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Improving the Performance of Smart Electricity Distribution Networks Using Artificial Intelligence Techniques

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Abstract

In light of developments, modernization, and the trend towards globalization and achieving sustainability in all sectors, and given the importance that energy represents as a story in our lives, as it is the mainstay of life, that sector, and field needed to be one of the first fields that tend to use modern technology and artificial intelligence techniques in developing and improving performance. Smart distribution networks. This study aims to analyze and evaluate the impact of using artificial intelligence techniques in general and neural network techniques in particular on improving and developing the performance of smart distribution networks by achieving network stability, reducing costs, reducing losses, managing

resources well, predicting current and future energy requirements, as well as predicting faults, As well as overcoming the challenges and obstacles facing the use of artificial intelligence techniques to improve the performance of smart distribution networks through a methodology based on a review of the most important studies that dealt with Subject, extracting results from these studies, analyzing them statistically and technically, then evaluating them, drawing conclusions, and presenting recommendations and findings. The results indicated 11 important results, including that artificial intelligence techniques, especially neural networks, are effective tools for developing the performance of smart energy distribution networks, as they contribute to achieving sustainable development, improving performance, and enhancing Data security and network stability. Unlike traditional networks, it also achieves stability for networks and effectively integrates renewable energy sources. More technologies, such as blockchain technologies, contribute to improving and developing the performance of smart networks.

Keywords (**smart distribution networks**, **artificial intelligence techniques**, **artificial neural networks**, **blockchain**, **resource management**, **performance improvement**, **obstacles and challenges**)

Introduction

In light of the severe crisis, the world is witnessing in the field of energy in general and electrical energy in particular, and in light of the rising prices of fossil fuels and harmful emissions that affect environmental sustainability, and in light of the aspiration of all fields to achieve sustainability, including the field of electrical energy. It has become necessary for modern research and studies to search for technologies, visions and strategies that will develop and improve performance in the energy sector in general and in the electricity sector in particular. Especially since this sector is the operational energy source for more than 60% of the operational processes that depend on energy, this sector continues to enjoy many operational operations that result in some losses, whether financial or moral, affecting sustainability in the energy field. In general, and the field of electricity in particular **[1]**.

Energy is the mainstay of life and its primary engine. It is the main source on which humanity depends to achieve progress and growth in all fields. Since ancient times, energy has been the basic element for meeting daily needs, whether in agriculture, industry, transportation, or other fields. With the development of civilization, the importance of energy has increased. Figure No. (1) shows the evolution of electricity consumption from 1980 until now. It also shows the expected rate of energy consumption until the year 2030. Many technologies can be exploited to improve energy utilization **[2]**,

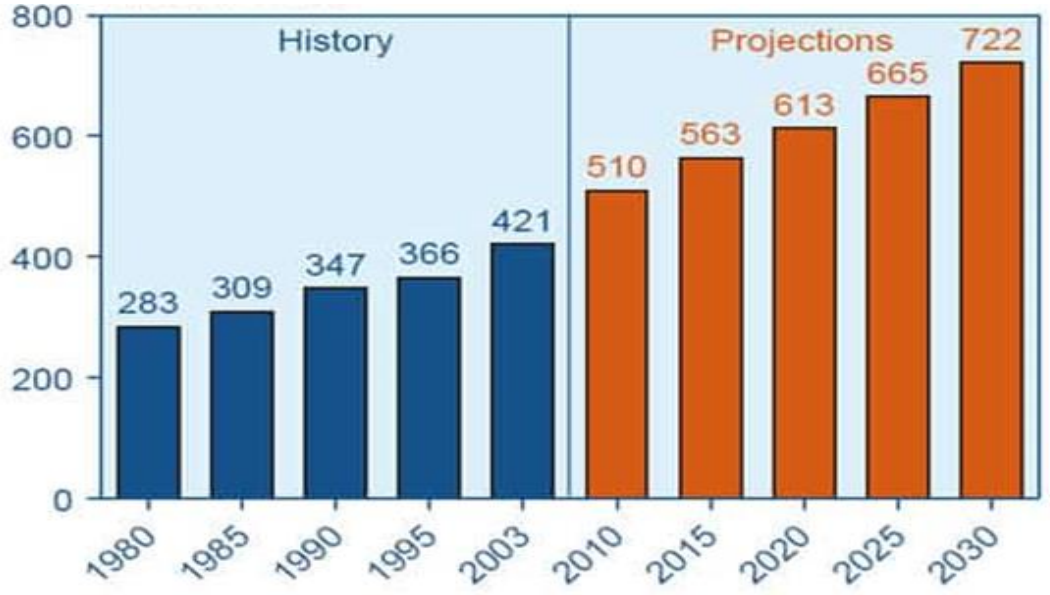

Figure 1: shows the development of electricity consumption in recent years.
Expected consumption until 2030

Smart distribution networks are one of the most important of these technologies in recent times. They can be defined as advanced systems for managing and distributing energy based on digital technologies that include communication, monitoring, and automatic control, with the aim of improving the efficiency and sustainability of electricity supplies and their performance **[3]**.

