

THE IMPACT OF BLOCKCHAIN TECHNOLOGY ON THE RENEWABLE ENERGY INDUSTRY



NATIONAL FUND FOR ENVIRONMENTAL PROTECTION AND WATER MANAGEMENT

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ABOUT THE SPEAKER

- D.Sc. in Economics and Business Administration, graduated from the School of Technology and Innovations, Industrial Management Department, University of Vaasa, Finland
- "Roadmap for Renewable Energy Technologies Diffusion: A comparative study of Socioeconomic, Regulatory, and Technological issues in Finland and Poland."
- Assistant Professor in the Dept. Of Management and Logistics of the Academy of Piotrków Trybunalski, Poland
- Senior Energy Innovation Specialist at NFoEP&WM (NFOSiGW), Dept. of Innovations
- **Research interest**: Renewable Energy markets, sustainable development, energy policies, green entrepreneurship, venture capital, energy **digital innovations**, sustainable supply chain management



PUBLICATIONS ON BLOCKCHAIN & OTHER DIGITAL INNOVATIONS (SO FAR...)

- Hafeez, S., Juszczyk, O., Takala, J. (2021) A Roadmap for successful IoT implementation: empirical evidence from the energy industry. Issues in Information Systems 22(1):92-113. https://doi.org/10.48009/1 iis 2021 92-113.
- Juszczyk. O., Shahzad, K. (2022) Blockchain for Renewable Energy Principles, Applications & Prospects. Energies 15(13):4603. <u>https://doi.org/10.3390/en15134603</u>.
- Shahzad, K., Juszczyk, O., Takala, J. (2022) Innovative and Sustainable Logistics: Main Direction of Development. In: Sustainable Logistics, Domagala, Gorecka, Roman (Ed.), Routledge (Taylor&Francis). <u>http://doi.org/10.4324/9781003304364-2</u>.
- Juszczyk, O. (2023). The Impact of Blockchain on Future Business Models within the Renewable Energy Sector. Human Interaction & Emerging Technologies (IHIET 2023): Artificial Intelligence & Future Applications, 111, 714–724. AHFE International, USA. <u>http://doi.org/10.54941/ahfe1004078</u>.

STRUCTURE

- 1. Introduction
- 2. Principles of blockchain technology
- 3. Applications within the Renewable Energy Technologies industry
- 4. Providing ",Supply Chain Revolution" optimizing SSCM
- 5. Impact on business models SBMI concept
- 6. Roadmap for Blockchain Adoption
- 7. Limitations and future research directions

INTRODUCTION

- Climate change as increasingly important issue
- Due to e.g. industrialization, digitalization, consumerism the energy demand levels are expeditiously increasing
- An urgent need to limit the energy generation from fossil fuels
- Renewable Energy Technologies can support the Energy transition by providing more sustainable, clean, and environmentally friendly solutions
- Digital innovative Energy solutions as catalysts for a widespread diffusion of renewables worldwide
- Disruptive technologies need for **Business Model Innovation**

BLOCKCHAIN – WHAT IS IT ACTUALLY?

- Distributed Ledger Technology (DLT)
- Mechanism that allows transactions to be verified by a group of unreliable actors.
- It provides a distributed, immutable, transparent, secure and auditable ledger.
- Can be consulted openly and fully, allowing access to all transactions that have occurred since the first transaction of the system, and can be verified and collated by any entity at any time.
- The blockchain protocol structures information in a chain of blocks, where each block stores a set of transactions performed at a given time. Blocks are linked together by a reference to the previous block, forming a chain.

BASIC PROCEDURE IN BLOCKCHAINS



KEY PRINCIPLES OF BLOCKCHAIN TECHNOLOGY

- Its primary assumption is to remove the intermediaries (or central authorities) from contracts and transactions – DECENTRALIZATION AS A KEY FEATURE
- Therefore, it revolutionizes supply chains ergo, it decreases the cost of the end-product
- It offers reliability, scalability and auditability of transactions
- It relates to the Internet of Things (IoT) and enhances e.g. immutability, decentralized structure of authority, autonomous transactions as well data security, transparency and integrity
- Main applications in the financial and fintech sectors, but many other are gradually implementing it (e.g. in healthcare and energy industry or even in voting systems)

BLOCKCHAIN FOR RENEWABLE ENERGY

- Blockchains have already contributed to the emerging concept called the Internet of Energy (IoE) that enables transparent, decentralized energy prosumer networks, including energy trading platforms.
- Improvements provided by this technology fostered the energy transition and circular economy initiatives through e.g. novel solutions for electric e-mobility, energy democratization, P2P energy trading platforms, demand-response mechanisms, smart metering, smart grid management, automation of green certificates issuance, or carbon trading

KEY APPLICATIONS WITHIN THE RET INDUSTRY



1) metering/billing and security;



 cryptocurrencies, tokens and investment;



 decentralized energy trading;



4) green certificates and carbon trading;

5) smart grid management;



6) IoT, smart devices, automation and asset management;



7) electric emobility;



8) and general purpose initiatives and consortia.

