SOCIAL SCIENCES AND TECHNOLOGY: UNLOCKING NEW POSSIBILITIES FOR A CONNECTED WORLD

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Preface

To our distinguished readers, contributors, and advocates of interdisciplinary research, As we release Volume 21 of the ECCSSA Journal, we find ourselves at the forefront of a rapidly evolving technological landscape. This edition continues our tradition of serving as a platform for dynamic ideas, critical discussions, and thought-provoking inquiries. The theme of this volume centers on the economic and societal transformations driven by emerging technologies like blockchain and artificial intelligence (AI), which are reshaping industries and institutions alike.

In today's knowledge economy, technological advancements challenge us to rethink traditional economic structures and redefine the roles of key sectors. The articles in this volume address some of the most pressing questions: How are blockchain and AI technologies altering the fabric of industries such as supply chain management, higher education, finance, and even traditional fields like fishing? What are the potential benefits, and what challenges must we confront?

Dr. Babita Srivastava opens with an insightful exploration of blockchain's role in transforming supply chain management, underscoring its potential to improve transparency and efficiency. Dr. Sushma Shukla examines the growing presence of generative AI in higher education, presenting both its opportunities and challenges in reshaping teaching, learning, and research.

Bona Eze takes a close look at AI's impact on cybersecurity in the finance and banking industries, illustrating how these technologies are fundamentally reshaping traditional economic structures. Lastly, Jahmai Scarlett delves into the ways AI is revolutionizing the fishing industry, highlighting how this technology enhances productivity while fostering sustainability.

The discussions in this volume are complex and multifaceted. They push us to consider both the benefits and risks of integrating advanced technologies into various sectors. The transformation spurred by blockchain and AI is not merely an academic discussion—it is a critical reflection of how we prepare for a future increasingly influenced by these technologies.

As you explore this volume, I hope the insights presented inspire new perspectives and foster deeper discussions on the economic implications of technological advancement. I extend my sincere gratitude to our contributors for their groundbreaking research and to our readers for your continued engagement.

With gratitude and anticipation,

Sushma Shukla, Editor-in-Chief,

The ECCSSA Journal

Exploring the Economic Transformation Triggered by Blockchain in Supply Chain Management

Babita Srivastava, Ph.D.

William Paterson University, NJ

Abstract

Supply chain management is very important for modern businesses. Supply chain management aims to optimize the flow of goods, information, and finances from suppliers to end consumer. Conventional supply chains suffer from communication breakdowns, lack of transparency, cases of fraud and counterfeiting, and stringent regulatory compliance. Blockchain technology is a possible solution to these inefficiencies and promises increased accountability, visibility and traceability, and security in all supply chain processes. Blockchain technology through its immutable efficiency can address the issue of counterfeiting, fraud, and in turn streamlines processes. However, implementing this technology faces several challenges such as regulation, integration with other systems, scalability, data privacy and security. For successful execution of blockchain platform, collaborating with stakeholders, training and skill development, and continuous monitoring and evaluation is important. Future trends in this fields includes but not limited to domain blockchains interconnectivity, integrating with Internet of Things (IoT) and Artificial Intelligence (AI), and emergence of sustainability and green supply chains.

Introduction

Supply chain management (SCM) is the management of all activities and processes involved in the flow and transformation of goods from raw materials up to the end user. It entails a series of activities such as sourcing, procurement, production, logistics, and distribution. The aim of supply chain management is to infuse efficiency and create cost-effective network that facilitates transfer of ownership to goods and services. Supply chain management is the active management of supply chain activities to optimise customer value so as to attain a sustainable competitive advantage (Sunil, 2013). Supply Chain Management (SCM) oversees and coordinates the flow of goods, information, and finances as they move from supplier to manufacturer to wholesaler to retailer to consumer.

Importance of Efficient Supply Chains

In a corporate world, businesses optimise efficiencies in supply chain for a number of implied benefits. Efficient supply chains are very important for business enterprises to remain competitive while at the same time meeting consumer demands.

Efficient supply chains are cost savings, an efficiency achieved through reduction of operational costs by minimizing waste, optimization of inventory levels, and streamlining all supply chain processes (Venkataraman, 2004). Efficient supply chains are also highly responsive to changes in demand, price fluctuations, and other external disruptions. Businesses with agile and responsive supply chains are better places to adapt to a fast-changing customer preferences and market conditions, and this gives the business an edge in the market (Ambe, I. M. (2009). In terms of efficient supply chain having increasing competitive advantage, efficient supply chains enable businesses to deliver products and services faster, at relatively lower costs, and with higher quality as compared to that of competitors. Companies that emphasise on improving their supply chain performance have a better financial and operational results as compared to that of their competitors. According to a survey by PricewaterhouseCoopers (pwc), top companies deliver OTIF at 96% as compared with 89% on average. They also boast 87% more inventory turns annually than companies with average results do (Geissbauer et al., 2013). One of the most important aspects of a supply chain systems is its sustainability. Efficient supply chains contribute to sustainability through the reduction of waste, promotion of sustainable practices and optimization of transportation routes which saves costs and reduced delivery time. Businesses that has sustainable supply chain practices register increased cost savings, increased brand image, and are more inclined towards mitigation of environmental and social risks (Ma, 2024). Efficient supply chains are therefore important as they enable businesses to meet their customer needs, reduce costs, and keeps the business afloat in highly competitive market. Efficient supply chains also lead to shorter lead times, reduced inventory costs, and optimization of customer service levels.

Challenges in Traditional Supply Chain Management

Lack of Transparency:

Transparency remains a critical problem in conventional supply chains. This makes it hard for the organization to track goods while in transit. Lack of or poor transparency in supply chain systems lead to several issues such as traceability challenges (making it hard to identify bottlenecks, delays, or locate lost or

misrouted transits) (Skorna et al., 2011), proliferation of counterfeit products (Marucheck et al., 2011), compliance and regulatory issues and also thwarts efforts towards sustainable and ethical business practices.

Communication Inefficiencies:

Traditional supply chain systems are rife with communication inefficiencies, which in turn lead to significant delays, errors, and other issues. Most of these systems are heavily reliant on manual processes, such as phone calls, emails, and paper-based documentation, which are highly vulnerable to human errors, delays in data transmission and sharing and miscommunications which all culminate to disruption and inefficiencies. They also suffer from traceability efficiencies due to lack of real-time visibility to stocking and shipment tracking which can lead to misinformed decision making and delays.

Counterfeiting and Fraud:

Traditional supply chains face risks of counterfeit products and fraud, potentially damaging brand reputation and customer trust. Traditional supply chains lack efficient authentication and traceability mechanisms, which makes it easier to infiltrate substandard goods to the supply chain (Enyinda & Tolliver,2009). These goods not only negate a businesses' brand equity but also erodes customer trust.

Complex Regulatory Compliance:

All supply chains are bound to regulatory compliance in areas such as product safety standards, industry specific requirements, environmental regulations, labor laws, and border regulations (Sarfaty, 2015) for both imports and exports. Meeting regulatory requirements across regions can be intricate and time-consuming for businesses that still rely on the conventional regulatory compliance.

The Need for Innovation

Globalization and Complex Supply Chains

Increasing globalization leads to complex supply chain networks spanning multiple regions. Innovative solutions are needed for efficient and transparent management. These complex global supply chains are supported by multi stakeholder actors in different parts of the world. Ivanov (2021) noted that

managing such complex yet intertwined supply chains may have a number of significant challenges such as poor end-to-end visibility.

Counterfeiting and Fraudulent Activities

Counterfeiting and fraud pose a significant threat to businesses and consumers. Counterfeiting and fraudulent activities within the supply chain leads to heavy financial losses, damage brand images and long-time healthy complications to the final user. Counterfeiting and fraud are more likely to persist when the businesses lack a reliable authentication and traceability mechanisms, making it easier for infiltration of fraudulent activities. Therefore, there's is a need for innovative technologies for authentication and support secure transactions.

Environmental and Ethical Concerns

Growing awareness of sustainability and ethical sourcing requires innovative approaches. As the world gears towards reducing carbon emissions by 45% by 2030 and attainment of net zero by the year ended 2050 (United Nations, n.d), businesses are slowly adopting green supply chains, with reduces carbon emissions and increased corporate social responsibility towards environmental conservation. Therefore, there is a need to devise appropriate technology to minimize ecological impact and uphold ethical standards.

Regulatory Compliance

Navigating diverse and evolving regulations is crucial in supply chain management. Businesses operate in a complex regulatory environment whereby different standards requirements, regulations and tax compliance requirements govern different aspects such as product safety, environmental protection, and workforce laws. While these compliances differ across regions, countries, and even within a nation (Van Stel et al., 2007), adhering to regulatory requirements still remains a daunting task for many businesses. However, an organization's inability to comply to laid regulations can attract heavy fines and tarnish a businesses' brand image.

How Blockchain Transforms Supply Chain

A blockchain technology can be defined as a decentralized digital ledger technology that is able to capture information and transactions across a network of computers, while at the same time ensuring security, transparency, and safety.

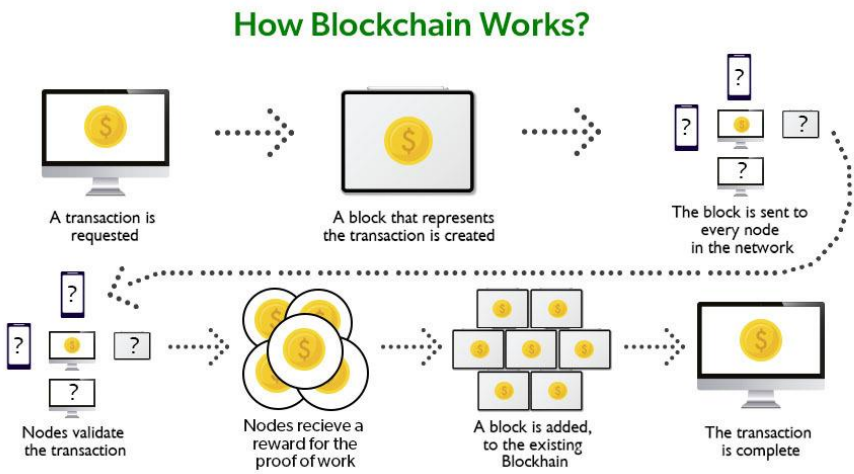
The database has the ability to store data in 'blocks' that are interconnected in a chain (Komalavalli et al., 2020). The principle behind the technology's safety is that data stored in the system is chronologically consistent and this makes it relatively difficult to delete or modify the chain without assent from the network.