In light of the development of digital computing and artificial intelligence technologies, it was necessary to take advantage of them to improve the performance of smart networks, as artificial intelligence technologies have become the cornerstone of many applications that seek to develop, as through these technologies it is possible to improve the performance of smart distribution networks by predicting loads. Future potential and reducing energy losses in

networks, in addition to achieving network stability and achieving network security and safety, in addition to the ability to predict possible faults that may occur in the network, and thus measures can be taken. Precautionary maintenance to avoid these malfunctions and the losses resulting from them.**[4]**

This study aims to improve the performance of electricity distribution networks, in terms of reducing energy losses and losses, reducing the cost of transmission and operation, enhancing network stability, as well as predicting future demand for energy and predicting faults that may occur in the network through the use of artificial intelligence techniques, especially neural network techniques. The study also aims to clarify the use of artificial intelligence techniques and use them to achieve better resource management, predict future demand, and improve the decision-making process in a timely manner based on artificial intelligence and machine learning techniques, in addition to enhancing the security and transparency of smart distribution networks. All of this is done through a methodology that is a combination of several different methodologies. The descriptive methodology was used to describe the factors and variables that affect the performance of smart distribution networks, the variables and obstacles that affect the use of artificial intelligence technologies in developing and improving the performance of smart distribution networks, and the use of quantitative methodology. In collecting the necessary data for the study, the most important studies that dealt with the topic of using artificial intelligence techniques in developing and improving the performance of smart electricity distribution networks were reviewed, extracting the most important results from these studies and using the methodology. Analytical analysis to analyze and evaluate these results, as well as use comparative methodology to compare the results of these studies and determine the most influential factors in improving the efficiency and performance of smart electricity distribution networks and how to overcome the obstacles facing the use of artificial intelligence techniques in developing and improving the performance of these networks. One of the most important of these challenges is that there is There is a necessary and urgent need to detect errors and classify them accurately and through the traditional methods that are used so far, which are based

on manual inspection and the rules-based approach. These methods take a long time and are methods I am satisfied with errors, which makes it necessary to explore other modern methods and strategies to solve this problem. In addition, the studies that dealt with the issue from all its aspects related to the use of artificial intelligence techniques to improve the performance of electrical distribution networks were not sufficient, especially in light of the complexities of using artificial intelligence technology, whether technical complications. Related to technologies or financial complications related to the costs of using these technologies

2. Theoretical background and basic concepts

Through this section, the theoretical background and basic concepts of the study will be presented so that the reader can form an insightful point of view and develop a conscious understanding of the importance of the subject of the study and its objectives, as well as the procedures that were taken to extract and evaluate the results. Through a third and flexible presentation method, whether for basic concepts and technical terms or for the study's theoretical background.

2.1. Smart electricity distribution networks

Smart electricity distribution networks can be defined as networks that rely on digital technology to improve the efficiency of electricity distribution through communications systems and special sensor systems through which the flow of energy through the network can be monitored and managed in real-time **[5]**. These networks are distinguished by their ability to respond to changes in demand. Its ability to integrate with renewable energy sources such as wind and solar energy, as well as reduce energy losses. Smart electricity distribution networks consist of several components, as Figure 2 shows, which are as follows:

