sustainability initiatives on environmental, social, and economic outcomes necessitates robust evaluation frameworks and longitudinal studies to understand the true effectiveness of the Sustainability Index. Addressing these limitations requires a multifaceted approach, including enhancing data collection and management, fostering stakeholder engagement, ensuring resource and technology access, and adapting to changing external conditions.

Future research should address these limitations by improving data quality, exploring additional dimensions of sustainability, considering evolving sustainability requirements, accounting for the local context, and investigating trade-offs and synergies among various sustainability objectives. Future research should explore the applicability of these findings across different industries. Furthermore, the study did not examine the long-term effects or sustainability of the suggested strategies. Future research should evaluate the long-term impact on performance, profitability, and environmental sustainability. Finally, the study could have explored the role of human resources and organizational culture in building resilient energy sectors. Future research should investigate how employee competencies and corporate culture contribute to Organization resilience. Even R & D should be encouraged in superconductivity in normal temperature to mitigate distribution losses and enhance efficiency.

The contribution and originality

Value of the research

The primary significance of this study lies in the creation of the Multi-level Integrated Process theory as a conceptual model. It aims to enhance our understanding of sustainability and offers valuable insights into strategies, practices, and factors that can improve the performance of energy companies. The research focuses on specific industries, providing practical recommendations for practitioners in those sectors and identifying crucial factors for constructing a sustainability index for DEWA. It places particular emphasis on considering external factors such as political instability and natural disasters, thereby offering a comprehensive understanding of the intricacies involved. The study also underscores the importance of employing objective measures and rigorous research methods to enhance the validity of findings, thereby guiding future research endeavours in the field.

Conclusion

To summarize, the Multi-level Integrated Process theory presents a comprehensive framework for comprehending the drivers of the Building Sustainability Index and its practical applicability. This study has made noteworthy contributions to the field by offering valuable insights into strategies, practices, and factors that can enhance the sustainability of energy companies. By focusing on specific industries or contexts, the research has provided pertinent and practical recommendations for professionals in those sectors. The study's emphasis on considering external factors, such as political instability and natural disasters, further enhances its value in understanding and improving sustainability performance. Furthermore, the study emphasizes the significance of objective and standardized measures to enhance the validity of research findings. Overall, this study has significantly advanced the existing literature on resilient supply chains by providing valuable insights, recommendations, and a comprehensive understanding of the complexities involved. It serves

as a foundational piece of work for future research and offers practical guidance for practitioners who aim to enhance DEWA's sustainability initiatives.

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Conflicts of interest

The authors declare that there is no conflict of interest.

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