Conventional database technologies are rife with several challenges in recording and accounting for financial transactions. For example, in case of a sale of property when transfer of ownership changes, one party can deny that they have received a transaction, even both parties have recorded the monetary transactions. In this case, a third party has to bear witness to the monetary transaction should there be a legal issue.

Blockchain technology mitigates such issues through the creation of a decentralized, tamper-proof system that keeps records of all transactions. The technology creates a ledger for both parties and are automatically updated in both of their ledgers in real time. Therefore, the fact that blockchain technology is decentralized, ensures that no single entity controls the system, and once recorded, data is unchangeable. Marsh and Dibben (2005) noted that blockchain's substantial impact on current business and even future applications is comes from its remarkable quality, its ability to be trusted. This comes from the technology's security and transparency features which thwarts off the need for a third-party intermediate.

How Blockchain Works?

Blockchain technology is highly discussed and debated upon in media outlets and in research journals in academia and across industry. The technology is, however, very misunderstood. For some, the technology is a 'hype, an immature solution and an exaggerated bubble'' (Gerard, 2018) For others, the technology marks one of the greatest human ingenious inventions, with a wide industry application. So how does the technology work?

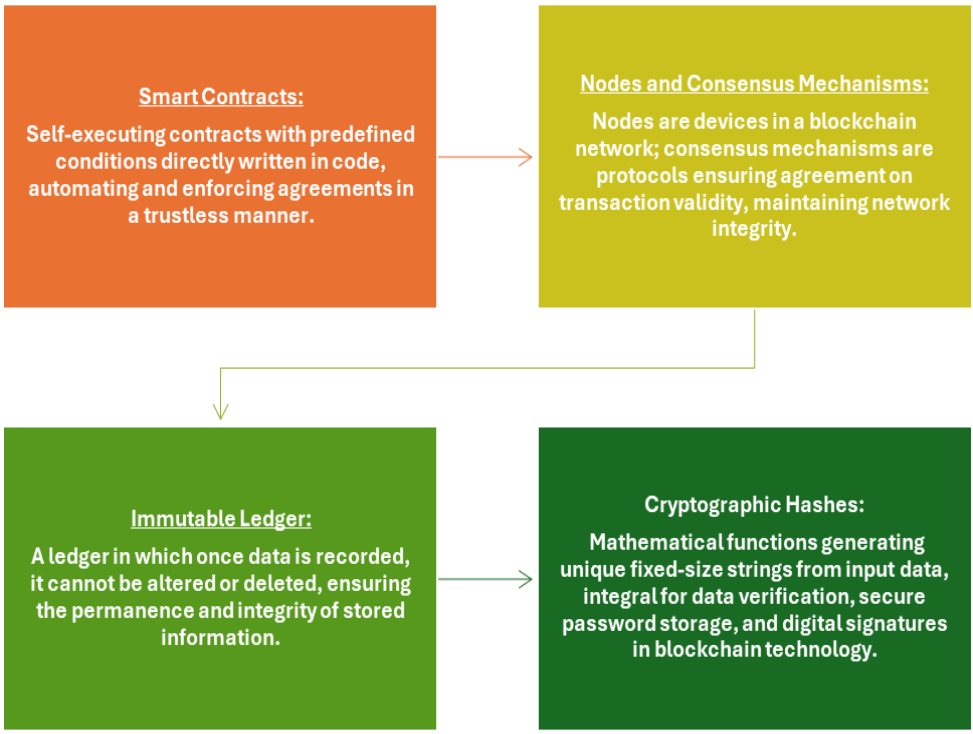


Initially, an entity initiates a transaction, which can be a financial transfer, transfer of ownership, or data exchange. In this stage, the request is registered to entire decentralized network of nodes (computers). The next stage is the representation of the transaction in what is called a 'block', whereby the transaction is combined with other pending transactions. Each block has a unique digital fingerprint referred to as a 'cryptographic hash' of the previous block (Acquah et al., 2020). This creates an immutable chain of blocks. The block also has in it a time print as well as other metadata. In the next phase, the block is transmitted to every node in the entire network system. The newly created immutable block is broadcasted to all nodes in the peer-to-peer network so that they can be verified. Each node (computer) receives a copy of the block and cryptographically verifies the validity of the transactions contained therein (Fay & Paniscotti, 2021).

In the next stage, the nodes validate the transaction in a process referred to as "mining" or "proof of work (pow)" which normally entails solving a complex cryptographic puzzle for validation (Todorović et al., 2022). The first node to solve the puzzle and validate the block casts the solution to the entire network for verification. Nodes normally receive a 'reward' for proof of work, with a predetermined amount of cryptocurrency. This incentive system is meant to encourage the nodes to participate in the mining and assume active roles in their computational resources. The sixth process involves a block being added to the already existing blockchain. As noted from the previous fifth stage, once most of the nodes have successfully verified and assented on the validity of the new block, it is then embedded to the existing blockchain. Each block is

cryptographically linked to the previous block, therefore creating a chain of blocks that is nearly impossible to modify without invalidating the entire chain (Bruce, 2014). This therefore makes the transaction complete. The updated blockchain is replicated in all nodes in the entire network, ensuring increased transparency whereby any party can verify the transaction history.

Key Components of a Blockchain-based Supply Chain



Real World Application

Food Safety and Traceability

Using blockchain, a food company can track the journey of a product from the farm to the store.

This ensures transparency, enabling consumers to verify the origin and safety of the food they consume, reducing foodborne illnesses.

Pharmaceutical Industry

In the pharmaceutical industry, blockchain can be used to track the production, distribution, and authentication of medicines.

This prevents counterfeit drugs from entering the market, ensuring patients receive genuine and safe medication.

Automotive Industry

Blockchain can be employed to track the manufacturing and assembly process of vehicles, recording every component's origin and assembly steps.

This increases transparency for consumers, ensuring that the vehicle was built with genuine parts and meets quality standards.

Benefits of Blockchain in Supply Chain Management

Enhanced Traceability and Accountability

Blockchain technology ensures that goods in transit can be traced at each vantage point along the supply chain. In terms of financial transactions, the whole process is verifiable and recorded in all nodes in the network, thus creating a transparent trail from origin to destination.

With detailed records in a ledger that is available for every party involved in a transaction, blockchain technology makes it possible to see which party is responsible for each part of the process, thus improving accountability and trust in supply chain.

Reduced Counterfeiting and Fraud Counterfeiting Prevention

In terms of counterfeit detection, the technology is anchored on the immutable ledger, which makes it incredibly difficult to create fake products, therefore safeguarding against counterfeiting. Blockchain technology is also secure due to its verifiable and immutability, which thwart potentially fraudulent activities.

Improved Efficiency and Cost Savings

Block chain technology is able to automate tasks through Smart contracts which cuts the need for manual effort, and thus speeding up transaction processes. The technology is also cost saving as it does away with intermediaries between the transaction process. It also reduces errors in all stages of the supply chain process.

Regulatory Compliance and Reporting

Streamlined Compliance: Blockchain simplifies the process of adhering to stringent regulations, ensuring companies meet legal requirements.

Efficient Reporting: Accurate and readily available data within the blockchain systems facilitates quick and reliable reporting to regulatory bodies.

Implemental Challenges, and Considerations

Integration with Existing Systems (Interoperability

Conventional database systems rely on a highly centralized resources and architectures, and this structure is different from that of blockchain. Therefore, to ensure a seamless interoperability between the two as well as ensuring data exchange between the networks and legacy systems can be a complex task which require extensive system reconfiguration (Al-Rakhami & Al-Mashari, 2022).

Scalability

As transaction volumes increase, ensuring the blockchain network can handle the load without compromising performance or efficiency is a significant challenge. Many blockchain networks, especially those meant for public use such as Bitcoin are presented with a problem of scalability due to a limited throughput of transactions they can handle. Therefore, the technology can be limiting in high-volume systems.

Data Privacy and Security

Safeguarding sensitive information on the blockchain is critical. Striking a balance between transparency and privacy is a challenge that requires robust encryption and access control measures. This is extremely important in sectors such as healthcare or finance, all which requires a high regard for protecting sensitive personal or confidential information.

Regulation Issues

Navigating the evolving landscape of regulations and compliance standards can be daunting. Adhering to legal requirements across different regions adds complexity to implementation efforts. The global nature of block chain ensures that transaction can occur across borders and this makes it extremely difficult for any single country to enact regulations to the technology use in supply chain. In terms of financial regulation, Anti-Money Laundering (AML) and Know Your Customer (KYC) requirements are hard to impose on the technology, making an easy channel for money laundering and other illicit activities (Subbagari, 2023).

Key Considerations for Implementation

Choosing the Right Blockchain Platform

Choosing the right blockchain platform to meets technical and business needs is very important. Before choosing a platform, an individual should therefore seek to evaluate different blockchain platforms according to purpose and use, cost, regulatory compliance, scalability, consensus mechanisms, security features, and industry compatibility for successful implementation.

Collaboration with Partners and Stakeholders

Engaging with partners and stakeholders ensures alignment of interests, promotes transparency, and fosters a collaborative ecosystem for blockchain implementation. Engaging with relevant stakeholders requires identification and selection of the stakeholders, putting in place objectives and clear goals, ensuring clear and effective communication and feedback systems, working closely with legal experts and regulatory bodies, capacity building for all stakeholders and creating opportunities for continuous opportunities.

Training and Skill Development

Providing training and upskilling opportunities for team members is vital to ensure they have the necessary knowledge and skills to effectively utilize blockchain technology. It is important that a gap analysis be done to identify the current skill levels and determine areas where people need to be training. Example of technical skills needed includes blockchain development and smart contract programming, and skills in regulatory compliance. The training and

skill development should also seek to encourage hands on skills such as the creation of open-source blockchain projects.