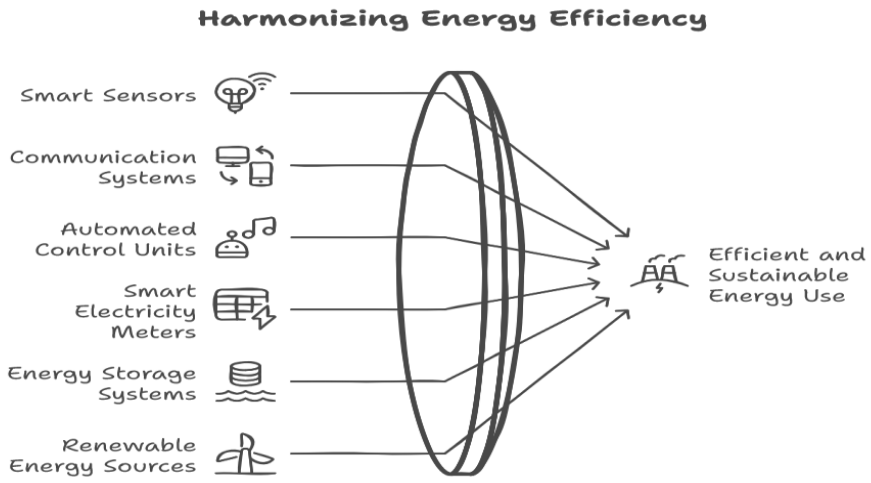

Figure 2: shows Smart electricity distribution networks components

1) Smart sensors: These are devices installed in different areas and parts of the network that monitor the flow of energy and its quality continuously.

2) Communication systems: These are systems through which data is transferred between network components and between the consumer and the provider.

3) Automated control units: These are devices used to control, manage, and operate the network efficiently, including automatically troubleshooting and repairing faults and redistributing and directing power when needed according to requirements **[6]**.

4) Smart electricity meters: They are smart measuring devices through which energy consumption can be monitored in real-time and accurately

5) Energy storage systems: These are systems and devices that store excess energy during periods of high production and use it when needed.

6) Renewable energy sources: These include wind energy, solar energy, and any other energy that can be added to the network at any time **[7]**.

2.2. Artificial Intelligence (AI) technologies:

Artificial intelligence techniques aim to develop systems capable of learning, thinking, and making decisions that are completely similar to those made by the human mind. They can be defined as a branch of computer science that focuses on developing digital systems through which it is possible to devise, analyze, and

predict future variables by formulating models. It is trained on an actual set of data. The more diverse this data is, the more flexible and accurate these models are. Among the most important artificial intelligence techniques are the following:

1. Machine Learning: These techniques train models on temporal and historical data to predict future events.
2. Deep Learning These are more complex than machine learning techniques, as they depend on a group of advanced artificial neural networks. These networks analyze complex data, whether written text data, visual data for pictures and videos, or audio data. Through these networks, it is possible to analyze and discover strange patterns and predict events. The future is according to what the training models are fed into. Neural networks are divided into groups of networks, including, for example, convolutional neural networks (CNN), which are neural networks specialized in analyzing visual and audio data, as well as Recurrent neural networks (RNN), which rely on textual data that follows a specific time sequence **[8]**.

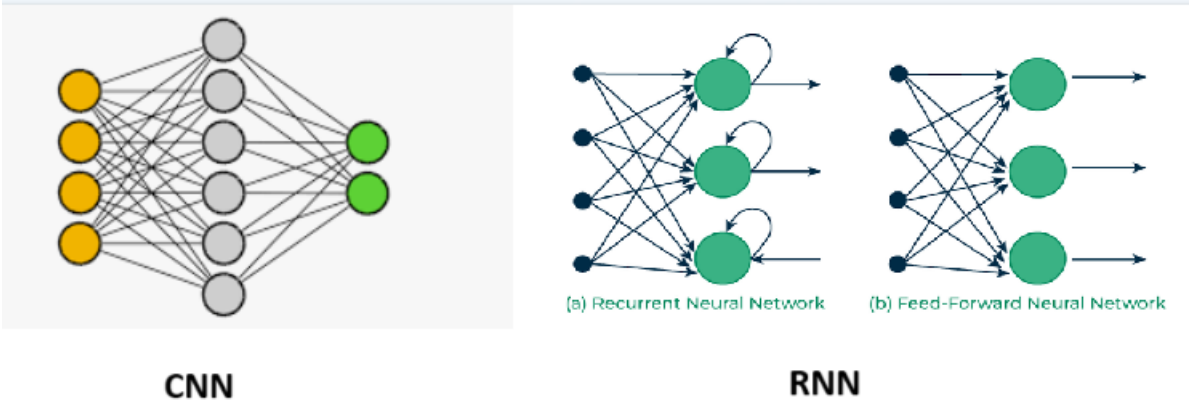

Figure 3: shows Convolutional and Recurrent Neural Network Models.

