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Blockchain in Energy Sector

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ABSTRACT

The necessity to manage resources as effectively as possible in order to fulfil the rapidly expanding global demand for energy is one of the most important study concerns. Talking about energy is essential when it comes to decentralisation, security, transparency, and traceability. Consequently, during the past few years, a number of research studies have emphasised blockchain technology as the most cutting-edge business platform capable of offering a privacy, see through & some time energy controlling system. For this article, we have done a SLR using the prisma framework that are currently Article publications on the use of block chain in the energy resource industry, published between 2008 and 2022. There are 769 total identified in the primary studies after laborious by human analysis & removing. There were some critaian to 6 address and some question of various block chain different point of applications platforms in the sector, the various sourcesof which some are implemented, the various emerging technology to create block chain result, various consensus mechanisms. We created a database based on the survey data that was acquired to categorise the current analysis works, identify analysis patten, point out information gaps & propose relevant themes for more field inquiry.

INTRODUCTION

The dominant industry in the world and the primary engine behind many applications is energy. With a market value of more than 6 trillion in 2022, it is crucial for social stability and economic growth.

The challenge of overcoming the tension between satisfying the world's escalating demands and its limiting energy supplies is motivating an growing number of studies on this topics. The growth of the power demands sensible, clever, and efficient answers to the resistance faced.

Due to the rising requirement of trustworthy smart and digital solutions in the era of the fourth generation industrial , technology is attracting the interest of more and more members of the scientific community, particularly those who are interested in the global energy business. Blockchain is a shared, distributed ledger that records all previous transactions that have ever taken place inside a network of businesses. A digital platform, that is. These transactions cannot be changed, revised, or deleted since they are stored in digital blocks that are connected cryptographically. Instead than requiring a centralised authority, they are approved and certified by a predetermined number of participants. The good properties of technology provide a potential answer for the intelligent management of energy networks and sources to facilitate the transition to a good secure and sustainable resource system.

One of the most in-demand hard skills for 2021 is blockchain. Due to the worldwide need for blockchain specialists and professionals, blockchain based jobs will rank among the top paying professions in year 2021 . The global job market for blockchain technology only saw a rise of more than 2000% between 2017 and 2020. This helps to explain the massive size of the anticipated world wild blockchain market. Which excluding cryptocurrency investments, is predicted to reach more than USA dollar 1.4 tril in year 2030. Regarding the energy sector, it is anticipated that the market value for blockchain technology would rise from USD 200 million in 2018 to USA dollar 3 bill in year 2025.

It is crucial to provide an efficient technique for managing and selling energy in the modern world, where energy-intensive businesses and technological growth go hand in hand. This will eventually lead to growing requirment and a diminishing supply of energy resouces.

RESEARCH METHODOLOGY

Research Methods The article's goal is to introduce current blockchain trends in this sector and given detaiedl introduction to this technology. Whether or if the three primary target of the existing industry can be accomplished

utilising a blockchain is the major question in this area. We spent a lot of time throughout the study figuring out how the information from related Research changed. The following questions onresarch are:

What will be the case studies with application?
Who is in charge of putting technology into practise: the government or a private company? Since it is helpful to understand what the papers cover and what categories and features are most commonly researched, a review was conducted as a starting point for the study. The actual publication is based on the PRISMA 2020 recommendations for proper review [34]. On June 21, 2022, the investigation was completed. Searching for publications on the topic of "blockchain & in the sector" was the main criterion used to choose the papers from the WoS. After that, documents that weren't articles or proceedings papers, weren't open access, weren't in the correct field, or weren't written in English were deleted. The appropriate areas were selected, which included engineering, electrical and electronics, fuels, computer and information technology systems, telecom etc . After the articles had been not manually eliminated, the second phase was personally evaluating the papers based on the title and abstract.

LITERATURE SEARCH STRATEGY

We have to take into account several scientific literature sources to extract as many pertinent publications as feasible. Two authors did the literature search in March 2022. These are the details of the databases we used:

- Digital libraries include resources like the IEEE Xplore, ACM Library, Springer Linkand Science-Direct.
- Scopus and Electronic databases, formerly ISI Web of information.
- Google Scholar and the DBLP are citation search engines.