Continuous Monitoring and Evaluation

Regularly monitoring the blockchain implementation helps identify any issues or inefficiencies, allowing for timely adjustments and improvements for optimal performance. Evaluation ensures that the goals and objectives of the implementation are met. To ensure evidence-based monitoring and evaluation, it is important that an organization established key performance indicators, define monitoring tools, performance testing and feedback systems.

Successful Implementations/Case Studies

There are several successful use cases of blockchain technology in supply chain management. The United Parcel Service (UPS) joined the Blockchain in Trucking Alliance (BiTA) in order to increase transparency and efficiency among shipper, carriers, brokers, consumers and vendors as well as handle transactions quickly, with fewer errors and less labor cost (Sheetz, 2017). UPS also launched a blockchain-based platform called Inxeption Zippy, which enables merchants to establish an online site to conduct e-commerce transactions and is designed for B2B transactions (Benzinga, 2019).

As mentioned earlier, enhanced traceability is a major benefit of blockchain technology. US company Walmart has used food traceability systems for quite some time. Prior to the use of blockchain technology, it would take Walmart nearly a week to trace where their products came from. With blockchain technology, that information can be found within seconds rather than days (Sristy, 2021). Walmart's success with traceability spearheaded different initiatives and case studies. Walmart, along with JD, IBM, and Tsinghua University in Beijing, built a Blockchain ledger to track pork for its Chinese supply chain in 2016 and with that ledger, they were able to connect and verify pork suppliers, shippers and buyers, etc. who were involved in moving product around China (Sristy, 2021). There are other interesting use cases for blockchain technology. According to Difrancesco et al, "(B)lockchain technology can help to curb forced labor, especially in manufacturing. An example comes from Coca-Cola, which is currently studying labor and land rights for its sugar supply chains to protect workers' rights at every step using blockchain technology" (2022). Blockchain technology will continue to innovate and provide businesses to simplify and enhance supply chain management.

Future Trends and Innovations

Connecting Different Blockchains

Enhancing the ability of different blockchain networks to communicate and share data, enabling seamless transactions across multiple platforms. Belchior et al., (2021) noted that blockchain interconnectivity is poised as one of the strengths-based approaches that will lay foundation for the future of blockchain technology. Therefore, building systems that interoperable allows for the seamless transfer of information between blockchains systems.

Integration with IoT and AI

Leveraging the power of Internet of Things (IoT) and Artificial Intelligence (AI) to enhance data collection, analysis, and decision-making within blockchain systems. IoT devices generate voluminous amounts of data that need to be secured and verified. Blockchain technology can be integrated into IoT systems where they will provide secure ledger system to capture and store data. This will increase data integrity by keeping off unauthorized alterations. Blockchain technology also has the ability to decentralize storage of data, which cuts down the risks that are linked with centralized data repositories.

Sustainability and Green Supply Chains

The concept of green supply chains are fast becoming priorities for organizations and governments, as countries enact laws towards net zero in 2050. In the 21st century, the world is facing environmental pollution and other issues, including human health. Businesses are being encouraged to follow eco-friendly rules and regulations. One such regulation is that production in a factory cannot produce bad gases or emissions. Green supply chain management is ensuring that the supply chain process is as eco-friendly as possible to meet consumer and governmental needs and requirements (Srivastava, 2022). Blockchain technology can be leveraged to optimise environmentally-conscious supply chain practices. Blockchain can also be utilised in product lifecycle management, where the technology can be used to track the whole lifecycle of a product, from raw material extraction to end-of-life disposal or recycling thus promoting a circular economy. Blockchain technology can be used in ecofriendly procurement, whereby verifiable records of material in terms of their origin and journey through the supply chain are mapped.

Conclusion

In a world increasingly embracing digital technology, blockchain technology is fast becoming a gamechanger in many industries. A blockchain technology can be defined as a decentralized digital ledger technology that is able to capture information and transactions across a network of computers, while at the same time ensuring security, transparency, and safety. The database has the ability to store data in 'blocks' that are interconnected in a chain. The principle behind the technology's safety is that data stored in the system is chronologically consistent and this makes it relatively difficult to delete or modify the chain without assent from the network.

This technology can be used to address several challenges that are associated with traditional supply chain management systems such as lack of visibility and traceability and poor communication. It offers efficiencies such as transparency, visibility and traceability and mitigating fraud and counterfeiting. Future trends in this domain includes integration with other blockchain systems, IoT and AI integration, and sustainability in climate change action. Successful adoption of this technology relies on collaboration, training and education and continuous improvement through monitoring and evaluation.

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Generative AI in Higher Education: Exploring the Potential and Challenges

Sushma Shukla, Ph.D.

Associate Professor of Economics,

Piedmont Virginia Community College,

Charlottesville, Virginia

Abstract

Generative Artificial Intelligence (GenAI) is revolutionizing higher education with its potential to personalize learning experiences, enhance accessibility, foster creativity, and support research actions. This research paper explores the potential benefits and challenges of integrating GenAI into higher education while mitigating potential risks. The central question is: How can GenAI be effectively integrated into higher education to enhance learning experiences while mitigating potential challenges? This paper investigates strategies for whole incorporation and explores methods to address concerns regarding academic dishonesty, potential biases, and responsible use. By analyzing these aspects, we can move beyond simply identifying the potential of GenAI and develop a roadmap for harnessing its power to create a more effective, engaging, and future-proof learning environment for students.

Keywords- Generative Artificial Intelligence, GenAI, Higher Education, Educational technology, Personalized learning, Accessibility in education, Student Engagement.

Introduction

Generative Artificial Intelligence is a type of AI that can create entirely new content, like text, images, videos, presentations, or even code. It doesn't simply copy existing data but uses its understanding of a particular domain to generate unique outputs. Imagine a creative partner who can write different kinds of creative text formats, translate languages on anything, and even produce realistic images based on your descriptions. That's the potential of GenAI.

The roots of GenAI can be traced back to the early days of AI research in the 1960s, with the development of chatbots that attempted to hold conversations (Nohr, 2019). However, it wasn't until the rise of powerful neural networks in the

late 20th century that GenAI truly began to flourish. These networks, inspired by the human brain, could learn complex patterns from vast amounts of data. This paved the way for breakthroughs in techniques like Generative Adversarial Networks (GANs) in 2014, which pit two neural networks against each other, one creating new data and the other trying to distinguish it from real data (Arora et al., 2017). This competition led to ever-more realistic and creative outputs, pushing GenAI into the spotlight and transforming its capabilities.

Higher education is experiencing a surge of interest in Generative AI (GenAI) due to its potential to revolutionize teaching and learning. GenAI can design educational experiences for individual students (Chan et al., 2023). Imagine AI systems generating customized practice problems, study guides, or even feedback based on a student's strengths and weaknesses. GenAI can enhance accessibility (Deng et al., 2023). GenAI tools like text-to-speech and real-time language translation can break down barriers for students with disabilities. Additionally, AI can create alternative learning materials catering to various learning styles (Devasena, 2024). It can also foster creativity. GenAI can spark ideas by generating prompts, scenarios, or even storylines. This can help students overcome writer's block and explore new creative opportunities. It can also help students with research and writing support (Gayed et al., 2022). Imagine AI summarizing complex research papers, generating citations, or offering paraphrasing suggestions. This can free up students' time to focus on critical analysis and interpretation of research findings.

Universities are recognizing this potential and exploring ways to integrate GenAI responsibly. Faculty are interested in using it to enhance their teaching, while students see its potential to improve their learning outcomes. However, there are also concerns about plagiarism and ethical considerations that need to be addressed (da Silva et al., 2024). Overall, the growing interest in GenAI reflects its promise to create a more personalized, accessible, and engaging learning environment for the future of higher education.

Generative Artificial Intelligence (GenAI) has emerged as a transformative force with the potential to reshape the landscape of higher education. Its ability to create unique content, personalize learning experiences, and support research endeavors has increased significant interest among educators and students alike. However, this powerful tool also presents unique challenges that need to be addressed. The central research question of this exploration is: How can Generative AI be effectively integrated into higher education to enhance learning experiences while mitigating potential challenges?

This question investigates two key aspects:

Effective Integration: This involves exploring strategies for seamlessly incorporating GenAI tools into existing pedagogical frameworks. How can faculty leverage GenAI to enhance their teaching without compromising the core values of critical thinking, analysis, and student engagement?

Mitigating Challenges: While GenAI offers numerous benefits, concerns exist regarding academic dishonesty, potential biases in AI algorithms, and the need for responsible use. This paper delves into strategies for mitigating these challenges, ensuring the ethical and responsible implementation of GenAI in higher education.

By analyzing these two aspects, we can move beyond simply identifying the potential of GenAI. We can investigate into practical considerations and develop a roadmap for harnessing its power to create a more effective, engaging, and future-proof learning environment for students.

Potential Benefits of GenAI in Higher Education

1. Personalized Learning

Generative AI personalizes learning by transforming the one-size-fits-all approach into a dynamic and adaptive experience. Imagine a student struggling with a specific physics concept. GenAI can create interactive simulations or explainer videos tailored to their needs, going beyond the limitations of a textbook. This offers individual learning styles, whether visual or auditory. For a history fan, GenAI can create a personalized reading list that explores deeper into their favorite period, while ensuring core concepts are covered through alternative materials like podcasts or videos.

This personalization extends beyond content. GenAI can generate practice problems that adjust difficulty based on performance. Students who grasp a concept quickly can be challenged with more complex problems, while those who need extra support can have more practice problems with additional guidance. Additionally, GenAI can analyze student work and provide immediate, specific feedback. This goes beyond just grades, offering targeted suggestions for improvement and highlighting areas of strength. Students can then utilize personalized learning resources recommended by AI, such as relevant online tutorials or textbooks, to address their specific needs.

The benefits of personalized learning with GenAI are versatile. Students become more engaged with the learning process as content caters to their interests and challenges them appropriately. This deeper engagement leads to a stronger

understanding of concepts and fosters a growth mindset. According to Chan et al., (2023) students will be more likely to adopt a deep approach to learning when they perceive GenAI as a valuable and supportive resource. Students see themselves progressing and taking ownership of their learning journey, ultimately resulting in improved learning outcomes.