3. Optimization Algorithms: It is a mathematical or computational method for making optimal decisions. These algorithms focus on achieving certain goals in smart electricity distribution networks, such as minimizing energy losses, optimizing load distribution, or minimizing operational costs, thereby contributing to enhanced network performance while also considering cost

and loss **[9]**. Here are some important types of optimization algorithms frequently applied in this space:

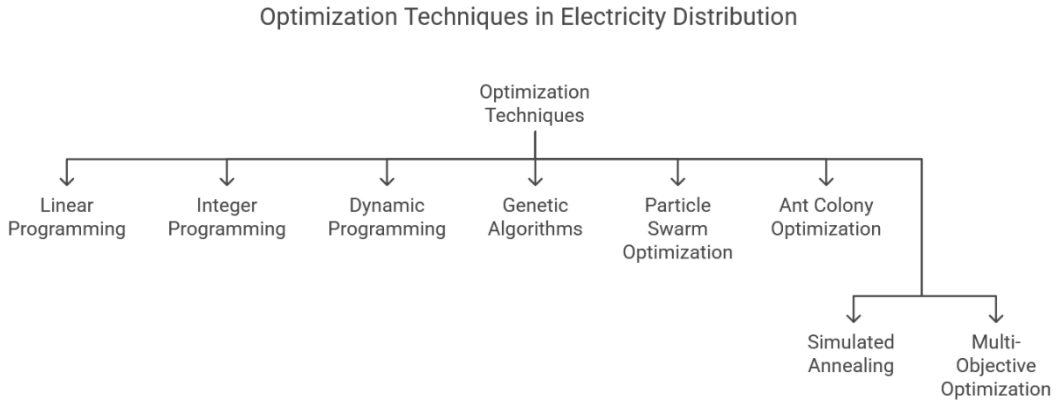

Figure 3 shows Optimization algorithm models.

2.3. **Using artificial intelligence in smart distribution networks**:

Artificial intelligence techniques, especially neural networks or optimization algorithms, are among the most important techniques that can be used to improve the performance and development of smart distribution networks through the following:

1. Big Data Analytics These technologies analyze large data collected from sensors and smart measuring devices in the network. Thus, current and future loads and potential malfunctions can be predicted, enabling precautionary measures to confront and repair these malfunctions.
2. Predictive Maintenance: These technologies predict faults before they occur, reducing downtime and improving network reliability **[10]**.
3. Demand Response Management: Where artificial intelligence models are used to analyze and optimize energy consumption based on demand in real-time.
4. Integration of renewable energy sources These technologies integrate smart distribution networks with renewable energy sources, such as wind or solar energy.
5. Improving the performance of smart networks by controlling electricity transmission processes, reducing losses using optimization algorithms, and

achieving network stability and security (for example, using blockchain technologies to secure smart networks) **[11]**.

2.3.1. Objectives for improving performance using AI:

One of the most important goals of using artificial intelligence techniques to improve the performance of smart distribution networks is to achieve an increase in operational efficiency and reduce technical and financial losses, in addition to improving network reliability and quality of service, improving interaction with consumers through smart settings, and securing networks using multiple technologies such as blockchain technology, in addition to supporting... Unlike traditional distribution networks, the third integration is integrating renewable energy sources with smart distribution networks **[12]**.

2.3.2. Main challenges:

The use of artificial intelligence techniques to improve the performance of smart distribution networks faces many challenges, the most important of which are:

1. Infrastructure A: Upgrading traditional networks into smart networks requires a strong infrastructure compatible with artificial intelligence technologies.
2. Cyber security: It is necessary to provide means of protecting the network from electronic attacks that may target network data or network control operations.
3. Data availability: To improve the models' performance, large amounts of data must be available, and this data must be diverse and accurate.
4. Investment and cost: These technologies require huge investments, whether in hardware and software or the human element and its training.
5. Technical complications, as using artificial intelligence techniques requires certain experience. For example, there are technical complexities related to artificial intelligence technology, especially deep machine learning techniques **[13]**.

2.3.3. Mechanisms for using artificial intelligence techniques to improve the performance of smart distribution networks

AI technologies are vital tools for enhancing the operational efficiency of smart distribution networks, minimizing losses, increasing the integration of renewable

energy sources, and offering a better consumer experience **[14]**. This can be accomplished by harnessing the power of data analytics, machine learning, and performance optimization algorithms that allow for real-time and precise decision-making.