ENERGY TRANSITION 3 DS VS. BLOCKCHAIN

- Decentralization
- Digitalization
- Decarbonization

IMPACT ON BUSINESS MODELS

- Significant cost savings due to faster transaction times, disintermediation, fewer record-keeping concerning customers due to distributed ledger technology, as well as enhanced data traceability and authentication
- A blockchain-based business model has a decentralized structure, operates in a secure network, and is based on peer-to-peer transactions, which are the three main characteristics of blockchain technology. Adopting blockchains may cause companies to re-evaluate and/or reformulate their existing business models, which could boost their profitability, productivity, and efficiency
- By using blockchain, companies could significantly improve their forecasting, optimization, scheduling, planning, management, and resource allocation operations

BLOCKCHAINS REQUIRE BUSINESS MODEL INNOVATION

- Enhancing sustainable business model innovation (SBMI) that could contribute to improvements in, inter alia, environmental management, supply chain and transaction costs reduction, investments and social entrepreneurship, or innovation and intellectual capital management
- Also, the usage of blockchain could attract new business partners such as information technology companies developing application programming interfaces (APIs) as well as software development kits (SDKs), and sustain transactional algorithms

RENEWABLE ENERGY – SUSTAINABLE BUSINESS MODEL INNOVATION

- Decentralized energy trading based on peer-to-peer platforms more direct access to the 'product', drastic reduction (or in other words, revolutionizes) energy supply chains by removing the intermediaries, significant reduction of the cost of this product, delivery time, and improvement of the overall efficiency
- Smart contracts, which automate the verification and execution of energy transactions in a transparent, interoperable, and trustworthy way. Smart contracts can help in smart grid management and enhancement of Internet of Things (IoT) solutions, which can result in improvements in supply-demand balancing, adequate and automated billing through smart metering, grid asset management, or delivery system coordination
- Moreover, customers are encouraged to play a more active role in the energy market, which creates the
 possibility to become energy prosumers, form local energy communities and new markets allowing lowvolume and limited-cost transactions, which were significantly restricted before

BUSINESS MODEL INNOVATION IN RENEWABLE ENERGY

- Such prosumer-based energy markets, particularly visible in the solar PV sector, can not only offer enhanced grid flexibility but also transparency about energy provenance and quality, which is ensured through the automation of green certificates and carbon trading issuance
- Such enhancements in societal awareness could lead to more intensified market competition as well as energy democratization.
- Last, decentralized P2P energy trading platforms could form local microgrids, which again can lead to the generation of new revenue streams and the limitation of the cost of the product for end-customers

IMPACT ON BUSINESS MODELS

- New markets, new business models required
- Value proposition needs to be redefined
- Novel opportunities for the development of the whole industry

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Customer segments

- New customer and segments outreach
- New, prosumer-based markets
- Local networks, energy crowds

Value proposition

- Verifiability, transparency and security
- Faster and cheaper transactions
- Automation through smart contracts
- Energy democratization
- Driving the energy transition

Channels

- New channels
- New APIs and SDKs
- P2P energy trading platforms

Customer relationships

- Enhanced transparency, automation, self-service, no intermediaries
- More active role energy prosumers
- More direct supplier-buyer relationships

Key resources

- P2P energy trading networks
- · Asset management through IoT
- Energy cryptocurrencies and tokens, green certificates
- Improved demand-supply balancing

Key partnerships

- Strengthened ties within shorter supply chains
- Enhanced data transparency and integrity
- Increased trust ("trustless" database)

Revenue streams

- New markets
- New payment methods
- Microgrids, cryptocurrencies and energy tokens, green investments
- EV charging infrastructure

Cost structure

- Reduced search, negotiation, transaction costs
- Increased time- and cost-efficiency
- Increased software/IT and personnel development costs



DEVELOPED ROADMAP

Blockchain Adoption in the RET Sector

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Industrial Use Cases
Big companies as catalysts
Supportive Regulations
National, International & Global
Education & Trainings
Know-how increases trust

Seed & Pilot Projects

University-Industry Collaboration

IN SUMMARY

- Blockchains can clearly benefit energy system operations, markets and consumers.
- They offer disintermediation, transparency and tamper-proof transactions, but most importantly, blockchains offer novel solutions for empowering consumers and small renewable generators to play a more active role in the energy market and monetize their assets.
- Blockchains have enabled applications of sharing-economy in the energy sector, which has resulted in **novel market models** and **energy democratization**.
- Digital innovations can play a pivotal role in fostering Energy transition
- Blockchains are a fast-moving area of research and development, therefore a review on this emergent technology is required to improve understanding, inform the body of knowledge on blockchains and realize their potential.

Thank you very much for you attention!



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Looking forward to collecting valuable feedback from you ③

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