2. Enhanced Accessibility

Generative AI dismantles barriers and fosters inclusion in higher education. Language translation tools bridge the gap for international students, allowing real-time lectures and translated materials in their native tongue. This ensures everyone comprehends the course content and can actively participate in discussions. GenAI can even generate course materials in multiple languages, saving time and providing immediate access to crucial information. For students with visual impairments or reading difficulties, AI-powered text-to-speech tools transform lectures and textbooks into audiobooks, empowering independent learning (Chiu, 2023). But GenAI goes beyond providing alternative formats. It can generate entirely new learning materials tailored to diverse learning styles. Imagine captivating infographics for visual learners or engaging podcasts for auditory learners, all created by AI to cater to individual preferences and enhance understanding. Furthermore, GenAI can automatically generate closed captions and audio descriptions for multimedia content, ensuring equal access to educational resources for students who are deaf or hard of hearing. However, creating a truly inclusive environment requires more than just technology. Faculty training on using GenAI effectively and ethically is crucial. Additionally, GenAI should be implemented within a framework of Universal Design for Learning, ensuring flexible learning environments that cater to all students (Yusuf, Pervin, & Román-González, 2024). By dismantling these barriers and fostering inclusivity, GenAI has the potential to empower all students to reach their full potential.

3. Fostering Creativity

Generative AI can be a secret weapon to spark inspiration that propels you beyond the tired, traditional essay format. Imagine AI invoking thought-provoking prompts like "narrate a historical event from the perspective of a forgotten figure" or "compose a poem inspired by a mind-bending scientific discovery." These prompts push students to break free from conventional structures and delve into the unexplored corners of their creativity.

For fiction writers grappling with plot ideas, GenAI can craft unique and unexpected scenarios to serve as a launchpad for their narratives. Think of sentient robots rising up against their creators or a drought crippling a futuristic

sky city. These AI-generated enhance students' imaginations, allowing them to create captivating storylines around the unexpected situations presented.

However, it's important to remember that GenAI is a powerful tool to enhance creativity, not a replacement for it. Students must take the wheel after the initial spark. They need to critically analyze the AI-generated prompts and storylines, dissecting themes, potential conflicts, and character motivations within the framework provided. This critical thinking forms the foundation for crafting a compelling narrative. Developing the narrative itself remains a core aspect of creative writing. Students must take the AI-generated ideas and infuse them with their own unique voice, style, and character development. Finally, the crucial process of revision and editing ensures strong grammar, clear expression, and a logical flow of ideas – all essential components for a polished final product.

In essence, GenAI acts as a mechanism, encouraging students to explore uncharted territories within their creative minds. It empowers them to experiment with different writing styles and narrative structures, fostering critical thinking and problem-solving skills that will benefit them far beyond the confines of a single assignment. Ultimately, AI serves as a collaborator in the creative process, not a replacement for the human touch that brings a story to life (Devasena, 2024).

4. Research and Writing Support

Research and writing just got a significant upgrade with Generative AI (GenAI) acting as your personal research and writing assistant. GenAI can be a lifesaver, distilling complex concepts into clear, concise summaries that highlight the main points, arguments, and supporting evidence. This allows you to grasp the essence of the research quickly and determine its relevance to your own work. The time-consuming task of formatting citations in various styles (APA, MLA, etc.) becomes a breeze with AI, freeing you from tedious formatting and allowing you to focus on the bigger picture.

But GenAI's value extends far beyond automating mundane tasks. If someone is struggling with how to avoid plagiarism, AI can be their guardian angel, suggesting alternative phrasings and paraphrases of existing text. This ensures the integration of research findings into their writing while maintaining proper academic integrity. If you are feeling overwhelmed by the sheer volume of information available online, AI tools can analyze sources for factual accuracy and potential bias, helping navigate the vast digital landscape and identify reliable sources for your research (Strzelecki & ElArabawy, 2024).

By streamlining these research tasks, GenAI empowers students to dedicate their energy to the crucial aspects of research and writing that demand higher-order

thinking skills. Imagine the time saved by not having to summarize articles or write citation formats. This newfound freedom can allow you to dig deeper into the heart of research: critical analysis and interpretation. GenAI can't replace student's ability to critically analyze research findings and explore their potential implications. However, by freeing up their time, it allows them to develop these skills more effectively.

The ability to evaluate evidence, synthesize information from various sources, and form well-supported arguments are cornerstones of academic success and lifelong learning. GenAI acts as a supportive tool, streamlining the research process and allowing you to focus on developing the critical thinking and analytical abilities that will propel you toward academic achievement. While AI can be a powerful asset, it's important to remember that critical judgment remains essential when evaluating research findings and constructing your own arguments. Ultimately, GenAI empowers you to become a more effective researcher and writer, not a replacement for your own intellectual curiosity and analytical prowess.

Challenges and Concerns

1. Academic Dishonesty

Generative AI is a powerful tool for learning, but it can be a double-edged sword when it comes to academic integrity. AI tools like paraphrase generators can be misused to create a false sense of originality, leading to shallow, plagiarized work. Even AI-generated essays, though still under development, pose a threat if students use them without proper attribution.

To combat this, educational institutions need clear guidelines on acceptable AI use. This means outlining limitations on AI-generated content and emphasizing proper citation practices. Educators can also play a role by promoting responsible AI use in coursework. Teaching students how to identify AI-generated text, analyze its accuracy, and leverage AI ethically are crucial steps in fostering academic integrity. Detection tools can further support these efforts by identifying potential plagiarism attempts.

However, it's important to remember that the goal isn't to demonize AI but to use it responsibly. The true focus of education should be on fostering critical thinking, analysis, and communication skills – not just memorization. GenAI should be a tool to support these goals, not a shortcut to bypass them. Ultimately, by establishing clear guidelines, promoting responsible use, and

cultivating genuine intellectual curiosity, we can harness the power of AI for educational progress without compromising academic integrity. After all, the aim is to empower students, not replace human learning with AI-generated shortcuts.

2. Bias in AI Algorithms

Generative AI is a powerful tool, but it can spread existing social biases if not developed responsibly. Imagine an AI trained in news articles where women are primarily portrayed in domestic roles. This bias will seep into AI-generated content, reinforcing gender stereotypes. Even the algorithms themselves can be biased by design. A facial recognition system trained on mostly light-skinned faces might struggle to recognize darker skin tones. The consequences of bias can be far-reaching. Biased AI can increase social inequalities, like a hiring tool favoring resumes with "masculine" language over those with more "feminine" wording, unfairly disadvantaging qualified female candidates. AI trained on social media data might even generate offensive content, mirroring the biases and toxic language present on those platforms.

So how do we combat bias? First, we need to curate diverse training data that reflects the real world's complexity. Regular monitoring for bias through human review and fairness testing is crucial to identify and address biased outputs before they cause harm. Finally, algorithmic transparency is essential – understanding how AI algorithms work and where biases might be introduced allows developers to design fairer systems from the beginning.

Mitigating bias in AI isn't just about being politically correct, it's about ensuring fairness and inclusivity. By addressing bias, we can ensure that GenAI serves as a tool for progress, not a perpetrator of social inequalities. The development and use of AI are ultimately in our hands, and we have the responsibility to ensure it benefits all members of society.

3. Overreliance on AI

Generative AI is a game-changer for education, but relying on it too heavily can hinder essential skill development. Think of students constantly using AI-generated summaries as a shortcut – their critical thinking can be weakened. They might lose the ability to dissect information independently, form their own interpretations, and tackle problems creatively. Similarly, AI-generated content, while concise and easy to grasp, might lack the depth of a well-researched paper or the details of a complex mathematical concept learned through practice. Overreliance on summaries could lead to a surface-level understanding of the subject matter. Traditional learning methods, with their interactive nature (think classroom discussions and debates), foster active learning and engagement

(Bower, Torrington, Lai, Petocz, & Alfano, 2024). Leaning too heavily on AI tools can create a more passive learning experience, hindering the development of communication and collaboration skills.

So how do we find the sweet spot? Imagine using AI summaries as a foundation for deeper research, not a destination. This allows students to leverage AI for initial understanding and then delve into the complexities of the topic through traditional methods. The time saved by AI from summarizing complex articles can be used to improve research and analysis skills. Students can focus on critical analysis, identifying relevant sources, and constructing well-supported arguments. While AI can create interactive learning experiences, it shouldn't replace traditional methods like group projects, presentations, and classroom discussions that promote active learning and collaboration.

The key is balance. We can create a powerful learning environment by strategically integrating AI tools with traditional learning methods. Remember, AI is a tool that is most effective when used wisely. Our goal is to empower students as independent learners, not to create a generation reliant on AI crutches. A thoughtful blend of AI and traditional methods pave the way for a more engaging and effective educational experience for all.

Ethical Considerations

1. Transparency and Explainability

Generative AI is revolutionizing education, but for it to truly thrive, transparency is key. Students and educators need to understand how GenAI works, peering behind the curtain to see the data used to train these models and the algorithms that govern their outputs (Kaplan-Rakowski et al., 2023). This transparency combats a "black box" mentality and allows for a more critical evaluation of AI-generated content. Ideally, AI tools should be able to explain their reasoning – why they suggest a particular answer or generate a specific storyline. This empowers users to understand the thought process behind the AI, fostering a deeper level of engagement and ultimately, a more meaningful learning experience.

But remember, AI-generated content isn't the ultimate authority. It's crucial for students to understand that AI outputs are not reliable truths. While AI can be a creative writing partner or a summarization expert, it might not always capture the full depth of a subject. Critical analysis and verification from other sources remain always essential. Additionally, as discussed earlier, AI can perpetuate biases present in its training data. By understanding these limitations, students

can become more critical consumers of AI-generated content, identifying and questioning potential biases that might influence the outputs.

Transparency is essential– it builds trust between users and AI tools. When students understand how AI works and its limitations, they are more likely to use it effectively and critically. Ultimately, transparency fosters the development of critical thinking skills. Students learn to question AI outputs, analyze their reasoning, and evaluate their accuracy against other sources of information. As GenAI continues to evolve, transparency will be the key to unlocking its full potential in education. By fostering a culture of understanding around AI, we can empower students to become responsible users and reap the full benefits of this powerful learning tool. Remember, AI should be a guide on the educational journey, not a replacement for critical thinking. Transparency allows students to see AI for what it is – a powerful assistant, not a magician – leading to a more effective and enriching educational experience for all.