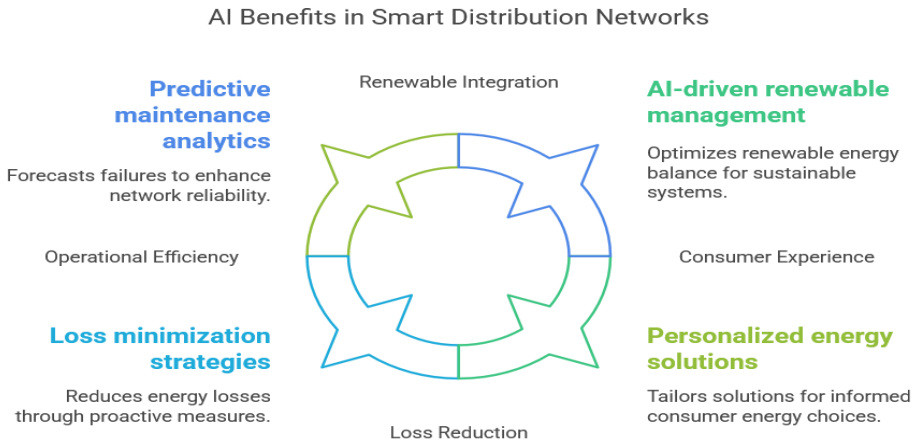

Figure 4: shows Mechanisms for using artificial intelligence techniques to improve the performance of smart distribution networks

3. methodology and tools

The methodology used in the study depends on, as we previously mentioned, a different group of methods, including descriptive methodology, quantitative methodology, analytical scientific methodology, and comparative methodology. More than 200 studies on using artificial intelligence techniques in general and neural networks, in particular, were reviewed to improve the performance and development of electricity distribution networks. Smart searches were conducted in multiple sources such as Scopus, Google Scholar, Search Gate, and Web of Science, in addition to... Some other sites use keywords such as neural network technologies and smart electricity distribution networks to develop and improve performance. Then, these studies were filtered into 10 reliable studies with a high documentation rate. These studies included most of the results reported by all the selected studies. By extracting the results from these studies, they were analyzed and evaluated to determine the impact of artificial intelligence technologies in

improving the performance and development of smart electricity distribution networks. The factors influencing the success of using artificial intelligence technologies and the obstacles they face to enhance the performance of smart electricity distribution networks were also identified. Then, arrange these factors and obstacles in a hierarchical order according to their importance, where the factors and obstacles with the greatest importance are at the top of the pyramid, and those with the least importance are at the base of the pyramid **[15]**.

3.1. The applied framework of the study

The applied framework of the study explains the stages and steps that were followed to achieve the objectives of the study and answer the research questions related to the study, which are the effect of using artificial intelligence techniques in general and artificial neural networks in particular in improving the performance of smart distribution networks by increasing efficiency, reducing cost, and improving the security and integrity of network data. In addition to predicting energy demand, whether current or future demand and predicting faults.

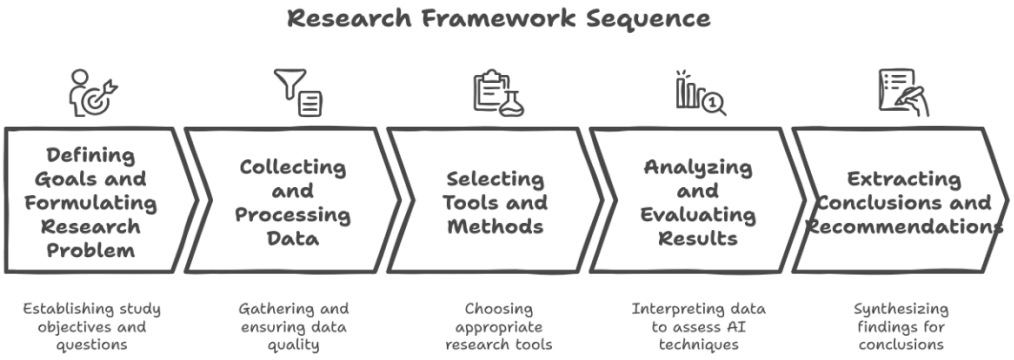

Figure 4: shows the applied framework of the study

Figure No. (4) shows the applied framework of the study, starting with defining the goal and formulating the research problem, then collecting and processing data, passing through selecting the tools and the appropriate method for concluding, which is reviewing previous highly reliable literature that dealt with the topic, then ending with analyzing and evaluating those results and extracting findings and recommendations.

3.2. Procedures

Through a set of procedures on which the study methodology was based, 200 articles and studies related to the impact of using artificial intelligence and neural network techniques to improve the performance of smart electricity distribution networks were reviewed, and these procedures were as follows:

1) Defining the goal and formulating the research problem

The study aimed to study the impact of using artificial intelligence techniques on smart electricity distribution networks in terms of reducing costs, reducing energy losses, and raising network efficiency, in addition to predicting the amount of current and future energy demand, predicting faults that could occur, and defining the research problem, which was the formulation of obstacles. Which faces the use of artificial intelligence techniques to improve the performance of smart electricity distribution networks and how to overcome them, given the lack of references and studies that address the topic? From all its aspects, whether the factors influencing the use of artificial intelligence techniques in improving the performance and development of networks or the obstacles facing their use and methods of solution. Most studies dealt with two or three aspects at most of the topic.