To include all potentially relevant papers in our search phase, we defined our search terms around two main axes: "blockchain" and "energy," which resulted in these both group of keywords specific to every area.

1: Block chain, share ledger, spread ledger..
2: Energy trading, smart grid, microgrid, distributed energy, and electrical power.

We wanted to be very specific with our search terms for "energy" to order order to gathered a papers relating to "electrical " and remove unnecessary papers like energy mining for platforms." The logical operators "&" and "/" were used to combine these terms in order to find every papers that had at end one word from every grouping in their title, abstract, as seen in Table
Utilizing a multi-stage approach based on the methodology chart for Preferred Reports that have Proper Reviews ,Analysis. To be certain of how many entries were acquired and deleted at each stage,as well as the whole number of back-issue articles, this phase was carried out independently by two authors.

The many processes we used in conducting our systematic review are listed below:

Step 1: Recogncation: They ran the querie in the various data bases we chose (as shown in Table 1). There were 3150 references in all. We obtained 2807 articles after deleting the duplicates (343 articles).

Stage 2: Screening: We examined the 2807 papers that were left over from the previous step and then used our exclusion & inclusion criteria to automatically eliminate 1917 articles. Additionally, each author manually reviewed the titles, abstracts, and, when necessary, the paper's body to weed out any papers that weren't relevant. A study quality assessment was also used, which resulted in the exclusion of 106 papers from our set of potential papers and the reduction of that set to 784 articles (discussed in Section 2.5). Our list was reduced by fifteen additional papers since they were not online.

Stage 3: Contains: The final collection of 769 articles that we included in our investigation was confirmed at this stage. It is important to note that the two writers used both the forward and backward snowballing techniques suggested by Wohlin [18], and we were unable to locate any additional studies to include in our final list of 769 pertinent publications.