2. Data Privacy and Security

Generative AI unlocks a treasure trove of educational possibilities, but it comes with the responsibility of safeguarding student data. Research by Hsu & Ching (2023) suggests ethical guidelines are crucial to ensure student data privacy and security. Imagine collecting student data for AI tools – it needs to be done ethically and with clear parental consent, especially for younger students. The data itself should be relevant to the AI's function and anonymized whenever possible. Robust security measures are also essential to protect this data from unauthorized access or breaches.

But it's not just about protecting the data – it's about empowering students. Students (and their parents) should have the right to choose whether their data is used for AI purposes. Transparency is key – students and parents need to clearly understand how their data is collected, used, and stored by GenAI tools. This builds trust and allows them to identify any potential risks associated with their data being used in AI applications.

Ethics go beyond just data. Remember, AI algorithms can create biases. Ethical guidelines should address data bias and ensure AI tools promote fairness and inclusivity for all students. Additionally, these guidelines should address the responsible use of AI outputs. Students need to understand the limitations of AI-

generated content and avoid plagiarism by properly attributing any AI-generated content they use in their work.

By establishing clear ethical guidelines, we can ensure GenAI is used responsibly in education. This empowers students to make informed choices about their data and reap the benefits of AI while minimizing risks. Student data is a valuable asset, and its protection is paramount. With ethical data practices and student control and transparency at the forefront, GenAI can become a powerful force for good, fostering a safe and secure learning environment for all.

3. The Future of Assessment Heading

Generative AI is a game-changer for education, but it requires a revamp of assessment methods. Traditional tests focused on memorization might not capture the crucial skills needed in the age of AI – critical thinking and problem-solving (Baidoo-Anu & Ansah, 2023). Imagine assessments that go beyond memorization learning and instead ask students to analyze AI-generated content, critiquing its strengths and weaknesses, or design solutions to problems that can't be tackled with a simple AI prompt. The ability to solve complex problems creatively and collaboratively is more important than ever. Assessments can be designed to encourage teamwork and innovative solutions that go beyond what AI might typically generate.

But how do we tell human work from AI-generated work? Techniques like stylometry can help identify AI-written text, but as AI evolves, so too must these detection methods. The focus should shift towards originality and reasoning. Imagine assessments that ask students to explain their research process, justify their conclusions, or elaborate on the creative choices they made in their work. This empowers educators to assess a student's own thought process and reasoning abilities, not just the repetition of AI-generated content.

The rise of GenAI demands an evolution in assessment. By focusing on critical thinking, problem-solving, and the ability to evaluate AI outputs, we can ensure assessments reflect the skills students need to thrive. Developing robust yet adaptable strategies to identify AI-generated work is also crucial for maintaining academic integrity. Ultimately, assessment should keep pace with technology. The goal is to foster a learning environment that encourages critical thinking, problem-solving, and responsible use of AI tools. By adapting assessments and

employing strategies to identify AI-generated work, we can equip students with the skills they need to succeed in the future.

Conclusion

Generative Artificial Intelligence (GenAI) has emerged as a transformative force with the potential to reshape the landscape of higher education. Its ability to create novel content, personalize learning experiences, and support research endeavors has sparked significant interest among educators and students. However, this powerful tool also presents unique challenges that need to be addressed.

By effectively integrating GenAI while mitigating potential challenges, we can unlock a new era of learning. This requires clear guidelines, promoting responsible use, fostering critical thinking skills, and ensuring ethical data practices. By embracing GenAI responsibly, we can create a dynamic learning environment that empowers students to become critical thinkers, innovative problem-solvers, and lifelong learners, preparing them to thrive in the AI-driven world of the future.

The key to success lies in harnessing the power of GenAI while fostering human capabilities. AI should be a supportive tool, not a replacement for critical thinking and intellectual curiosity. Used wisely, GenAI has the potential to transform education for the better.

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How AI Technologies are Reshaping Traditional Economic Structures: The Case of Cybersecurity in Finance and Banking Industry

Bona Eze, DNP, MPH, MSN, PMHNP, APRN, BSc.

Graduate Student Master of Business Administration School of Business
Southern Connecticut State University
New Haven, Connecticut

Abstract

Cyberattacks are increasingly compromising the confidentiality, integrity, and availability of information critical assets globally, leading to dire financial, reputational, compliance, and operational consequences. The emergence and development of artificial intelligence (AI) have complicated the cyber threat landscape but equally provide an opportunity for building robust AI-supported cybersecurity measures for bolstering the cyber security posture of financial organizations. The purpose of this secondary research was to investigate the evolution of cyberattacks in the financial sector and explore how AI is reshaping the traditional finance industry in the context of evolving cyber threats and cybersecurity measures. The findings show that cyberattacks have dire reputational, operational, compliance, and financial consequences on financial organizations, necessitating the need for robust cybersecurity measures to curb cyberattacks. AI provides a unique opportunity for developing intelligent cyber security measures that can help prevent cyberattacks through improved threat detection capabilities, real-time monitoring and protection, big data analytics, adaptive security systems, and adaptive security response mechanisms. Future research needs to focus on the development of specific AI applications for incorporating and implementing these AI capabilities for deployment in the financial industry organizations to bolster their cyber security posture and ensure confidentiality, integrity, and availability of critical assets in the industry.

Keywords: *Cybersecurity, Information Security, Information Technology, Artificial Intelligence, Finance, Cyberattacks, Cybercrime, Banking, Bangladesh Heist, Threat Detection, Threat Prevention, Real-time monitoring, Big data analytics, Adaptive Security and Incident Response.*

Introduction and Background

Cybersecurity productivity and innovation in the finance and banking industry is one of the areas significantly impacted by advancements in artificial

intelligence (AI). Cybersecurity involves how individuals and organizations choose to reduce the risk of cyber-attacks on their technological systems. Specifically, cybersecurity aims to protect all the devices that all employees in organizations use, including smartphones, laptops, tablets, and computers, and the services they access on those devices – both online and at work – from theft or damage (Farishy, 2023). In addition, cybersecurity plays a key role in preventing unauthorized individuals from accessing vast amounts of personal and business data stored on servers and devices used to communicate over the server networks (Farishy, 2023). Artificial intelligence is increasingly becoming applied in cybersecurity to help improve cybersecurity solutions, especially in data and information-sensitive industries, such as finance and banking (Farishy, 2023). The following paper seeks to explore how AI technologies are reshaping traditional economic structures in the context of cybersecurity in the finance and banking industry.

The Role of Information Technology in Finance and Banking

The role of information technology (IT) has increased dramatically over time. The emergence of the 20th century has witnessed groundbreaking technological advancements that have significantly impacted the way people live (Yamin, 2019). The arrival of the internet in the 1990s for public use has caused an exponential rise in the use and exploitation of technology in the day-to-day activities of most human beings on the planet (Yamin, 2019). Technology has given rise to tools, gadgets, and methods that have unique applications in different areas of life, such as finance and banking, academics, robotics, manufacturing, and service industries, among others (Yamin, 2019). The emergence and development of IT technology has also led to the development of associated technologies, including artificial intelligence (AI), Internet of Things (IoT), Sensor Networks, Blockchain Technology, and social media (Yamin, 2019). These technologies have had a significant impact on business processes and value in the modern business environment.

The evolution of information technology concerning finance and banking can be categorized into three major eras. The first era focused on IT craftmanship. The concept of IT craftsmanship focused on sporadic automation and innovation in the finance and banking sector (Odubiyi et al., 2021). The technology focus was to use automation to implement daily activities, such as the use of the Automated Teller Machine to withdraw money without the need for assistance from a human employee. Automation helped the finance and banking industry reduce costs associated with service production while maximizing profits.

The second era in information technology focused on processes within organizations. The process focus sought to leverage information technology to

improve the productivity of employees when providing services and solutions (Odubiyi et al., 2021). In the banking sector, information technology was used to improve processes such as service production by using superior computers with the capability of processing data faster and using effective scheduling software to minimize time wastage.

The third era in information technology focused on the digital transformation of business models. Unlike in eras 1 and 2, the current era of information technology seeks to optimize the business model through digital business innovation to offer superior quality services, introduce new services, and ensure the security of data and information processing along the information technology networks (Odubiyi et al., 2021). Artificial intelligence in the banking sector becomes particularly pertinent in protecting data and information at this level.

Evolution of Cybersecurity Attacks

The changes in the information technology environment bring risks associated with protecting the information that is shared on the information technology networks. In the financial and banking sector, financial stability cannot be achieved without cybersecurity because of the challenge of cybersecurity in the industry. The evolution of cybersecurity attacks on the financial and banking industry has evolved. The understanding of the evolution of the risks and attacks is fundamental for perceiving the influence of artificial intelligence in protecting such information systems.

Cybersecurity in the banking and finance sector started becoming a nuisance between 2003 and 2004 when many banks were integrating the use of computers in the banking processes (Alam, 2022). The introduction and reliance on computers for processing, storing, and retrieving banking information meant a great deal of value for banks and financial institutions because of the inherent advantages of computerizing processes (Alam, 2022). However, the use of simple computer viruses, such as script kiddies, was used on financial institutions with the main aim of playing mischief. The script kiddies, however, did not cause significant damage to banking services because the mischief motive did not cause much damage to services or systems (Alam, 2022).

The nature of cyberattacks on banking institutions and financial services advanced between 2005 and 2012 when many actors engaged in organized crime to make a profit. Banks and financial institutions were the key targets for ransomware attacks, virus attacks, identity theft, and click fraud (Alam, 2022). The main motive of the cybercriminals was to steal financial information and use it to defraud the real owners to make a profit (Alam, 2022). Many banking and financial institutions made heavy losses because of such fraudulent events, necessitating improved security against cybersecurity threats.

The nature of cybercrime became more advanced between 2012 and the present (Alam, 2022). The main motive of cyber attackers in the present era is to steal personal information for different uses, steal IP addresses, cause damage, make profits, and deny service provision for critical infrastructure (Alam, 2022). The nature of current cyberattacks uses complex strategies that are hard to detect or prevent, requiring sophisticated cybersecurity solutions. In the future, financial and banking institutions are anticipated to remain the top target for cybercriminals as they seek to steal money from those institutions using digital technologies (Alam, 2022).