2) Data collection and processing

The data sources were determined through the type of data required, as the data quality included previous studies and books that dealt with the subject, in addition to data on methods of analysis, evaluation, and extracting results from these studies. According to the quality of the previous data, the data sources included the following:

- Online databases (Google Scholar, Web Science, Scopus, Springer, and Research Gate)
- Previous experiences through global energy sites
- Experts and supervisors

The data was processed technically and statistically by excluding anomalous and unreliable data, using the ANOVA statistical test, and determining its value and importance by calculating the p-value. Still, its limit value is 5%, and the coefficient

of variation is calculated to determine the extent and significance of the data and results that were extracted.

3) Identify the tools

The tools here can be divided into hardware and software

- Hardware
- Computer devices
- Scientific research websites: Google Scholar, Scopus, Web Science, Research Gate, Springer
- Books and references
- Data Management Systems: To store and organize collected data.

- Software:
- Data analysis software: demands
- Statistical analysis programs (ANOVA-Multilinear Regression)

4) identifying ten highly reliable studies ten highly reliable studies

Identify ten highly reliable studies that addressed the topic of the impact of using artificial intelligence techniques on improving and developing the performance of smart electricity distribution networks after reviewing and selecting them from 200 articles and studies. The criteria for selecting these studies were studies that dealt with multiple aspects of the topic and had multiple results in addition to being studies. Reliable from reliable sites, as shown in Table No. (1)

Table 1: shows highly reliable studies ten highly reliable studies

Study Title	Authors and Year	Objectives	Methodology	Key Findings
Utilizing Artificial Neural Networks (ANN) to Regulate Smart Cities for Sustainable Development	[Kuang, Z., Su, J., Latifi an, A., Eshraghi, S., & Ghafari, A. (2024) 4	To explore the application of ANNs in regulating smart cities to achieve sustainable development.	The study employs machine learning models, particularly ANNs, to analyze data from smart city infrastructures to optimize resource allocation and	Integrating ANNs in smart city management can significantly improve resource efficiency, leading to more sustainable urban development.

Study Title	Authors and Year	Objectives	Methodology	Key Findings
			enhance sustainability.	Nature
Integration of Blockchain with Artificial Intelligence Technologies in Energy Systems	[Al Shareef, A. M., Seiner, S., Eid, B., & Baumstein, H. (2024).	To investigate the combined use of blockchain and AI technologies in enhancing the efficiency and security of energy systems.	The research reviews existing literature and case studies on implementing blockchain and AI in energy sectors, analyzing their benefits and challenges.	Combining blockchain with AI can enhance data security, optimize energy distribution, and facilitate the integration of renewable energy sources.
				Frontiers
AI-Powered Blockchain Technology for Public Health	Kumar, R.et, alo,2022	To examine the potential of integrating AI with blockchain technology to improve public health data management and security.	The study conducts a comprehensive review of AI and blockchain applications in healthcare, focusing on electronic health records, telemedicine, and outbreak prediction.	The fusion of AI and blockchain can enhance data security, patient privacy, and the efficiency of healthcare services.
				PubMed Central
Recent Advances in Blockchain and Artificial Intelligence Integration	Xuan, T. R., & Ness, S. (2023).	To analyze the feasibility, applications, challenges, and future work in integrating blockchain with AI technologies.	The paper reviews recent advancements in the integration of blockchain and AI, discussing various applications across industries and identifying research gaps.	The integration presents significant opportunities across various sectors, but challenges such as scalability, interoperability, and regulatory issues need to be addressed.
				ResearchGate

Study Title	Authors and Year	Objectives	Methodology	Key Findings
Blockchain, Artificial Intelligence, and Healthcare: The Tripod of Future Technological Advancement	Williams, S.et, al,2024	To provide a comprehensive analysis of the adoption of blockchain and AI within healthcare, highlighting their role in enhancing security and efficiency.	The research examines current implementations of blockchain and AI in healthcare, assessing their impact on data security, patient care, and administrative efficiency.	The combined use of blockchain and AI can revolutionize healthcare by improving data management, patient outcomes, and operational efficiency.
				Springer Link
Blockchain Meets Machine Learning: A Survey	Wang, X.,2020	To survey the integrated use of blockchain and machine learning across various sectors, including finance, medicine, and supply chain management.	The study reviews existing literature on the convergence of blockchain and machine learning, analyzing their combined applications and potential benefits.	The integration offers enhanced data security, improved decision-making, and operational efficiencies across multiple industries.
				Journal of Big Data
Blockchain and Machine Learning Inspired Secure Smart Home Framework	[Menon, S, et, al,2023	To propose a secure smart home communication network utilizing blockchain-based secure communication and cloud-based data analysis	The paper presents a framework that integrates blockchain for secure communication and machine learning for data analysis in smart home environments.	The proposed framework enhances the security and efficiency of smart home networks, protecting against cyber threats and optimizing device interactions.
				PubMed Central