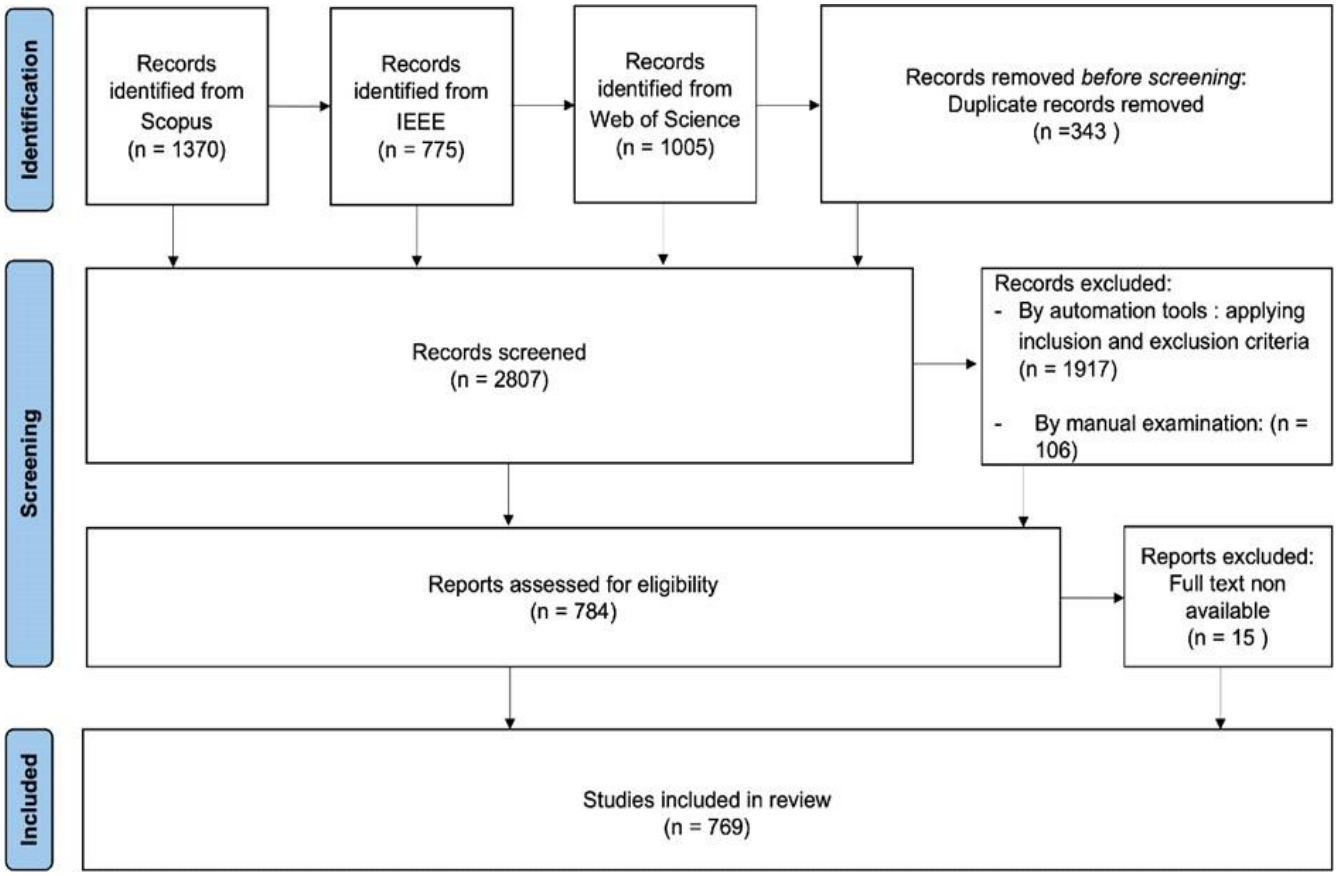

Fig: flow chart for the assessment process using PRISMA.

Study Classification:-

- RQ: Energy blockchain platforms' types of energy sources:

Three different kinds of energy sources are mentioned when we discuss them:

- fossil fuels: This comprises all forms of energy, such as natural gas, crude oil, and coal,that resulted from the fossilization of buried plant and animal remnants over millions of years. With more than 60% of the share, this form of energy is now anticipated to make up the majority of the worldwide electricity mix in 2021 [20].
- fissionable: materials,which are created whenever an atomic nucleus of any kind, such as uranium, could undergo a fission process.which are created whenever an atomic nucleus of any kind, such as uranium, could undergo a fission process. This form of energy, which will make up around 28% of the world's electrical mix in 2021 [20], is regarded as clean but risky.
- Renewable energy: This refers to all forms of energy that are produced from naturally replenishing and endless sources, like the sun and wind.

What can be achieved from the technology?

We stated at the outset that the key 3D goals of the power industry will be achieved (or at least started to be achieved) by using blockchain. The connection between these goals and the application of blockchain technology cannot possibly be emphasized enough. In this section, we outline the potential applications of technology in the sector that are mentioned in the context of these objectives in the papers under study.

Decarbonization

Even individual households can share electricity thanks to the blockchain application. Since excess energy can be

directly distributed via the grid, it enables the more widespread adoption of renewable energy sources [40]. A relatively low or nil economy (decarbonization) can be implemented thanks to blockchain and other innovations like digital twins. This can be done, at the time of building virtual enegry plants, using renewable sources of energy more frequently, and boosting prosumer availiable in the energy mix [41]. Another option to lower carbon pollution from the power system is to use clean energy sources, like solar photovoltaic power, which may be incorporated into solar pv for homes or businesses. Technology would make it feasible to create connection that would allow these Prosumers to address energy surpluses and shortages [48].Tracking ownership and carbon credits with digital notarization [43] is another application that can help in reaching this goal. Even the process of digitizing paper documents might help the environment [46].

Decentralization

A blockchain is a popular option because of the unchangeable of the blockchain record, the consensus procedures to used certify detailed added to block chain. Secure exchanges in distributed networks [47]. The blockchain is made up of changes from numerous nodes that require approval because it is a decentralized distributed database. The banking industry and Bitcoin are two examples of how blockchain can decentralize an industry. It enables the removal of all middlemen and the development of a peer to peer system trading . The distribution of energy can also be directly addressed using the same model. As a result, not only would it be able to decentralize information and payment transmission, but also energy distribution [40]. It will also be possible for decentralized storage systems to emerge that permit the storage of surplus energy [41].