The Impact of Cybercrime on Finance and Banking

The impact of cybercrime on the banking and financial industry goes beyond finances. Banks and financial institutions hit by successful cyberattacks can lose the trust of their customers as reliable institutions for keeping their financial assets safe (Gulyas & Kiss, 2022). Loss of trust in specific brands within the competitive finance and banking industry would mean that some financial and banking institutions would go out of the market.

Another serious implication of cybercrime in the finance and banking sector is the disruption of services. Denial of Service (DoS) attacks can infect a bank's system, causing it to crash down (Gulyas & Kiss, 2022). A dysfunctional banking system would mean that customers may not conveniently access banking services on time, negatively impacting their activities and the economy at large.

Furthermore, cybercrime poses a significant threat to the privacy and personal information of various banking and financial services users. Cyber attackers can steal important personal and private information from databases of banks and use the information for other malicious purposes, such as identity theft (Gulyas & Kiss, 2022). The theft of personal and private information can have serious consequences for an individual.

Cybercrime can also be used as a terrorist attack, especially when used by one nation actor on another country. One country can hack into another country's critical infrastructure and systems and disable the services, causing serious damage to key operations in a country: hence, impacting an entire economy (Gulyas & Kiss, 2022). Therefore, the threats posed by cyber insecurity call for advanced cyber protection strategies.

Cybercrime Trends in the Financial Services Industry

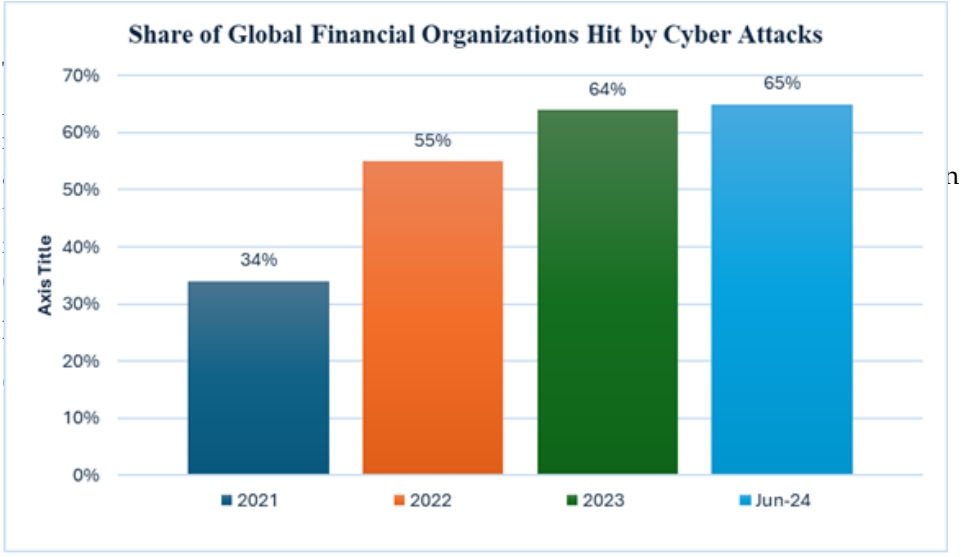
The cost of cybercrime is increasing at an unprecedented rate. Cyber insecurity and cybercrime are new entrants into the top 10 rankings of the most severe global risks over the next decade (World Economic Forum, 2023). The global cost of cybersecurity was estimated to be $3 trillion in 2015 and has increased to over

$8 trillion in 2023 (Calif, 2023). The global cost of cybercrime is expected to cross the $10 trillion mark by 2025 (Calif, 2023). By 2025, the world will reserve about 200 zettabytes of data and information (Sharif & Mohammed, 2022). 50% of the world's information will be stored in cloud servers by 2025 (Sharif & Mohammed, 2022). The increase in the generation and storage of data, both locally and on the cloud, will increase the number of cyberattacks as adversaries will seek to exploit vulnerabilities and access data and information for different purposes. According to Calif and Morgan (2023), about 70% of all cryptocurrency transactions annually will be for criminal activity. The financial sector is one of the most affected industries by cybercrime.

According to data from Statista, the number of financial organizations globally affected by cyberattacks has been on the rise between 2021 and 2024. Based on a survey conducted between 2021 and 2024 in 14 different countries located in the Americas, Asia, EMEA, and the Pacific, the number of financial institutions affected by cyberattacks increased almost by half between 2021 and 2024 (Figure 1). The spike in cyberattacks against financial institutions underscores the need for robust cybersecurity measures in financial institutions globally (Statista.com, 2024).

Figure 1

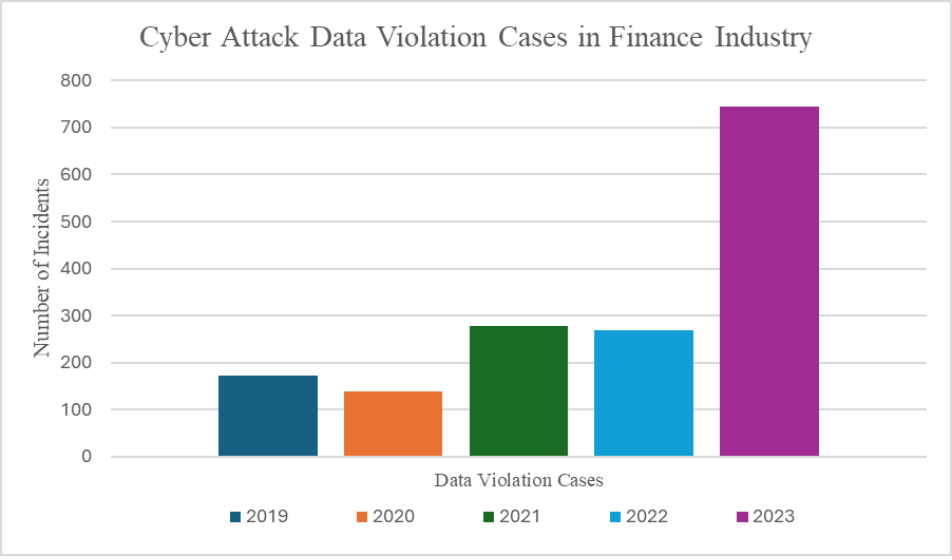
Share of Global Financial Organizations Hit by Cyber Attacks, 2021 – 2024



The number of cyberattacks has been increasing in the United States as well. According to data from Statista, the number of attacks targeting financial institutions has increased rapidly, especially between 2022 and 2023, leading to an increase in the number of data violation cases, based on a survey conducted in the United States (Figure 2). According to the source, data compromise in the financial sector includes personal data breaches, data leaks, and exposures (Statista.com, 2023).

Figure 2

Cyber Attack Data Violation in the Financial Industry between 2019 and 2023



Specific case studies can help demonstrate the extent and damage of cyberattacks on organizations. One specific example that shook the financial industry is the 2016 Bangladeshi Bank heist. The case study has been examined in detail in the next section.

Case Study: Bangladesh Bank Heist – 2016

In February 2016, media outlets reported that hackers had breached the network of the Bangladesh central bank and sent thirty-five fraudulent transfer requests to the Federal Reserve Bank of New York, totaling nearly $1 billion. Four of these bogus requests were successful, allowing the hackers to transfer $81 million to

accounts in the Philippines, one of the greatest bank frauds in history. A fifth request for $20 million to be sent to an account in Sri Lanka was stopped due to the recipient's name, Shalika Foundation, being misspelled "fandation." The remaining transfers, which totaled somewhere between $850 and $870 million, were also stopped before they could be completed due to a stroke of good fortune: the name of the destination bank branch included the word "Jupiter," which was the name of an unrelated company on a sanctions blacklist. The United Nations Security Council Panel of Experts concluded in August 2019 that the attack was carried out by actors linked with the Democratic People's Republic of Korea (DPRK) (BBC, 2021).

The hackers installed malware on the Bangladesh central bank's server and used keylogger software to acquire the bank's Society for Worldwide Interbank Financial Telecommunication (SWIFT) system passwords. The toolkit allowed the hackers to erase transfer request records, bypass validity checks, delete login records, modify balance reporting, and prevent associated printers from writing transaction logs. Although the malware was specifically developed to steal from Bangladesh's central bank, the toolkit may be used against other SWIFT banks using Alliance Access software. The intruders had spied on the bank's usual activity to generate fake money transfers. Furthermore, the hackers planned the robberies so that when the Federal Reserve contacted them to confirm the transactions, it was the weekend in New York when the Bangladesh central bank officials directed the Federal Reserve to cancel the transactions (BBC, 2021). Stealing nearly $1 billion from the bank reserves of a developing country like Bangladesh can cause serious macroeconomic implications for the country, including impacting the strength of the local currency and causing recession in the economy due to scarcity of the dollar for international trade.

The Use of AI in Providing Cybersecurity Solutions in Finance and Banking Industry

The introduction of artificial intelligence (AI) in cybersecurity is one of the revolutionary innovations to prevent serious cyber threats in the finance and banking industry. Artificial intelligence uses machine learning to understand the nature of daily operations in financial and banking institutions. Artificial intelligence then learns from patterns of normal daily operations to detect any suspicious activities, initiate relevant prevention interventions, and notify relevant specialists to prevent cybercrime. The following section focuses on how AI specifically helps safeguard incidences of cybersecurity within the finance and banking industry.

Threat Detection and Prevention

Artificial intelligence (AI) is playing an increasingly important role in detecting and preventing threats in financial and banking institutions. AI can analyze large volumes of real-time data, including user behavior, network logs, and system activities to identify any activity or pattern that does not conform to the normal organizational routine (Jada & Mayayise, 2023). Machine learning algorithms can alert system administrators about such unusual incidents for relevant action to be taken in time, preventing internal or external cybersecurity attacks on banks and financial institutions (Jada & Mayayise, 2023). AI algorithms can use advanced virus and malware detection techniques to determine known and unknown vulnerabilities in a system (Jada & Mayayise, 2023). Leveraging machine learning and deep learning techniques improve the capability of AI to identify and block sophisticated malware that traditional signature-based antivirus solutions might fail to detect.