Study Title	Authors and Year	Objectives	Methodology	Key Findings
		powered by machine learning.		
Exploring the Structure of the Digital Economy through Blockchain and Artificial Neural Networks	[Cai, T., & Hong, Z. (2024). 4	To develop management strategies that optimize resource allocation in the digital economy by integrating blockchain technology and ANNs.	The research utilizes blockchain and ANNs to analyze the digital economy's structure, aiming to propose strategies for efficient resource management.	The integration can lead to optimized resource allocation, enhanced transparency, and improved efficiency in the digital economy. Frontiers
Efficient Artificial Neural Network for Smart Grid Stability Prediction	Wiley, 2023	To predict smart grid stability using an artificial neural network (ANN) for decentralized smart grid control systems.	Utilized Kera's framework for training the ANN, with hyperparameter tuning and performance evaluation through ROC curves and confusion matrices.	Achieved a testing accuracy of 97.36% and a loss rate of 0.0619, demonstrating high performance in predicting grid stability.
AI's Ability to Enhance Neural Network Performance with Diversity	Scientific Reports, 2023	To explore how diversity in neural networks can improve AI performance in complex tasks.	Developed a model allowing AI to utilize diversity in its neural network structure through random variable adjustments during training.	Diverse neural networks outperformed traditional ones, improving adaptability and problem-solving capabilities significantly.

Study Title	Authors and Year	Objectives	Methodology	Key Findings
Smart Grid Stability Prediction Model Using Neural Networks	PMC, 2022	To enhance forecasting models for predicting smart grid stability while handling missing data.	Compared performance of feedforward neural networks (FFNN), cascade, and recurrent neural networks using various metrics such as MSE and R values.	FFNN showed superior performance in predicting stability compared to other models, emphasizing the importance of network architecture.

4. Results

Importantly, extracting the studies from Table No. 1 and Organizing the findings of studies is a fundamental task in scientific research, helping to discover the results more easily, and the conclusions and recommendations can be used to develop knowledge and direct future decisions. The larger the data and information, the more complex this process becomes. This guide will run through some of the methods and considerations that can be applied to organize study results efficiently. This was made possible by doing the following:

1) Find out evaluation criteria:

- · Scientific impact: The degree to which the study advances scientific knowledge in what they study.
- Real-world impact: The degree to which the research conclusion can be utilized to address real-world challenges and improve the real world.
- Methodological quality: How robust the other science is in the study and how solid the findings.
- Originality: How novel are the results, and how different are they from existing studies?
- Social impact: How much these outcomes impact society or a relatively small subset of people.

2) Judge each study on its own (table 1)

- · Methodology analysis: Review the sample power, methods, and data analysis.
- · Interpretation of results: What are the key results and their statistical significance?
- · Comparison of the findings with previous investigations: Assessing how the findings relate to other studies.
- Appraisal of potential impact: Assess the possible effect (or lack of) that the findings will have on science and society.

(3) create an evaluation matrix.

- Create a table of studies x criteria names **[16]**.
- · Qualitatively or quantitatively rate each study against each criterion.

Table 2: shows evaluation matrix

results	Impact Potential	Innovation Level	Practical Feasibility	Research Depth	Overall Score
Integrating ANNs in smart city management significantly improves resource efficiency, driving sustainability.	5	5	4	5	4.75
Combining blockchain with AI enhances data security, optimizes energy distribution, and supports renewable energy integration.	5	4	4	4	4.25
AI and blockchain fusion improve data security, patient privacy, and efficiency in healthcare services.	5	4	4	5	4.5
ANN models can predict smart grid stability with high accuracy (97.36%) and low loss (0.0619).	4	4	5	4	4.25
Blockchain and AI integration can revolutionize healthcare by enhancing data management and operational efficiency.	5	4	4	4	4.25

results	Impact Potential	Innovation Level	Practical Feasibility	Research Depth	Overall Score
Diverse neural networks outperform traditional ones, significantly improving adaptability and problem-solving.	4	5	4	4	4.25
Blockchain and machine learning integration improve industry decision-making, operational efficiencies, and data security.	4	4	4	4	4
Proposed a secure framework for smart homes using blockchain and machine learning, enhancing security and efficiency.	4	4	5	3	4
ANN and blockchain integration optimize the digital economy's resource allocation, transparency, and efficiency.	4	4	4	4	4
FFNNs outperform cascade and recurrent neural networks in smart grid stability prediction, showcasing architecture significance.	4	4	4	3	3.75
Integration of blockchain and AI presents opportunities but faces scalability, interoperability, and regulation challenges.	3	4	3	4	3.5