Digitalization

Blockchain technology have the potential to hasten the establishing smart grids ,might been used in sector to enhance grid monitoring [40]. Energy wholesalers may find that a fully digital system that are based on crypto currency bills is a useful system for accelerating the payment process [43]. The blockchain can be used to hold documents connected to the energy industry, assuring their digitization [46].

Application:

There can be two ways to look at energy management: first, from the perspective of the company that provides the energy. This company hires energy specialists to carry out various network management tasks, like monitoring energy production and consumption to maintain a balance, increasing energy efficiency, and making sure energy sourcing, that also contains dependence on imports and the buying of sustainable power sources. The next rate of enegry monotring is at the time of users who seek to control and decrease the energy usage of their facilities in order to reduce their costs.This is crucial considering that energy expenditures account for 20 %to 25 % of total operating expenses in office buildings and may be reduced by 15% with an effective energy management system [21]. These are two way of monitoring & management can be simply integrated into one platform thanks to blockchain, which boosts platform efficiency and reduces the need for human work. Sustainability: 2022, 14, 15826, 10 of 45.

Energy storage: By keeping excess electricity in reserve and releasing it when demand is high, storage in one of the essential components of providing a reliable and secure energy required. Storage is now even more crucial given the growing share of renewable sources in the electric mixer. Due to their erratic nature and potential to cause grid instability, renewable energies are viewed as "unreliable" sources. By allowing for flexibility, having enough storage can assist in stabilise the electrical grid. This opens up a wide range of opportunities for Analysing in this sector, depend upon domain of energy . The current energy storage methods are expensive in most countries. Sharing energy storage among people or organizations living in the same community is one conceivably workable answer to this. Only can be utilizing to the paltfrom that could be ideadtified of peer 2 peer storage sharing be made available.

Development of microgrids and smart grids

To guarantee a consistent supply of electricity in the immediate area and to reduce the price of obtaining electricity in other types, an electricity microgrid is a system of electricity generating equipment, energy storage availablity, and loads that create a single grid. A micro-grid is made up of small conventional and renewable energy sources, energy consumers, and energy storage (batteries, supercapacitors, etc.), all of which function as a single unit close to one another to provide electricity as efficiently aspossible (Matusiak 2013).

Participants in a microgrid can use to-kens or cryptocurrencies to settle disputes with one another or with the microgrid environment, including producers, consumers, and prosumers (who concurrently create and consume electricity). The blockchain network's actualized payments and settlements are quick, accessible to all participants, carried out automatically, and done so without the use of middlemen. By developing a settlement mechanism based on blockchain technology, microgrids will be settled automatically and dynamically. The procedure should be coupled with smart

electricity meters in order to be referred to as fully automated .

Wholesale market

As a commodity, electric is frequently exchanged on exchanges, with the wholesale energy market serving as the main vehicle. Large producers and wholesale customers are hence its users. Theoretically, direct customers might engage in this market, but they are discouraged from doing so due to the high expenses associated with doing so, which include market availabilty fees, the required to maintain an IT infrastructure, and labor price.

Reducing the cost of participation might have a favorable effect on the market since it would increase supply flexibility, increase competition, and affect the commitment of small-scale renewable generators. Additionally, the longer time windows for purchasing electricity may be impacted by the trading platform's larger capacity. By implementing settlements using cryptocurrencies or cryptocurrency tokens and the Application of a trading platform through a smart contract, which ensures that trading occurs in a decentralized way, blockchain technology could, by the rules adopted by participants, become a tool to improve the market.

Emissions trading

The market for trading emission permits has the objectives to allow players to exchange documents they have acquired or received from an issuer that certifies their right to release a specific amount of environmentally damaging particals into the environment for payment.

Because there are few players and a closed market, trading costs are relatively expensive. The carbon trading method might be supported by blockchain technology tools. Tokens for cryptocurrencies, for instance, could be applied. By doing away with middlemen, blockchain technology can offer cheaper trade costs. The trading market could be set up using a blockchain network that is run by a consortium made up of all or just the most important trade participants. In the network, a cryptocurrency token would be established, and a controlling authority would be given the authority to issue it. This organization would guarantee the token's worth as well as the validity of its issuance and redemption.