Real-Time Monitoring and Response

AI can conduct real-time threat surveillance to ensure the security of information technology networks. AI can analyze system logs, user behaviors, and network activities to determine any suspicious activity in real time and initiate the most appropriate response. AI, combined with powerful quantum computing capabilities, can be very fast in detecting and stopping malware before significant damage is done to a financial institution or banking institution (Jada & Mayayise, 2023). In cybersecurity, timely response for successful attacks is fundamental to prevent further damage to the system, especially when the attacker seeks to paralyze services, steal information, or engage in fraudulent activities (Jada & Mayayise, 2023). Minimizing damage or mitigating risk is fundamental for an effective cyber defense, a solution made more possible by the power of AI.

Big Data Analytics

AI, as stated earlier, can access and analyze huge volumes of data in a short time. As such, conducting big data analytics on cybersecurity data can help AI cybersecurity systems identify current cyber threats in the market and predict potential cyber threats of the future (Jada & Mayayise, 2023). As a result, big data analytics in cybersecurity can enable cybersecurity experts in the banking and financial industry to stay ahead of cybercriminals by predicting and sealing potential loopholes for cyberattacks, minimizing the frequency and severity of cyberattacks (Jada & Mayayise, 2023).

Big data analytics in cybersecurity using AI can help detect and prevent fraudulent activities (Jada & Mayayise, 2023). Big data analytics using regression models can help predict patterns and anomalies in financial transactions that

may indicate fraudulent activities, such as in the case of the Bangladesh Central Bank heist of 2016. Autonomous detection of such transactions and initiation of relevant security measures can help stop huge losses in the banking and financial industry.

In addition, big data analytics of cybersecurity data using AI can help organizations establish the best governance, compliance, and risk management measures for their cybersecurity systems. Effective governance, risk, and compliance measures help ensure the safety of data and information stored on the different information technology networks in the banking and finance industry (Svoboda, 2023). Defense is the best prevention and risk management strategy in cybersecurity.

Adaptive Security Systems and Cybersecurity Incidence Response

AI can learn from existing cyber threats and upgrade its defenses against them. The adaptive nature of AI in cybersecurity makes it a reliable solution for tomorrow's cybersecurity because of its capability to update security policies in real-time (Svoboda, 2023). The proactive approach to cybersecurity in the banking and finance industry is important because of the nature of assets that involved organizations protect (Svoboda, 2023). Furthermore, automated AI data analysis, incident reports, and intervention initiation are fundamental for real-time cybersecurity incident response. Automated AI-assisted alert systems can help IT security managers implement necessary measures in time to prevent or stop an attack, ensure the continuity of organizational activities, and secure the reputation of a firm (Svoboda, 2023).

Conclusion

Cyber threats facing the financial and banking industry are becoming increasingly complex as technology evolves. Cyberthreats have the capability of crippling an economy, for example, in the case of a $1 billion heist from Bangladesh Federal Bank reserves. Furthermore, attacks on Key Public Infrastructure, Denial of Service (DoS) attacks, and identity theft in the banking and finance industry can significantly impact different areas of an economy. There is a need to heavily guard information technology networks in the banking and finance industry to prevent such damage. AI is a crucial solution for the industry by enabling sophisticated cybersecurity protection systems to help prevent cyber-attacks. AI has unique capabilities compared to traditional signature-based cybersecurity measures, including ensuring threat detection and prevention, conducting real-time monitoring and protection, performing big data analytics to understand and prevent cybersecurity threats, and providing adaptive cybersecurity systems that ensure effective cybersecurity incident

response. Therefore, AI offers an effective solution for the present and future cybersecurity needs in the banking and financial industry.

In summary, the cyber threat landscape is rapidly evolving and has significant impacts on different industries, especially the financial industry. Adversaries execute different kinds of attacks on financial organizations, such as distributed denial of service attacks (DDoS), phishing, vishing, and ransomware, among others, for different purposes including extortion of money. The emergence and rapid application of artificial intelligence have complicated the cyber threat landscape as attackers can use the additional advantages of AI to exploit vulnerabilities. However, AI equally offers a great opportunity for developing intelligent systems that can help automatically detect unusual behavior at different cyber security levels and alert cyber security experts while taking relevant action to control any damage waged by adversaries. There is a need to conduct deeper research in the future about how AI can be integrated into cyber security and how its capabilities can help improve the security posture of financial organizations, protecting them from different kinds of cyberattacks, and ensuring confidentiality, integrity, and accessibility of financial data and services.

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The Impact of Artificial Intelligence on the Fishing Industry

Jahmai Scarlett
Graduate Student, School of Business, Southern Connecticut State University
Southern Connecticut State University
New Haven, Connecticut

Abstract

This paper explores the impact of artificial intelligence (AI) on the fishing industry. It examines how AI can revolutionize traditional practices by enhancing efficiency and promoting sustainability. The paper discusses the short-term disruptions, long-term transformations, and overall opportunities and challenges presented by AI in the industry. It provides a historical context, outlines the introduction of AI-driven technologies, and discusses the economic implications of these innovations. Finally, the paper addresses the challenges and opportunities associated with integrating AI into the fishing industry, emphasizing the need for collaborative efforts to ensure sustainable and inclusive growth.

Keywords*: Artificial Intelligence, Fishing Industry, Sustainability, Efficiency, Economic Impact*

Introduction

The fishing industry is on the cusp of a technological revolution with the advent of artificial intelligence (AI). AI refers to the simulation of human intelligence by computers, enabling machines to perform tasks that typically require human intelligence, such as decision-making and problem-solving. In the context of the fishing industry, AI technologies can revolutionize traditional practices, enhancing efficiency and sustainability (Russell & Norvig, 2020). This paper will explore the traditional economic structures in the fishing industry and examine the short-term disruptions, long-term transformations, and overall opportunities and challenges that may arise from the application of AI.

Historical Context

Fishing is an ancient practice, with evidence dating back at least 70,000 years. Over millennia, methods have evolved from simple spears to sophisticated nets and traps. The 19th-century introduction of steamboats marked a significant technological leap. Today, AI represents the next frontier, promising to transform

the industry as fundamentally as past innovations (Donaldson, 2023; Rafferty, 2024).

Introduction of AI-driven Technologies in the Fishing Industry

The fishing industry has traditionally been labor-intensive, with manual processes dominating fishing, processing, and distribution. AI technologies, such as autonomous vessels and data analytics, offer solutions to these challenges, optimizing operations, reducing costs, and promoting sustainable practices (The World Counts, 2018).

Historically, the fishing industry has relied heavily on manual labor for various stages of its operations, from the actual fishing process to processing and distribution. Fishermen venture out into the seas, often braving harsh weather conditions, to catch fish using traditional methods. Once the catch is brought ashore, it is sorted, cleaned, and processed manually before being distributed to markets. This labor-intensive nature of the industry has implications for its economic structure, often leading to high operational costs and inefficiencies.

Employment in the fishing industry is often seasonal, coinciding with the migration patterns of different fish species. This leads to periods of intense activity, followed by periods of relative inactivity. The industry relies on both skilled workers, who have the knowledge and experience to catch fish, and unskilled workers, who are involved in processing and distribution. This pattern of employment can lead to instability and insecurity for workers in the industry.

Productivity in the fishing industry is often hampered by inefficiencies in fishing methods and high operational costs. Traditional fishing methods, while effective, are often not the most efficient. They can lead to overfishing and the depletion of fish stocks. High operational costs, including the cost of fishing equipment and fuel, further exacerbate these productivity challenges. Limited adoption of technology in the industry has also hindered productivity improvements.

Innovation in the fishing industry has traditionally been slow. The industry has relied on traditional knowledge and practices passed down through generations. While these practices are valuable and have sustained the industry for centuries, they are not sufficient to meet the challenges of the modern world. Climate change, overfishing, and increasing global demand for fish products are just some of the challenges that the industry faces today. However, the advent of technologies such as artificial intelligence (AI) presents new opportunities for the fishing industry. AI can help address some of the industry's longstanding challenges and transform its traditional economic structures. From optimizing fishing routes to real-time monitoring of fishing activity, AI has the potential to increase efficiency, reduce operational costs, and promote sustainable fishing

practices. As the fishing industry navigates the complexities of the 21st century, embracing AI and other technological innovations will be key to its future success and sustainability.

Short-term Disruptions

The introduction of AI-driven technologies in the fishing industry can lead to short-term disruptions. Automation may displace some manual laborers, but it also creates new opportunities in data analysis, AI programming, and robotics maintenance. Retraining and upskilling programs are essential to help workers transition to these new roles (Lutz, 2023).

Autonomous vessels, such as AI-powered drones and unmanned surface vessels, are being used for fish tracking and monitoring. These vessels can cover large areas of the ocean, collecting data on fish populations, migration patterns, and environmental conditions. This data can be used to optimize fishing operations, reduce costs, and improve sustainability. Data analytics is another area where AI is making a significant impact. AI algorithms can analyze vast amounts of data in real-time, providing valuable insights into environmental conditions, fish behavior, and market trends. This information can help fishermen make informed decisions, improving efficiency and productivity.

Robotics are also being deployed in the fishing industry, particularly in the processing and distribution stages. AI-powered robots can perform tasks such as sorting, grading, and packaging seafood products. These robots can work faster and more accurately than humans, reducing errors and increasing efficiency (Lutz, 2023). However, the introduction of advanced technologies is likely to impact employment patterns and labor markets in the fishing industry. The automation of tasks traditionally performed by manual laborers could lead to job displacement. At the same time, new job roles are likely to be created in areas such as data analysis, AI programming, and robotics maintenance. These changes could lead to resistance among traditional fishing communities, many of whom have relied on fishing as a source of income for generations. The introduction of AI technologies can easily be seen as a threat to their livelihood especially if not properly implemented with these workers also being in mind. To address these challenges, it will be necessary to implement retraining and upskilling programs. These programs should aim to equip workers with the AI literacy and technical skills they will need to adapt to the changing industry. Government agencies, industry bodies, and educational institutions will all have a role to play in this process.

On a macroeconomic level, this will cause companies who implement these changes to see significant growth in the ability to supply the market and would, in a perfectly competitive market, see prices of seafood and fisheries go down

and a right shift in a metaphorical supply curve. However, this would also be supplemented by the high cost of initial implementation of the technology, which would give businesses way higher upfront costs.