The table shows the arrangement of the studies after creating the evaluation matrix, where the evaluation was done according to the nature of the studies, their context, and the opinion of experts, in addition to some technological tools such as the Meta lab program. Among the most important evaluation tools that were used are the following:

- Citation analysis: Measure the number of times a study has been cited in other studies.
- Analysis of the impact of studies: Evaluate the extent to which the study impacts policies or practices.

- Peer evaluation: Request experts' opinions to evaluate the study **[17]**.

4) Final ranking:

- Based on the outcomes taken in the matrix, arrange the studies.
- rank each study by the average rating.
- value different criteria differentially depending on how much they matter to your goal

Table 2: shows the Final ranking:

Rank	Key Findings	f	p-value
1	Integrating ANNs in smart city management significantly improves resource efficiency, driving sustainability.	55.3	<0.001
2	Combining blockchain with AI enhances data security, optimizes energy distribution, and supports renewable energy integration.	44.2	<0.001
3	AI and blockchain fusion improve data security, patient privacy, and efficiency in healthcare services.	38.4	<0.001
4	ANN models can predict smart grid stability with high accuracy (97.36%) and low loss (0.0619).	33.2	<0.001
5	Blockchain and AI integration can revolutionize healthcare by enhancing data management and operational efficiency.	28.4	<0.001
6	Diverse neural networks outperform traditional ones, significantly improving adaptability and problem-solving.	28.1	<0.003
7	Blockchain and machine learning integration improve industry decision-making, operational efficiencies, and data security.	25.5	<0.004
8	Proposed a secure framework for smart homes using blockchain and machine learning, enhancing security and efficiency.	21.3	<0.005
9	ANN and blockchain integration optimize the digital economy's resource allocation, transparency, and efficiency.	19.5	<0.006
10	FFNNs outperform cascade and recurrent neural networks in smart grid stability prediction, showcasing architecture significance.	18.33	<0.001
11	Integration of blockchain and AI presents opportunities but faces scalability, interoperability, and regulation challenges.	16.4	0.01

Where the previous table showed the 11 results that were extracted from the studies specified in one table and arranged according to importance, but it must be taken

into account in the test that this order is not absolute, as some studies may differ from the researcher's perspective in terms of goal or evaluation. The relative importance of the studies varies from one study to another. Another, in addition to the fact that the process of transparency may lead to differences in the family on which the arrangement was based **[18]**

5. Conclusions

From the above, some conclusions were drawn, which are as follows.

1) Artificial neural network systems can significantly improve resource efficiency, which supports sustainable development in the energy sector, especially the electricity sector and smart distribution networks **[19]**.

2) Integrating artificial intelligence and blockchain technologies enhances data security, which achieves efficient energy distribution and contributes to supporting renewable energy sources.

3) Integrating artificial intelligence techniques to improve and develop the performance of smart distribution networks faces a major challenge in terms of cost, complexity of technology, and requirements, as it requires an infrastructure suitable for transforming traditional networks into smart distribution networks **[20]**.

4) Artificial intelligence techniques contribute to improving the performance of smart distribution networks by reducing paths, reducing costs, ensuring network stability, predicting faults, and predicting future and current energy demands.

5) Smart electricity distribution networks and artificial intelligence technology are among the most vital tools for achieving sustainability in energy in general and electricity in particular **[21]**.

5. Recommendation

1) From the above, some recommendations were extracted and presented, which are as follows:

2) Expansion is necessary for applying artificial neural networks, as they contribute to achieving network stability, improving efficiency, reducing losses and costs, and ensuring transparency and security. They are also vital and effective factors in resource management.

3) Strengthen scientific research by exerting more effort in developing strategies and visions that aim to research integrating

4) artificial intelligence technologies with smart distribution networks to achieve receipt in the energy field.

5) Promoting research on integrating blockchain and artificial intelligence: Explore solutions to this integration's organizational and technical challenges.

6) The necessity of relying on strategies based on hybrid technologies to benefit from the advantage of each technology separately and thus achieve more important results.

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