Electromobility

The future of the energy sector depends on how the electromobility market develops. The progressive development of relevant legislative requirements and the rising demand for environmentally friendly goods and arguments in support of incorporating e-mobility into energy companies' strategic operations are solutions.

For the further advancement of electromobility, the price of charging an electric vehicle is crucial. Where a person lives, the cost of their power and the charging station itself all affect this. By removing financial intermediaries via the use of blockchain technology, power costs might be cheaper than they would be if bank-provided payment methods were used in their place.Bitcoin-based transactionsmay, if required, be done without a person present, which would be ideal for automated charging stations to operate without needless human involvement. Users of charging stations might, for instance, utilize cryptocurrencies or cryptocurrency tokens to make payments through blockchain.

Emerging Technologies in the Energy Sector Related to Blockchain:-

Energy blockchain experts will inevitably look to other cutting-edge technologies in their hunt for effective answers. The following is a list of some of the most significant upcoming technologies that are related to energy blockchains:

- Internet of Things: With this innovation, Many pieces of machinery, including EV chargers, energy metres, solar panels, wind turbines, and solar panels, could communicate directly with the blockchain platform.
- Energy blockchains fall under the wide umbrella of artificial intelligence, which encompasses a number of different technologies, including machine learning andlarge data analysis.
- __Management information systems are necessary to effectively tailor the system to the actual corporate demands ways availiablity decision making.
- __Systems can make decisions: By enabling automated decision-making, might give the blockchain an intelligence component.

Challenges and restrictions faced by the energy sector:

Inadequate transparency:

The energy industry is the key contributors to societal, political, and even economic growth. Because of this, openness and traceability are crucial for society, politics, science, and business. Because of this, it has drawn a lot of attention from the media, the general public, as well as legislators, who call for total openness on present policies, sectoral and technology advancements, the possibilities & can building future market advances, the ecological & financial effect on various paths. Unfortunately, this is not always the case, especially in light of the fact that energy systems are becoming

more complicated. People may assume that the future of the energy supply is being deliberately controlled as a result of this lack of transparency.

Corruption:

In various countries over the glod, the sector of energy is a point many opportunities & incentives of illegal achivement since it is typically associated with lax oversight, little transparency, and poor civil service pay. Without a doubt, via the extraction, transformation, and consumption of energy, the industry has every been an important source of creating economic rent. Because of this, the sector has long been plagued by corruption, which is especially problematic given how expensive, time-sensitive, and dependent on government institutions the industry is. Corruption in the sector can be take varoius forms that including breaching the law or bribing people with bribes to offering services. Corruption is difficult to quantify as it depends on so many diverse conditions. However, it is anticipated that corruption in the energy sector may result in a 20–30% increase in costs and an equivalent percentage decline in revenues for the gas, coal, and power industries.

Lack of integration of green energy sources:

Only 27% of the world's energy production in 2019 was green energy, according to the IEA. When compared to the targets for lowering CO2 emissions by incorporating more and more renewable energy sources, this rate is still quite low. By 2050, the International Energy Agency projects that 62% of power will come from green energy due to global awareness of environment protection, climate change and the need to shift to green energy sources and low-carbon energy (IEA). Renewable energy sources are intermittent and completely reliant on the weather, which could compromise the stability of the system. As a result, integrating them into the grid is more difficult than it might first appear. Renewable energy sources can seriously disrupt the grid without a sophisticated management system, turning them into a problem rather than a solution.

CONCLUSION

In order to address the defined research issues the literature review that we have been conduct given detail information about block chain technology used in energy sector. The importance of the block chain technology is growing fast now days, which help people in there work and problem solving. In Energy section application are Energy storage, micro grid and smart grid ,wholesale market, emission trading, elecromobility etc. where has there emerging technology that can used block chain can used in energy section. There are also some challenges before block chain technology in field of energy in that be should solve in the future. There block chain provide many feature like security, traceability, transferce and so on.

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