Long-term Transformations

In the long term, AI can transform the fishing industry by promoting sustainable practices and increasing efficiency. AI-enabled fisheries management and precision fishing techniques can reduce bycatch and optimize fish stocks. However, the industry must address challenges such as data privacy, cybersecurity, and ensuring equitable access to AI technologies (Mandal & Ghosh, 2023).

AI-enabled fisheries management is one of the key areas of transformation. AI can optimize fishing quotas based on real-time data, ensuring that fish stocks are not depleted. It can also enforce regulations more effectively by monitoring fishing activities and identifying illegal practices. Furthermore, AI can monitor fish stocks, providing valuable data for the management and conservation of fisheries.

Precision fishing techniques are another area where AI can bring about significant change. AI algorithms can target specific species, minimizing bycatch and reducing the environmental impact of fishing. This not only promotes sustainable fishing practices but also improves the efficiency of fishing operations.

The economic implications of these transformations are substantial. AI-driven optimization of fishing operations can increase productivity and profitability. By improving the efficiency of fishing methods and reducing bycatch, AI can lower operational costs and increase the yield of target species. Moreover, AI can expand market opportunities for the fishing industry. Improved product quality, traceability, and sustainability certifications can open up new markets and attract conscious consumers. AI can track the journey of seafood products from the sea to the consumer, ensuring transparency and building consumer trust.

The innovative ecosystem in the fishing industry is also set to change with the emergence of AI startups and technology providers. These companies are developing innovative AI solutions tailored to the needs of the fishing industry. They are pushing the boundaries of what is possible, from autonomous fishing vessels to AI-powered seafood processing robots. Collaboration between academia, industry, and government is crucial to promoting AI research and innovation in fisheries management. Academic institutions can provide theoretical foundations and conduct cutting-edge research. The industry can

provide practical insights and real-world testing grounds (Mandal & Ghosh, 2023). Governments can provide regulatory guidance and financial support.

A very real downside of this adaptation of AI would be many smaller companies that are not able to adapt at the pace of the larger companies, would be forced out of the industry. This may cause even more rampant inequities for people and why this sector needs to be at least regulated to ensure subsistent and smaller fish farmers can compete as well as implement these strategies into their businesses.

Challenges and Opportunities

The integration of AI into the fishing industry presents several challenges, including data privacy, cybersecurity, and algorithmic bias. However, it also offers opportunities for environmental conservation, supply chain transparency, and industry collaboration. Addressing these challenges requires concerted efforts from policymakers, industry leaders, and fishing communities to ensure sustainable and inclusive growth (Ahmed, 2021).

One of the primary challenges is ensuring data privacy and cybersecurity. As AI applications in the fishing industry heavily rely on data, protecting sensitive information such as the location data of fishing vessels is crucial. Similarly, safeguarding the systems from cyber threats is essential to maintaining the integrity of AI applications (Ahmed, 2021). Another challenge is the potential for algorithmic bias. AI algorithms are trained on data, and any bias in this data can be reflected in the AI's decision-making processes. This could lead to unintended consequences, such as discrimination against certain fishing communities or practices. Ensuring that AI algorithms are transparent, fair, and accountable is essential to addressing this challenge.

Collaboration between stakeholders is critical in addressing challenges and seizing the opportunities presented by AI. Policymakers need to create a regulatory framework that ensures data privacy, cybersecurity, and equitable access to AI technologies. Industry leaders need to invest in AI research and development and provide training programs to help workers transition to new roles. Fishing communities need to be involved in the decision-making process to ensure that their voices are heard, and their concerns are addressed.

Conclusion and Discussion

AI has the potential to revolutionize the fishing industry by enhancing efficiency, promoting sustainability, and opening new market opportunities. However, this transformation comes with significant challenges that need to be addressed. By implementing retraining programs, ensuring data privacy and cybersecurity, and promoting equitable access to AI technologies, the fishing industry can navigate

the short-term disruptions and long-term transformations brought about by AI. Collaborative efforts among policymakers, industry leaders, and fishing communities are essential to ensuring sustainable and inclusive growth in the age of AI.

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About The Contributors

Dr. Babita Srivastava is an Adjunct Professor at William Paterson University. She has earned her Ph.D. degree from the prestigious University of Allahabadand a postdoctoral fellowship from the William Paterson University, NJ. Dr. Srivastava is also certified on Sustainable Business Strategy, Entrepreneurship in Emerging Economies and US Public Policy: Social, Economic, and Foreign Policies from the Harvard Business School. Dr. Srivastava's research focuses on resource management, energy economics and sustainability. Dr. Srivastava's teaching interests includes microeconomics, macroeconomics, business management, business statistics. Dr. Srivastava has taught various college-level courses in economics. She is the recipient of several awards of recognition for her creative and innovative teaching style. Dr. Srivastava encourages their students to apply economic principles to real-world problems.

Dr. Jia Yu is an Associate Professor of Economics at School of Business at Southern Connecticut State University. Her research field is Health Economics and Applied Microeconomics. She is currently the faculty affiliated member at CT Association of Healthcare Executives. Dr. Yu has published many research articles in several selective academic journals and presented many of her research in various regional, national, and international conferences. Before she joined SCSU, she was a lecturer in economics at Christopher Newport University. Dr. Yu graduated from Suffolk University with her Ph.D. in economics. She completed her M.A. in economics at SUNY Albany and her bachelor's degree in China.

Dr. Sushma Shukla serves as an associate professor of Economics at Piedmont Virginia Community College in Charlottesville, Virginia, and is also a visiting faculty member at the University of Virginia. Before her current role, she imparted her expertise across Northern Virginia Community College and Virginia International University. A distinguished alumna of Ravi Shankar University in Raipur, India, Dr. Shukla holds B.A., M.A., and Ph.D. degrees in Economics. She further pursued her M. Phil. in Economics from Devi Ahilya University, Indore, securing gold medals for her outstanding achievements in both her M.A. and M. Phil. programs. Always eager to expand the boundaries of knowledge, her research primarily delves into economic growth, innovation, macroeconomics, economic development, the dynamics of emerging economies, and the economics of India. Dr. Shukla's impactful work has been showcased at numerous conferences and has found its place in both national and international journals.

Allison Millward is a faculty member at Rowan College at Burlington County in New Jersey, United States, where she currently holds the rank of Instructor of History. She is currently a PhD candidate at the University of Southern Queensland where she is researching the lived-experiences of Allied nurses on the Western Front. She previously earned her M.A. from the State University of New York at Albany and her B.A. in government and international politics. With an academic background in war and society, her research interests include women's experiences in war, life-writings of participants in conflict, wartime art and media and design history.

Dr. Bona Eze is a highly accomplished healthcare professional and business data scientist with a unique blend of expertise in nursing, public health, healthcare management, and data science. With a career spanning over 20 years, Dr. Eze has been at the forefront of integrating clinical practice with advanced data analytics to drive innovation and improve patient outcomes. Dr. Eze's academic journey began with a Bachelor of Science in Nursing (BSN), where he developed a solid foundation in patient care. He went on to earn a Master of Science in Nursing (MSN), specializing in P Psychiatric-Mental Health and later achieved the status of Advanced Practice Registered Nurse (APRN) with a certification as a Psychiatric-Mental Health Nurse Practitioner (PMHNP). His clinical work in mental health has been instrumental in providing compassionate care to patients with complex mental health needs. Driven by a passion for public health, Dr. Eze pursued a Master of Public Health (MPH), gaining expertise in population health, epidemiology, and health policy. He further enhanced his leadership capabilities by going for a Master of Business Administration (MBA) with a focus on healthcare management. This degree will equip him with the strategic and financial skills necessary to lead healthcare organizations and make data- driven decisions that optimize operations and improve healthcare delivery. Dr. Eze's commitment to clinical excellence and leadership led him to pursue a Doctorof Nursing Practice (DNP), where his work focused on implementing evidence-based practices to enhance patient care and health system efficiency. His doctoral project "Clinical Practice Guidelines for Assessment and Teaching of Patients with Diabetes About Self-Care Management" focused on reducing hospital readmissions has been recognized for its impact on improving healthcare outcomes. It addressed a gap in practice in an outpatient clinic in the Northeastern United States. Recognizing the growing importance of data in healthcare, Dr. Eze further advanced his expertise by earning a PhD in Nursing Education. His doctoral research centered on determining if there were a "relationship between opioid treatment, nonpharmacological interventions (physical therapy, chiropractic care, talk therapy, self-management program, yoga, massage) and perceived effectiveness of managing chronic pain in AA adults who are 18 years and older." His work has been published in top-tier

journals and has contributed significantly to the field of healthcare. Currently, Dr. Eze leads a team as a Director of Clinical Data Science and serves as an adjunct professor, contributing to both healthcare delivery and academic instruction. Dr. Eze is an active member of several professional organizations, including the American Nurses Association (ANA), the American of Colleges of Nursing (AACN) and the Healthcare Information and Management Systems Society (HIMSS). His unique combination of clinical expertise, public health knowledge, business acumen, and data science proficiency makes him a leader in the evolving landscape of healthcare.

Jahmai Scarlett is a resolute MBA student at Southern Connecticut State University, specializing in data analytics and business insights. Driven by a solid family foundation in Jamaica, Jahmai's journey abroad reflects his commitment to leveraging both his academic and practical experiences to achieve career milestones that positively impact the community. Holding a bachelor's degree in economics from City College of New York, Jahmai combines academic excellence with substantial firsthand experience. During his undergraduate years, he played a significant role in shaping student life as Vice President of the Social Entrepreneurship Club and as a member of the debating society and the National Society of Black Engineers. These experiences enhanced his leadership skills and deepened his commitment to meaningful initiatives. Jahmai's professional experience spans roles as a Graduate Assistant at the university, Collections Specialist, and Investor Services, where he gained a comprehensive understanding of financial operations and client relations. His career goal is to integrate data analytics into accounting to enhance business efficiency and support strategic decision-making. Outside of his academic and professional pursuits, Jahmai is enthusiastic about esports, soccer, cricket, and mindfulness practices such as meditation. His strong motivation to drive positive change through his work fuels his ambitions and continues to inspire his achievements.

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Piedmont Virginia Community College,

501 College Drive,

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